Rapid economical, social and technological developments require ever increasing flexibility and alertness of companies. New organizational forms, such as internal and external network organizations are required. Furthermore, companies need to apply information technology (IT) proactively instead of reactively. This means that existing organizational characteristics, such as business strategy, organization structure and business processes are not taken as given facts, but are changed to profit fully from the possibilities of IT. This can be Business Process Redesign or Reengineering or even business scope redefinition or Business Redesign. Applying IT in organizations and the way of IS management is a learning process. The more creatively IT is applied, the higher the costs and risks of IT investments, but the higher IT’s potential to add value to the business and to successfully support business redirection.

A CONSISTENCY MODEL OF IS MANAGEMENT

A consistency model of an organization views the organization as an open system with a limited number of basic subsystems (in systems thinking, often defined as aspect systems) or ‘forces’, in which relevant variables can be arranged. To achieve internal and external stability, these subsystems strive towards mutual harmony and consistency through mutual adaptation and adjustment. Changes in one of the subsystems directly result in changes in the other subsystems until equilibrium is restored. Well-known consistency models are the McKinsey 7-S framework and the MIT90s framework. The MIT90s framework used in ‘The management in the 1990s’ research program of the MIT Sloan School of Management, recognizes five ‘forces’ (subsystems) that must be in dynamic equilibrium with each other: Strategy, Structure (functions and processes), Technology, People (individuals and roles) and Management (management processes). The external environment consists of a socio-economic environment and a technological environment.
The MIT90s framework can be expanded to a more complete consistency model of IS management, which is shown in Exhibit 1. This model has three domains:

- the environment domain;
- the organization domain;
- the IT domain (the IT facilities in the organization).

In accordance with the MIT90s framework, the five subsystems in the organization domain are:

1. Strategy: the organization's goals and how the organization tries to realize these goals; the selection of markets and products and the marketing mix (the business plan).
2. Structure: the organization structure and process structure.
3. Technology: the technology used for the business processes.
4. People: the knowledge, skills, ambitions, attitudes and social ties of people in the organization (the human resources).
5. Management: general management (senior and line management) responsible for the selection and realization of the business strategy and aligning the subsystems in the organization to each other.
All the subsystems influence each other through mutual interaction. The first four subsystems are also influenced respectively by changes in the marketplace, the dynamics (rate of change), the technological developments and the socio-economic changes in the environment.

The IT domain is a subdomain of the organization domain. In the IT domain, the subsystems of the organization should be focused on problems concerning the application of IT:

- Strategy → IS strategy
- Structure → IS organization
- Technology → Information systems → Data and technical infrastructure
- People → IT specialists → Users
- Management → IS management

In the IT domain, Technology comprises all the IT resources. These resources are divided into Information Systems (applications) and the Data and Technical Infrastructure, because the data and technical infrastructure have greater long-term and common characteristics than do the applications. The subsystem People is divided into IT specialists and Users, since these groups usually have a different view of information systems and their managers often have different priorities.

The five subsystems of the organization domain interact with the following seven subsystems of the IT domain, that also are mutually influential:

1. IS strategy: the goals, preconditions, guidelines, selected standards and plans of IT application.
2. Information systems: the applications, including manual procedures.
3. Users: the knowledge, skills, ambitions and attitudes of the information systems’ users.
4. Data and technical infrastructure (information infrastructure): the common data and knowledge bases and technical infrastructure (the hardware and systems software of computers and communication networks).
5. IS organization: the IS organization structure and process structure.
6. IT specialists: the knowledge, skills, ambitions and attitudes of the IT specialists.
7. IS management: the management of the IS function by senior, line and IS managers, who are responsible for adequate information facilities by aligning the above-mentioned subsystems.

The first three subsystems express the demand for information facilities: the organization’s need for information systems and the users’ knowledge and skills to work with these systems. Subsystems 4 through 6 pertain to the available IS organization, the abilities of IT staff and the data and technical
infrastructure: the supply of information facilities. The last subsystem, IS management, should balance supply and demand at an acceptable cost level.

There are also environmental forces that directly influence the subsystems of the IT domain in an organization. For example, the impact of IT developments on the technical infrastructure and the impact of the IT employment market on the IT specialists. Finally, Exhibit 1 shows time as a third dimension. This will be discussed in the next section.

**IS MANAGEMENT PLATEAUS IN ORGANIZATIONS**

In a constantly changing environment, an organization must continuously search for new situations where the subsystems are in equilibrium with each other. Time is a critical factor. To include the factor time and the changes in the environment and the organization in time, the consistency model of IS management should be combined with a stages model. Stages or development models help to understand the present and future positions of an organization. A stages model also illustrates the learning processes in an organization. A stage or phase cannot be skipped, but may be passed through faster. A well-known stage model of the application of IT in organizations is Nolan’s Stages Theory. Nolan described six stages: initiation, contagion, control, integration, architecture and demassing. Although this model was later updated, Nolan did not take proactive application of IT into account.

In this chapter, an *IS management plateau (ISM plateau)* is defined as a period of time during which the subsystems of an organization and its IT domain are in equilibrium. The ISM plateau is regarded as a development stage of IS management or IT application in an organization. On the basis of Venkatraman’s levels of IT-enabled business reconfiguration, the following five ISM plateaus can be identified (Exhibit 2):

1. Functional integration
2. Cross-functional integration
3. Process integration
4. Business process redesign (BPR)
5. Business scope redefinition or business redesign (BR)

On each successive IS management plateau the organization is further tailored to the IT possibilities. Therefore, on each successive plateau, IT has more potential added value for the business, however this also requires more complex information systems, more knowledge to build these systems and more extensive organizational change to implement these systems and therefore higher costs and risks. On each ISM plateau, there must be a dynamic equilibrium between all the subsystems of the consistency model. Only then can the next plateau can be reached by means of an harmonic development of the seven subsystems. Thus periods
of relative stability alternate with periods of change. A harmonic development is one that preserves unity through simultaneous and equivalent growth of the subsystems, which is only possible through mutual interaction and adjustment. The subsystems are mutually adjusted or aligned by means of communication and coordination within and between the organization domain and the IT domain. Each successive ISM plateau requires a higher degree (quality) of communication and coordination, because of the necessity of a progressively better alignment of the subsystems. A higher IS management plateau cannot be reached by, for example, merely changing the organization structure and building new information systems. If the IS strategy remains unchanged, the data and technical infrastructure unadapted and management, users and IT specialists improperly trained, the operation is bound to fail. The seven subsystems of the IT domain on each IS management plateau are briefly described as follows.

1. **Functional integration**

On this first ISM plateau, the information systems support the existing workflow in the business functions (functional departments), such as manufacturing, sales and finance separately. Aside from some procedural adjustments, no organizational changes are needed. The different business functions often exploit different technical platforms. The objective of the application of IT is operational efficiency. The IS plan is based on an inventory of users’ demands. The IS organization basically mirrors the business
organization. Depending on situational factors, this can vary from a completely centralized IS organization for a functional organization to a completely decentralized IS organization for a divisional organization. The information systems are developed and built by the IT specialists according to the users’ functional specifications. Within the IT budget, IT decisions are made by the IS manager(s).

Until the early 1980s, most organizations were on this IS management plateau. Data processing in the Sixties and Seventies can also be characterized as functional integration, although the IS organization was completely centralized, with only one single technical platform because of the technological limitations (a mainframe’s economies of scale) and the users’ contribution was very limited because of their almost complete lack of IT know-how.

2. Cross-functional integration

The information systems integrate the workflow across several related business functions, such as purchasing, inventory control and accounting. The development and implementation of these systems are more complex than those on the first plateau. Minor organizational adjustments may be required, but the functional structure and the working methods remain largely unchanged. Naturally, the technical infrastructures of the functional departments concerned must work together. There should be at least some common standards. The objective of the application of IT is to improve the effectiveness of the business. The IS plan is derived from the business plan. The IS organization cannot be completely decentralized, because some form of central coordination is required. Depending on situational factors, the IS organization may vary from complete centralization to a federation in which agreements are made about, for example, common standards and joint projects. Here too, the information systems are developed and built by the IT specialists in accordance with the users’ functional specifications. Many IT decisions are made by a steering committee of line and IS managers. Of course, if a management team with roughly the same composition already exists, it is better that this team functions as the steering committee.

Today, most organizations for which IT has a support or operational function, are situated on this second ISM plateau. This is especially true for organizations in, for example, government and health care.

3. Process integration

In this stage, information systems enable the work of integral business processes to be carried out across several organizational units. On this plateau management starts to adopt a process view instead of a functional view on the organization. The implementation of these information
systems necessitates extensive organizational changes and an integrated data and technical infrastructure. The objective of the application of IT is to achieve (durable) competitive advantage in existing product-market combinations (PMCs). The IS plan and the business plan should be linked. The IS organization on this ISM plateau cannot be completely decentralized; on the other hand, a centralized organization is not in accordance with the line managers’ responsibility for their information systems. Therefore, the IS function must be selectively decentralized (a combination of centralization and decentralization), so that the responsibility for IS is spread over different parts of the organization. For example, decentralized systems development and centralized management of the data and technical infrastructure. IT specialists and users together identify and analyze the most important business processes using, for example, Michael Porter’s value chain method. A project manager (process owner) should be appointed for each main business process. Information systems are built by the IT specialists under the supervision of line management and IT decisions are made by a steering committee of line and IS managers and chaired by a member of senior management.

Most organizations where IT is of strategic importance, such as banks, insurance companies, publishing/printing companies and transportation companies, are now on this ISM plateau.

4. Business process redesign

As with the former plateau, the information systems on this ISM plateau also enable the work of the most important business processes to be carried out as single entities. However, existing business processes are not taken as given, but are redesigned or reengineered to make use of IT in new ways (proactive IT application). Thus business processes are performed in ways that were previously impractical or impossible. A customer order fulfillment process, for instance, can be eliminated by arranging for customers to place their orders electronically. Drastic organizational changes are usually necessary to implement these information systems. This is, of course, only possible with an integrated data and technical infrastructure. This infrastructure should also include development (CASE) tools and standard application modules to speed up systems development. The success of a process redesign project is often dependent on the speed of implementation. The objective of using IT is to realize competitive advantage in existing and new product-market combinations. The IS plan and the business plan are designed as one integrated strategic plan. The IT organization must be selectively decentralized with sufficient involvement by senior management, because IT has consequences for the entire company. Management consultants and user departments select and redesign the business processes together with IT specialists. The information systems
are developed by the IT specialists and users together, under the supervision of line management. IT decisions are made by senior management following consultation with a steering committee, with the same composition as on the former plateau.

Nowadays, business process redesign or reengineering (BPR) is applied by most organizations where IT is of strategic importance. However, business process redesign is not a simple matter. Some large management consultancy companies have developed their own BPR methodology and some have also developed tools for specific parts. At this moment, a proven methodology is not available, which is why many reengineering projects fail. According to a recent study by the Arthur D. Little consultancy, involving 350 managers of Fortune 1000-listed companies, 85% of the respondents were not satisfied with the results of their reengineering projects. For organizations where IT is of strategic importance, reaching this ISM plateau is the main challenge for the Nineties and beyond. Well-known examples of such organizations are IBM Credit Corp. and Ford Motor Co.

IBM Credit finances IBM’s products and services. Formerly, the entire finance process, from request to tender, was handled by four functional groups (with each group having their own information system) for, successively, checking the potential borrower’s credit rating, modifying the standard loan covenant to the customer’s requests, determining the appropriate interest rate and writing a quote. The four functional groups were replaced by a single group of generalists supported by a small pool of specialists for the difficult cases, all using one integrated information system. This reduced the throughput time from an average of seven days to four hours. The productivity increased no less than a hundredfold.

At Ford the parts procurement process occurred as follows. The purchasing department sent a purchase order to a supplier, with a copy going to the accounts payable department. When the goods arrived, a clerk at the receiving dock sent a receipt form to accounts payable. Accounts payable payed the invoice after checking the purchase order and the receival document. A lot of time was lost when these three documents did not match. The procurement process was reengineered, so that now the data is entered into an on-line database when a purchase order is issued. When the goods arrive at the receiving dock, a clerk checks at the computer terminal to see whether the received shipment corresponds to an outstanding purchase order in the database. If so, the clerk accepts the goods with the press of a button; the computer then automatically makes out a check to the supplier. In this way, the accounts payable staff could be reduced by no less than 95%.

These drastic productivity improvements, caused by radical process changes, are typical for this ISM plateau. It is sometimes claimed that reengineering projects resulting in less than 50% improvement are not worth the
name BPR. Productivity improvements on the first and second ISM plateau are usually no more than 10 to 20%. Therefore, a larger increase in IT’s added value is shown between the third and the fourth plateau in Exhibit 2.

5. Business redesign

Here too, information systems enable the most important business processes to be carried out using an integrated data and technical infrastructure. However, to make optimum use of IT, not only are business processes redesigned, even the business scope is enlarged or shifted if necessary. This requires not only redesigning the business processes, but the entire business. A new definition of the business objectives generally results in new business processes and the redesign of existing processes, which goes hand in hand with radical organizational changes. The objective of the application of IT on this plateau is to realize innovative product-market combinations. The business plan and the IS plan form one integrated strategic plan. A highly selective decentralization of the IS organization is required. The information processes are carried out by small process teams. Users and IT specialists together develop the new business processes and the corresponding information systems under the supervision of line management. An ‘enriched’ information infrastructure is necessary to realize new applications quickly and to absorb new information technologies. IT decisions are made by senior management, because of the consequences for the business purpose. The intensive involvement of senior management and the close cooperation between users and IT specialists require the organization to be a so-called network organization (see section on network organizations).

It is expected that most companies will reach this ISM plateau after the year 2000. The fact that this is the highest plateau does not mean that there will be no further developments after this level. By that time, however, the application of IT will have become as normal as using pencil and paper and information processes will have become ordinary business processes.

Exhibit 3 summarizes the seven subsystems of the IT domain for each IS management plateau. The ISM plateaus illustrate the ‘natural’ development of the application of IT in organizations, as a result of learning processes of line managers, users, IS managers and IT specialists. Two breakthroughs can be distinguished:

1. A transition from looking at functions to looking at business processes in organizations due to experiences with quality management programs between the second and the third plateau.
2. A transition from reactive to proactive application of IT due to the rising popularity of business process reengineering between the third and the fourth plateau.
<table>
<thead>
<tr>
<th>Subsystem</th>
<th>Reactive IT application</th>
<th>Proactive IT application</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>IS strategy</strong></td>
<td>Improve efficiency. IS plan is inventory of users’ demands</td>
<td>Competitive advantage in existing PMCs. IS and business plan linked.</td>
</tr>
<tr>
<td><strong>Information systems</strong></td>
<td>Support existing workflow in business functions.</td>
<td>Enable existing (complete) business processes.</td>
</tr>
<tr>
<td><strong>Information infrastructure</strong></td>
<td>Platform for each function.</td>
<td>Integrated data and technical infrastructure.</td>
</tr>
<tr>
<td><strong>IS organization</strong></td>
<td>From completely centralized to completely decentralized.</td>
<td>Selectively decentralized. Small teams.</td>
</tr>
<tr>
<td><strong>Users</strong></td>
<td>Functional specifications</td>
<td>Redesign of business processes and realize IS</td>
</tr>
<tr>
<td><strong>IT specialists</strong></td>
<td>Realize IS</td>
<td>Design and build IS</td>
</tr>
<tr>
<td><strong>IS management</strong></td>
<td>IS managers decide within budget.</td>
<td>Senior management decides after consulting with steering committee.</td>
</tr>
</tbody>
</table>

Exhibit 3. The subsystems of the IT domain on each ISM plateau in organizations.
Exhibit 3 can be used as a diagnostic tool to assess the functioning of an IS organization. For a proper functioning the characteristics of the subsystems should be located in the same column (plateau). Subsystems situated on different plateaus is an indication of problems in an organization.

Different sections of an organization can be situated on different ISM plateaus. A faster transition to a higher plateau can be achieved by adequate planning and control of the necessary activities. The higher plateau is then regarded as the goal of the IS strategy. Intermediate plateaus can be defined, if necessary, to realize the transformation in smaller steps, thus increasing the manageability of the migration. A proper alignment between the subsystems through adequate communication and coordination must be attained as soon as possible after reaching a higher ISM plateau, to prevent falling back to the lower plateau.

The following conditions for a successful transition to a higher ISM plateau are suggested:

- All subsystems of the organization domain and the IT domain on the present ISM plateau are consistent with each other.
- Senior management believes that IT can be used as a lever for greater competitive advantage.
- A clearly defined IS strategy exists, supported by senior, line and IS management.
- A climate of change is created in the entire organization (unfreezing).
- The IS strategy is defined as concrete action plans or projects for each subsystem.
- There is adequate control of the development of these projects.
- There is sufficient commitment and support from senior management.

It is however not always necessary to reach the highest ISM plateau as soon as possible. This is only the case if IT has strategic importance for the organization’s survival, for example in the case of financial institutions, retailers and transportation companies.

IS MANAGEMENT PLATEAUS IN COALITIONS OF ORGANIZATIONS

Michael Porter has shown that companies, together with their main suppliers, distribution channels and customers, form a value system through the vertical links between the value chains of each company. By working together, the value chain of each of the participating companies can be improved. Additionally, the exploitation of vertical links is difficult for competitors to copy. In this way, a market or even an entire branch of industry can be dramatically changed in favor of a group of cooperating organizations or coalition of organizations.
Coalitions or alliances are defined as long-term strategic cooperation between companies, encompassing more than the normal business transactions, but less than a merger or an acquisition. The following types of strategic cooperation are possible between businesses:

- an alliance, based on a long term cooperative agreement or contract;
- a participation: acquiring a minority of the shares; this can also be a mutual interest, for example by exchanging shares;
- a joint venture: jointly setting up a new business.

*Interorganizational information systems* are the shared information systems of a coalition of organizations. These systems support business processes that extend to all the participating companies, enabling them to expand their scope and capabilities outwards to customers and suppliers. These systems support or trigger the redesign of business processes across the boundaries of multiple organizations. For example, with Just-In-Time delivery the outbound logistics of a number of suppliers are linked to or integrated with the inbound logistics of a company, resulting in considerable cost reduction for all the participating companies. The most simple form is linking by Electronic Data Interchange (EDI) or Internet. In this way, the advantages of the familiar forms of horizontal and vertical integration of businesses can be obtained without actual acquisitions. Interorganizational information systems integrate businesses electronically without affecting the economic and legal independence of the separate businesses.

The consistency model of IS management (Exhibit 1) can also be applied to a coalition of organizations. In this case, a coalition rather than a single organization is seen as a collection of entities. The same subsystems can be identified in a coalition of organizations as in a single organization. After all, it is improbable that there are fundamental differences between a coalition of companies and for example a divisional organization with different business units. All the participating organizations make up the organization domain; the IT domain refers to the joint application of IT and the common IT facilities. The subsystems of both the organization domain and the IT domain apply to the entire group of cooperating organizations. Essentially, the five IS management plateaus in Exhibit 2, representing the development stages of joint application of IT or common IS management, also apply to a network of cooperating organizations. The following paragraphs offer brief descriptions for each ISM plateau, of the subsystems IS strategy, Information systems, Information infrastructure, IS organization and IS management of the IT domain. The subsystems IT specialists and Users also apply to all the participating organizations. The interorganizational information systems are generally developed by joint project teams, consisting of IT specialists and users from the participating organizations. User involvement increases at each successive plateau. Although the characteristics are similar to those of a single organization presented in the
former section, there are higher barriers to close cooperation between IT specialists and users from different organizations, partly because of differences in company culture.

1. **Functional integration (transaction automation)**

   In a coalition of organizations, functional integration implies transaction automation. High-volume, repetitive paper transactions between the participating organizations are replaced by electronic messages (electronic mail or basic EDI transactions). The objective of the common application of IT is to increase the speed and reliability of the transactions between the organizations. Generally the messages cannot link directly into the participants’ main applications. Examples are sending and confirming orders, receipt notices and invoicing. Only minor, peripheral alterations to the organizations’ working procedures are necessary. The IS strategy, the data and technical infrastructure, the information systems and the IS organization of the business participants can essentially remain the same and common IS management is fragmented. The situation is similar to a completely decentralized IS organization in a single company.

2. **Cross-functional integration (procedure automation)**

   On this second ISM plateau, the interorganizational systems enable all transactions of a procedure to be carried out in the form of electronic messages. A procedure consists of a number of related transactions often performed by different functional departments of the participating companies, such as an invoice-to-payment procedure. Procedure automation requires a direct link into participants’ application systems, because transactions must also trigger responses (e.g., an invoice initiates a payment). The objective of the common application of IT is cost reduction. Work methods within the participating organizations are affected by the procedural adjustments, but no significant changes to the internal organization structure and process structure of the participating companies are necessary. However, the IS strategies and technical infrastructures of the participating organizations should allow the realization of these systems. This implies at least an agreement on common IT standards. A steering committee of the involved line and IS managers must be set up to define these standards and to supervise the creation of these interorganizational systems. The situation is comparable to a completely decentralized IS organization with interdepartmental cooperation on a few applications in a single company.

   Most EDI or Internet applications today are situated on the first or the second ISM plateau. These applications are used particularly by manufacturing companies, transportation companies, retailers, financial institutions and government organizations.
3. Process integration

In this stage interorganizational systems enable the execution of some main business processes between the participants in a value chain, such as keeping shelves stocked. Of course, this is only possible if process integration has already been implemented in the individual organizations and if a common data and technical infrastructure is available. Process integration usually requires adjustments to the internal organization, process structure and work methods of the participating organizations. The objective of the common application of IT is (durable) competitive advantage in existing product-market combinations. There must be a joint IS plan that is consistent with the individual business plans and individual IS plans. This joint IS plan must also address the development and maintenance of the common information infrastructure. The definition and implementation of the joint IS plan is controlled by a steering committee that includes members of senior management from the participating businesses. The IS organization has the federation form and is guided by the steering committee. Examples are companies with Just-In-Time supplying, such as Benetton, the worldwide supplier of knitwear based in Italy, and Wal-Mart, the largest retailer in the United States.

Benetton agents in the different countries relay orders for shops in their territories to Benetton’s headquarters in Italy through a data network. An interorganizational order management system collects information from the agents’ computers, updates the agents’ product and price files, confirms orders and routes them to the appropriate production plants in the various countries.

Wal-Mart uses an interorganizational information system to replenish all their stores. The product inventory is minimized by letting day-to-day sales data automatically trigger orders to the suppliers and delivery to the stores. All Wal-Mart suppliers are linked up to point-of-sale computers and have online access to the database of product-purchase information fed by these systems.

4. Business process redesign

As on the former plateau, interorganizational systems enable all transactions pertaining to a shared main business process, on the basis of a common information infrastructure. The systems are fully integrated with the corresponding process-supporting applications in the participating organizations. However, business processes will be changed if this is necessary to optimize the IT potential. This often results in radical changes in the participants’ internal organization and process structures. Sometimes, even the boundaries between the organizations must be reset. The objective of the common application of IT is competitive advantage in existing and new product-market combinations. Realization of these interorganizational systems
and common information infrastructure requires a joint strategic plan, integrating a business and an IS plan. The IS organization on this plateau is also federal. The decisions are made by a steering committee, that includes senior management representatives from each of the participating organizations, because of possibly severe organizational consequences. In spite of the rising popularity of BPR, only a few pioneers, such as the Blockbuster Entertainment stores in the United States, have reached this fourth ISM plateau.

Blockbuster Entertainment and IBM have developed a system that enables record shops to download CDs and videotapes on the spot using a central database filled by recording companies, movie studios and game makers. Customers are thus presented with an almost unlimited availability and diversity of products, while shopkeepers can drastically reduce or eliminate the costs of shipping and inventory. Additionally, unsold inventory and lost sales or rental revenues when popular copies are out of stock become things of the past.

5. Business redesign

Business redesign (BR) or business scope redefinition is also possible in a coalition of organizations. It is a logical step following the redesigning of business processes across organizational boundaries. This implies boundary corrections and drastic organizational changes in the participating organizations. The objective of the common application of IT is to realize innovative product-market combinations, that may create completely new business and market opportunities. This requires a common integrated strategic plan and a common ‘enriched’ information infrastructure. The IT activities are functionally coordinated by senior management. Because of the strong interdependence of the participating companies, the steering committee on this highest ISM plateau takes the form of a board of directors of a holdings company. In effect, the coalition becomes a single (network) organization.

It is expected that coalitions of organizations will reach this highest plateau in the 2000s. The pioneers are today's core enterprises, described in the section on network organizations.

**Exhibit 4** summarizes the seven subsystems of the IT domain on each ISM plateau for a coalition of organizations. Also in a coalition of organizations, all subsystems on each plateau must be in equilibrium before transition to a higher plateau can take place. On each successive ISM plateau, the impact of IT on the individual organizations and on the relationships between the organizations increases, the costs and risks rise, but so does the potential competitive advantage generated by IT. Furthermore, more and more knowledge and skills of the managers, users and IT specialists are necessary to realize the necessary interorganizational information systems.
<table>
<thead>
<tr>
<th>Subsystem</th>
<th>Reactive IT application</th>
<th>Proactive IT application</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>IS strategy</strong></td>
<td>Increase speed and reliability of transactions. IS plan based on users demands.</td>
<td>Competitive advantage in existing PMCs IS plan adjusted to individual business and IS plans.</td>
</tr>
<tr>
<td><strong>Information systems</strong></td>
<td>Transaction automation with EDI or Internet.</td>
<td>Procedure automation with EDI or Internet.</td>
</tr>
<tr>
<td><strong>Information infrastructure</strong></td>
<td>Different information infrastructures</td>
<td>Common standards.</td>
</tr>
<tr>
<td><strong>IS organization</strong></td>
<td>Project organization</td>
<td>Federal</td>
</tr>
<tr>
<td><strong>Users</strong></td>
<td>Functional specifications</td>
<td>Accountable for realizing IS</td>
</tr>
<tr>
<td><strong>IT specialists</strong></td>
<td>Realize IS</td>
<td>Design and build IS.</td>
</tr>
<tr>
<td><strong>IS management</strong></td>
<td>IS managers decide within budget.</td>
<td>Steering committee of line and IS managers.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Steering committee chaired by senior management.</td>
</tr>
</tbody>
</table>

**Exhibit 4.** The subsystems of the IT domain on each ISM plateau in coalitions of organizations.
On the highest two ISM plateaus, a common ‘enriched’ information infrastructure is respectively desirable and required. IT is applied reactively on first three ISM plateaus and proactively on the two highest plateaus. The interdependence of the participating companies increases on each successive ISM plateau. Thus, stronger forms of cooperation arise on the higher plateaus, such as joint ventures and mutual participation. Similar to a single organization, a coalition of organizations is transformed to one single network organization on the highest ISM plateau. Adequate planning and control of the required activities is necessary for a directed migration to a higher plateau. An essential condition for a successful migration is mutual trust within the coalition. Additionally, the conditions mentioned in the former section also apply to coalitions of organizations.

Because a single (network) organization is formed on the highest ISM plateau, the five ISM plateaus can also be used as stepping stones to integrate a group of businesses into a single enterprise following mergers or acquisitions. It can start with EDI and Internet applications of the first and second ISM plateau, which will not affect the independence of the individual companies. The highest ISM plateau, where the business objectives of the individual companies are redefined and a single network organization is formed, is then chosen as the business strategy objective. The intermediate ISM plateaus can be used as intermediate steps for planning and control in order to increase the manageability of the transformation process. The companies’ interdependence increases on successive plateaus because of the interorganizational information systems. In this way, IT can be used to lever the integration of acquired businesses into one enterprise. This will work especially for companies whose primary business process is a data processing process, such as banks and insurance companies.

NETWORK ORGANIZATIONS

New organizational forms are required to obtain a sufficient degree of flexibility and alertness of companies to survive in a complex and dynamic environment. Many different descriptions can be found in textbooks of these new (future) organization structures. Peter Drucker for example predicted the coming of the information-based organization. The intensive exchange of information makes whole layers of middle management and staff redundant. The operational work is executed by different specialists with a high degree of autonomy, such as in an orchestra. This does not take place sequentially but is a synchronized team effort. James Quinn described the intelligent enterprise, concentrated around a few core competencies in which it is world leader and which provide a unique added value. Only those primary and support activities in which the organization is the absolute best, are selected from the value chain. Any activity that can be performed better or more cheaply elsewhere in the world, is outsourced.
Modern management techniques and IT enable an effective control of contracted work.

This results into *boundaryless organizations*. The views of the authors above can be summarized in the following description of advanced organizations, referred to as *network organizations*. The three basic principles of a network organization are:

1. Integration of management and execution (task integration).
2. Concentration on core competencies.
3. Coordination by means of IT rather than a hierarchy.

These principles can be applied on a single organization or a coalition of organizations working together, here indicated as internal and external network organization respectively.

**Internal network organizations**

The most important characteristics of such an organization are:

- minimal hierarchy because of the integration of management and execution and the use of IT for coordination;
- the organization’s center of mass is formed by managers and specialists (knowledge workers), that work together in changing multi disciplinary self managed teams (strong selective decentralization);
- self-organizing and self-learning features because of the integration of management and execution (a network organization is a learning organization);
- a large amount of work is outsourced to concentrate on core competencies;
- a diamond-shaped rather than a pyramid-shaped organization due to the outsourcing of low-skilled work;
- IT is used intensively at all levels: a network organization without IT is an impossibility since coordination and communication is mainly performed by IT (groupware).

Network organizations have no departments or sections. The organizational unit in a network organization is the (multi disciplinary) self managed team. The self managed teams may have to deal with strongly differing assignments. Every team should have a goal, preferably quantified, that is clear to every team member. One-time activities can be assigned to a team as well-defined projects. As for the ongoing activities, each integral business process is assigned to a process team, consisting of a process owner or manager and a number of specialists from different disciplines. If parts of the business processes (sub-processes) are outsourced, the processes extend beyond the organization’s boundaries and reach into the partner organizations. A team’s composition and required information
systems should be changed frequently, because business processes must continue to meet the customer’s needs. Changing information systems rapidly is only possible with an ‘enriched’ information infrastructure as described further on.

A critical factor in a network organization is the availability of people with the required knowledge, skills and attitudes, because of the integration of management and execution (empowerment). Different expertises can fade away quickly in multi disciplinary teams. A network organization therefore needs human resource managers or expertise coaches to develop and maintain specific expertise and to regularly rotate team members to ensure the necessary exchange of know-how between process teams. These managers are accountable for the knowledge management and supervise the necessary learning processes in the organization. Every team member has his or her own process manager and expertise coach, who are directly accountable to senior management. The process managers, the expertise coaches and senior management together form the senior management team. Larger organizations can be subdivided in a larger number of business processes, that are then grouped into clusters of strongly interdependent processes, so that the exchange of information between the clusters is minimal. In this case, process managers and expertise coaches do not report directly to senior management, but to cluster managers, who are part of the senior management team. People in a network organization have no functions specifying their tasks, but roles indicating their goals and responsibilities. There are only five roles in a network organization: senior manager or director, cluster manager, process manager, expertise coach and team member.

In a network organization, an important part of the management is carried out by the people themselves (self-organization through integration of management and execution). They have access to all the required information to take decisions independently. Clearly defined mission statement and goals are necessary to keep people directed towards the same objectives, and these should be easily translatable to individual actions. A network organization can only perform well in a customer-oriented company culture, because customer care is not concentrated into a separate unit. The company’s results are expressed not only in sales and profit figures, but also in customer satisfaction. A customer-oriented company culture is encouraged if staff have regular contact with clients and if clients are included in the process teams. Also, staff should have a high degree of self-motivation and strive for personal development through performing challenging assignments and having interesting experiences. Managers in a network organization convince rather than direct and are especially concerned with motivating their staff and stimulating them to high performances: in other words, they are good coaches. As ‘assisting foremen’, process managers also
execute tasks. The reward system is not only based on individual performance, but also on the team’s results and the development of required knowledge and skills. Recognition is mostly expressed through horizontal, rather than vertical, promotions, giving an employee the chance to pick up new skills and know-how and work on more interesting projects.

The ‘enriched’ information infrastructure

The current developments on open systems, three-tier client-server architecture and object orientation make an ‘enriched’ information infrastructure possible. Shared servers and object-oriented software components or building blocks (business objects) harbor the largest part of the functionality of all possible applications (Exhibit 5). The number of available servers is increasing rapidly. There are now special servers for storing text, images and sound, servers for processing transactions, document imaging, workflow management and groupware, and servers for data mining (searching for characteristics and trends in databases). Re-usable software components, that are partly self-made and partly purchased (class libraries), are stored in a component library that is part of the information infrastructure. Object orientation enables a distinction between objects that represent an organization’s more fundamental properties and objects that represent the current (temporary) work methods. The result is a layered information infrastructure, with the more permanent elements in the lower layers and the temporary elements in the upper layers.
With an “enriched” information infrastructure, new applications can be realized quickly and existing applications can be adapted readily while maintaining a durable infrastructure. In other words, flexibility is combined with stability. There is also no need to make a distinction between central and local information systems, because the infrastructure is available both locally and centrally.

Organizations can also absorb new technologies rapidly by adopting new IT products and services, in the form of servers and object-oriented software components, in their ‘enriched’ information infrastructure. Fast absorption of new technologies is a source of competitive advantage and therefore part of an organization’s core competence. Because massive application systems have become obsolete, adopting new technologies no longer requires extensive conversions.

External network organizations

One of the characteristics of a network organization is a large amount of outsourcing. A network organization therefore needs a network of other organizations in order to function effectively. Today, an organization’s success is largely determined by its strategic alliances with the world’s best suppliers, designers, distribution channels and other external services. In fact, expectations are that networks of companies will rule the global market in the coming years. Three constructions can be distinguished:

- Core enterprises or strategic centers
- Coalitions or federations of companies
- Virtual organizations

Core enterprises. Core enterprises create a network of small partner companies in which competition and cooperation are balanced by:

- Outsourcing as many activities as possible, that are not part of a core competence, in the form of strategic alliances with carefully selected companies that can make a valuable contribution to the whole. For example, this might be knowledge of local circumstances or capability of fast and cheap production.
- Developing partners’ competencies and encouraging innovation through an intensive exchange of information and introducing a ‘knowledge competition’, in which existing and new partners participate. Partners who can’t keep up are shaken off.

Through standardization and task distribution among the various partners, core enterprises can realize economies of scale without losing flexibility or responsiveness, since this is innate to the small, autonomous partner companies. Core enterprises can also grow and adapt rapidly by attracting and rejecting partner companies. Examples of core enterprises
are the U.S. computer manufacturer Sun Systems and the Italian clothing business Benetton.

**Coalitions of companies.** Companies can also enter networks of strategic collaboration with companies of about the same size. This results in a coalition or federation of independent companies. The value chains of the participating organizations can be strengthened by entering into alliances with suppliers, distribution channels and/or customers using interorganizational information systems. On the higher ISM plateaus a shared information infrastructure is required. This federation form combines autonomy with cooperation and the economies of scale of large companies with the flexibility and effectivity of small companies (see former section).

**Virtual organizations.** Core enterprises and coalitions of companies are long term alliances or stable networks. Alliances between companies may also be formed temporarily, for a specific task or project. When the task or project is completed, the coalition breaks up and the participating organizations are free to enter into new coalitions. This is referred to as virtual organizations or dynamic networks. A form of virtual organization is the so called broker organization, a small core that manages independent specialty firms in different countries performing all the required business functions to realize certain products and services. Lewis Galoob Toys is an example of such an organization.

**A NEW ROLE FOR IS MANAGEMENT**

The proactive application of IT requires more from IS management than simply knowing what the company needs at a given moment. IS management’s new role is to anticipate future demands, to stimulate innovation and organizational change by ‘enriching’ the information infrastructure as soon as possible. In other words, the IS strategy is not a derivative of the business strategy, nor is the IS organization derived from the business organization. An integrated strategic plan is worked out and an integrated IS and business organization is set up. Exhibit 6 summarizes the changing role of IS management.

A successful launching of this new IS management role requires a new methodology to support this role. The Information Infrastructure Management (IIM) methodology is developed for this purpose. IIM is a methodology to integrally manage, develop, maintain and use information infrastructures consisting of applications, databases and technical infrastructure components (hardware and systems software of computer systems and communication networks). IIM has solved the difficulty of fitting an information infrastructure adequately to an organization, by making the architecture the focus-point and defining architecture as the whole of business and information functions, business and information processes and
information infrastructure. This results in a flexible IS organization that changes with the business organization. IIM offers a continuous improvement of the performance of business processes and can accommodate existing methods and techniques. These topics are covered in the author’s article in the Fall 1997 issue of Information Systems Management.

CONCLUSION

Consistency models describe the subsystems of an organization, while stages models describe its development phases. Combining the two types of models results in a complete picture of an organization, in both stable and dynamic environments. IS management plateaus can be defined by combining a consistency model of IS management with a stages model of the application of IT. There are five stages of IS management: functional integration, cross-functional integration, process integration, business process redesign (BPR) and business scope redefinition or business redesign (BR). For a successful application of IT, all subsystems of the organization domain and the IT domain should be in equilibrium. This requires good communication between users and IT specialists and adequate coordination by senior, line and IS management. At each successive ISM plateau, IT yields more added value, but it requires greater organizational change, relatively higher IT expenditures, more IT knowledge on behalf of users and line management, more insight into business processes on behalf of IT specialists and IS management, and greater involvement from senior management. Each successive ISM plateau demands a higher degree (quality) of

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<th>Prevalent IS management</th>
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<td>Role</td>
<td>Supplier of IT products and services</td>
<td>Leader in organizational change</td>
</tr>
<tr>
<td>Purpose</td>
<td>Ensuring optimum IT facilities</td>
<td>Optimum contribution to achieving business goals</td>
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<td>Products</td>
<td>IT products and services</td>
<td>Knowledge and information</td>
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<td>Primary knowledge</td>
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<td>Method of IT application</td>
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<td>Primary focus</td>
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<tr>
<td>IS strategy</td>
<td>Derived from business strategy</td>
<td>Integrated with business strategy</td>
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<td>IS organization</td>
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Exhibit 6. The changing role of IS management.
communication and coordination for an adequate alignment of the seven subsystems.

On the first three ISM plateaus, the application of IT is based on the current business strategy, organization and culture. On these lower plateaus the subsystems of the IT domain are adapted to the subsystems of the organization domain. This reactive IT application results in productivity improvements of 10 to 20%. At the two highest ISM plateaus, the current organizational features are modified, if required, to enable an optimum utilization of the possibilities of IT. This means that, if necessary, the subsystems of the organization domain will be adapted to those of the IT domain. With this pro-active IT application, productivity gains of more than 50% are possible. The third ISM plateau is a transition stage between reactive and pro-active application of IT, where management starts to adopt a process view instead of a functional view of their organization. The transition to a higher ISM plateau requires adequate planning and control of the development of each subsystem, based on a clear business outlook and strategy. Progressing to higher ISM plateaus reduces the possible forms of IS organization. From the third ISM plateau on, only a selective decentralization of the IS function is appropriate.

The consistency model of IS management and the ISM plateaus can also be applied to a network of cooperating organizations or coalition of organizations. The further the interorganizational information systems intervene in the business processes of the participating companies, the greater the possible competitive advantages, but also the greater the costs, risks and interdependence. Entering higher ISM plateaus means that the joint IS organization evolves from a completely decentralized form (with a project organization for the development and maintenance of the interorganizational information systems) to a federal form.

On the highest ISM plateau, both a single organization and a coalition of organizations transform into a network organization. The basic principles of a network organization are integration of management and execution, concentration on core competencies and coordination by means of IT rather than a hierarchy. A network organization also needs a network of other organizations in order to function adequately. This can have the form of a core enterprise with a network of small partner companies, a coalition of independent companies of roughly the same size or a temporary alliance (virtual organization).

Since a single network organization is formed on the highest plateau, the ISM plateaus could be use as stepping stones to integrate a group of businesses into a single enterprise following mergers and/or acquisitions. This applies especially to organizations whose primary business process is data
manipulation, such as financial institutions. IT is then used as a lever in the integration of businesses.

A network organization requires an ‘enriched’ information infrastructure, in which the greatest part of the functionality of all possible applications is in the form of shared servers and re-usable object-oriented software components or building blocks. With an ‘enriched’ information infrastructure, new applications can be realized rapidly and existing applications can be adapted readily while maintaining a durable infrastructure. Organizations can then also absorb new technologies quickly. The ‘enriched’ information infrastructure illustrates the increasing importance of information infrastructures. The focal point of the IT facilities in an organization is shifting from information systems (applications) to the information infrastructure. IS management is becoming II management.

On the fourth and fifth ISM plateau, where IT is proactively applied, a new role of IS management is required. This new IS management is supported by a new methodology called Information Infrastructure Management (IIM).

Bibliography