Technology and Organization: an Integrated Approach

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Abstract

Many problems with regard to the development and implementation of information technology are organizational problems ("it works but it does not fit").
Research shows that in IT-projects insufficient attention is paid to:
* organizational consequences of technical changes,
* cost-benefit analysis of technological change,
* changes in the quality of work,
* training, education, recruitment and selection,
* the decision making processes (project organization; user participation).

These problems are caused by
* the *one-dimensional, technical point of view* of technological change (while the importance of social and organizational aspects is being underestimated) and
* the *unbalanced power*, the lack of participation of the so called 'powerless' groups involved in technological innovation: the users, the management, the staff.

The development and implementation of information technology need an *integrated approach* in which the redesigning of technology and organization is a mutual and interrelated process.
Traditional information technology methodology and tools may be insufficient for such complex task. The integrated approach needs new methods and new instruments, in which special attention is paid to the participation of users, management, and staff in the decision-making process of technological development.

For Example...

Insurance Company 'The Hope'

Once there was an insurance company involved in a complex process of technological change. New systems and procedures had to be developed. This process also implicated a change in the work organization.. new tasks had to be carried out and old ones would disappear.

It was not the first technological change the company was involved in. Everybody remembered the last time and especially its complete disaster!! For example.. the first week after the implementation the system was 'out' for three days... thousands of data appear to be 'missing'.. new tasks emerged suddenly.. the work load increased rapidly.. training programmes were promised but never carried out.. etc.
"Teething troubles of the new system!", they said!
That might be true, but the disillusion was great and all parties involved - the management, the workers, the DP staff - were keen to do it better this time. Everybody was aware of the fact that technological change can only be successful if all parties would really participate in the decision making process with regard to the automation project. Participation was regarded as the key to solve all problems. The company created, especially for this new automation project, a 'project organization'. In this project organization there was an important role for the user group, in which representatives of the users would make proposals for the functioning of the new system.
It looked fine. And in good spirits they all started the project...

June
Rumours in the Policy Department: there will be another automation project! The Head of the Department, however, emphasizes that this time everything is much better organized than in the past. For example, there is a user group and therefore there is room for participation!
Who will be part of this user group?
"John", the Head says, "John, will you participate? Actually you are the only one in our Department who was involved in automation projects earlier. You must know how to handle these things..."
John agrees to participate. Other employees, among them Sally and Carl, join the group.

At the first meeting the user group discusses the report 'To Go Top' of the DP-department, which presents in

detail the proposals of the new automation project.
Sally and Carl did read this report before the meeting. Although they understand the main ideas presented in it, they do not always understand precisely the detailed descriptions of the process of development and implementation. Many technical explications are not clear to them. At the meeting itself Chris from the DP-department - he is responsible for the project - gives a short explanation. But, Sally and Carl find it hard sometimes to follow the line of arguments Chris elaborates.
"..therefore, if we install the 420, we can run this debug programme, which I explained to you earlier, and then it will be possible to start the Testing Phase I in the beginning of September", Chris ends his explanation, "are there any questions or remarks?"
"So, we choose the 420 and not the F30?", John asks.
"That is right, John", Chris says, "That seems more sophisticated due to the larger intervention capacity of the 420... Any more questions"
Sally hesitates. She is afraid that everybody will think she is dumb, if she would admit that some remarks or descriptions are not clear to her... She looks at the others. They all keep silent, Carl as well.
"...Alright. Than we can get started with this plan!", the Chairman decides, "Thank you for your contributions."
When they return to the Department, Carl says to Sally: "I did not get it at all! Most of it is abracadabra to me!" They look at each other: "Well, it doesn't matter.. we will see..."

In the meeting room Chris collects his overhead sheets. He thinks: "I wonder.. John is OK, but the others... I do not think that they will ever produce a good idea.. But, who knows... we will see"

September
Chris walks out of the meeting room of the user group. He is angry.
"If that is the way it goes, we will never make it before Christmas!", he complains to John. John knows exactly what Chris means. In the user group discussions had been started over and over again, there were no plain decisions made and Chris had to explain everything twice. Today, for example, the user group discussed the lay-out of the screen: how to arrange columns and data on the screen. It seems a simple matter: just a matter of arranging simple data like policy numbers, several amounts, dates, etc. But in the user group they kept bleating about it: "That is not the way we work..", they said, "..and where do I put the control figures?" And again Chris had to explain that - of course - with the new system you will never work exactly in the same way as in the past and that an automated system does not need control figures, because it controls itself! But it seems that they did not want to understand it. It really dejects Chris.
"Let us look at the screen lay-out together!" John suggests.
No problems for them. The same afternoon they develop a brand new lay-out; and more, Chris produces an example of the screen lay-out on his note-book.
The next meeting they proudly present their solution in the user group and suddenly all members of the group accept their ideas. "Good job, Chris", Sally says, "Now I see what you meant last week". Everybody is enthusiastic..

"Well done", John says, "That is 'coming and winning in one move', as they say!" "Yes", Chris answers, "User participation is a hot issue and sacred as well. But when it comes to the point, it is always up to us!!"

December the t. 10.30 pm
Chris puts down his papers and logs off. It is Sunday evening and he has been working during the weekend to adjust this new Policy System. He hopes it will function this time. Last week was a straight calamity. And not because he made a bad system! Technically it worked all perfect! But somehow the users were not able to use the system properly:.. they had difficulties in filling in the amounts and numbers.. they came up with completely different procedures than he elaborated in the user group.. Even that damned screen lay-out did not work! "Follow-up and maintenance" they call it in the manuals!! Forget it, sometimes you have to spend more time at maintenance that at the sheer production itself!

January
Board meeting. On the agenda is the evaluation of the 'Policy project'. Until now the system did not function properly. Even at this very moment the system is out again. Another adjustment has to be made by the DP-department. Besides, there are many problems with the automatic production of the account. That part of the system is not yet in operation.
"I do not get it right", the General Manager says, "in Manchester and Birmingham they work with an automatic account production system for years now. They just bought it somewhere, ready-made I heard!"
For a moment it falls silent.
"Actually we have that in mind for some time now," the Head of the DP-department says, "Parallel to the production of 'policy' we checked the possibility to buy ready-made packages for parts of our system. There is this programma Account, which seems very suitable for our account problems. If we link Account to our own system - which is very easy to do - all problems are solved."
"Then do it!"
"Do we need to discuss this in the user group?"
"No of course not.. after all it concerns just a small technical adjustment. It will not have any organizational or social consequences. No, just leave it...."

February
In the Policy Department the employees work with the new system for some weeks now. The system works.. more or less. There are not so many interruptions as in

the beginning, but nevertheless it still does not work smoothly. For instance, response time is still high: sometimes it takes the system 2 or 3 seconds to react!
"That has nothing to do with the system, Sally" Chris explains, "It is caused by the way you work in this Department. No one uses the system before 10.30 and then, suddenly, everyone of you wants to work with it at the same time. That produces the overload..!!"
"Well, it all seems very logical to me," Sally says, "that is the way we always work! We begin with a batch of polis orders, than we have our first coffee break and than we prepare this batch for processing.."
"That I did not know! You never told me!", Chris says.
"Well, you never asked!"

And so on...
So, in order to prevent this long response time, the employees change their normal way of working.
In the same way many other major and minor changes in the work organization take place, solutions are being foud for smaller and bigger problems that - ad hoc - emerge while working with the new system. And all these small and large changes together implicate fundamental changes in the work organization of the Policy Department.
The contents of the work have changed, but it is very doubtful if these changes make the work more attractive.. sometimes one just has to put in simple data for hours and hours.. Besides, the training sessions they promised have not been started yet!

Furthermore, there are rumours that the Account Department will disappear and that the employees in the Policy Department will take over the work. Could that be caused by the implementation of this Account-programma in the new system? By the way, this implementation was never discussed in the user group! "Just a minor technical application" they said, "without organizational consequences..."
What the hell do they call 'organizational consequences', if the deletion of an entire Department is not qualified as such?

It is all very disappointing...

Backgrounds of Success and Failure

Everybody, involved in technological change, will recognize these problems. In many organizations - before the start of the project, during the development of the system and its implementation and also afterwards when the system functions - many problems rise with regard to social, economic and organizational aspects of automation.
Recent studies in The Netherlands - and why would it be different in other countries? - show that, according to the opinion of directly involved persons (DP-staff, management) technological change is very problematic (see figure 1).

Opinion	%
Successful	51,1
Problematic	43,8
Failure	4,7

figure 1. Success and Failure

It shows that 50% of the projects are considered to be problematic or te have failed. Suppose your bank tells you that there would be a mistake with regard to 50% of your transactions!
Such figures increase the importance of further research with regard to the backgrounds of success and failure of IT: which are the so called 'critical factors of success?

The main problems of technological innovation seem to be, first, a one-dimensional technical point of view and, secondly, the unbalanced power of involved parties. Let us consider these backgrounds.

One-dimensional Technical Point of View

Hardware and Software
Research with regard to the backgrounds of success and failure usually focuses on the problems of system development itself (problems with regard to hardware and software). Indeed, in the first place success depends on the *quality of the system* itself. The new system must function optimally in a technical sense; it must be fast and reliable.
Although hardware and software problems still exist, these aspects of IT have been improved tremendously, as IT companies frequently - and proudly - express: technical improvements, new systems, new programmes, new networks, etc.
However, this exclusive focus on the technology might be a critical factor itself! It represents a one-dimensional approach, in which the technical point of view dominates: "once the technological problems solved, the rest will follow likewise". We must question the effectivity and the efficiency of this, one-dimensional, approach.

Costs/benefits
First, one should not exclude the economic component. Suppose the system works and its results are reliable, but suppose it is delivered more than a year later than planned and it costs twice as much as originally agreed. Success or failure? Research shows that - if at all there is a time schedule or a budget - many IT projects run out of time and appear to be much more expansive than planned. More and more, this overrunning time and budget is considered to be an aspect of failure, especial-

ly since user organizations are more likely to submit insurance claims - and with success! - for damage due to overrunning time and budget.

'Org-ware'

Secondly, one should not forget the social and organizational components. The one-dimensional approach often leads to a situation in which a technological balanced product does not work because insufficient attention is given to other components of technological change: the organizational, the economic and the social components. Like in the case of the insurance company 'The Hope', it occurs that a system does function in a technical sense, but still does not work 'properly', because there is no 'fit' between the technical functioning and the work organization. Decision making processes with regard to IT appear to be dominated by considerations concerning the hardware and the software but not concerning the so called **orgware.**

A very clear example of this process we may recognize in the use of word processing programs, like WordPerfect. These word processing systems are technically very well developed. Still, in most companies, one hardly makes use of the numerous options of these programmes. Training programmes do not exist or the work organization is not adapted to the new system. In spite of all the technical possibilities of WordPerfect most PC's are used as polished typewriters. This has nothing to do with technical failures, but with organizational misuse.

In our insurance company 'The Hope" you have recognized the same situation with regard to the Account package. The organization just bought this package. Initially it seems to have no effect on the organization. But at the end it appears to be the main cause of a complex reorganization within two Departments!

The *quality of the organization* therefore also is an important parameter of success. Success or failure depends in this sense on the effectivity and efficiency of the work processes, the coordination of work processes, the coordination between departments, etc. Furthermore, success and failure might have positive or negative consequences for the *quality of the working life*: how many work places will disappear, how many new places will be created, what will be the contents of jobs after automation.. will there be 'downgrading' or 'upgrading'... does automation creates opportunities for individual carriers or would automation lead to dead end jobs?

This insufficient attention does not only implies a missed chance to improve the quality of the working life for the personnel, but often this situation causes a lack of motivation of the workers in accepting the new system. Success of automation depends for a great deal on the good will of the people involved, as experienced system developers and project managers know.

Research on so called 'critical success factors' of technological change shows that in many cases failures in automation are not only due to technical mistakes (minor quality of hardware and software), but also to social, economic and organizational failures ("it works but it does not fit"). These insights broaden the analysis of information technology towards an analysis of organizational change: technological change is always interrelated with organizational change. We must therefore analyze the constraints of technological development as organizational problems, threats and opportunities.

Unbalanced Power

Much of these problems are related to insufficient participation of users, management and staff.

Many problems rise as 'semantic problems': users do not understand the DP-language and technological experts seem not able to understand the ordinary work organization. These semantic problems, however, are exponents of problems related to *power*.

Distinct groups or parties are involved in each IT project. Each group has its own wishes and interests. We recognize the group of technical experts ("all we want is to deliver a good functioning system, conform the user specifications"), the managers ("we want a cheap system that helps to increase the productivity and we want it in action by tomorrow"), the users ("we want a system that is reliable and smooth and does what we want it to do, although we do not know exactly how to explain our demands in technical specifications"), personnel manager ("be aware of the quality of the work"), organization adviser ("technological change always implies organizational change"), etc.

Like always, these wishes and demands sometimes interfere. Not everybody will have power enough to realize his or her interests. Such a complex constellation of interests and power relations makes high demands to the management of IT projects. There must be room given to all parties involved to express their wishes, for everybody knows that success highly depends on goodwill and acceptance of all groups. However, in spite of all good intentions, in the actual decision making process, the interests and wishes of one group still dominate. Decisions on IT are dictated by technical principles of design and the strategies of technological experts to realize their specific interests. This power basis reinforces the unidimensional technical point of view mentioned before. Especially those parties, whom we expect to have interests and wishes in the field of quality of the organization or quality of the working life (the management, the users and the staff) are not involved in the actual decision making process.

Be aware! This is not due to 'mean intentions' or 'manipulations' of the 'techs', but has grown from:

a. the kind of problems the IT-branch had to solve during the past decennia and

b. 'The A-team': the daily practice of IT development inside the user organization.

Let us look at both processes.

IT-problems (until the early eighties)

As argued by Friedman and Cornford (1989), since the fifties we may distinguish several phases in the history of information technology.

The *first* period (from the early fifties until 1965) is characterized by the search to solve problems with regard to hardware constraints. The IT branch struggles with technical problems: it appear to be very problematic to build and implement big computers, although these machines had a rather small capacity compared with the turbo-computers of the nineties. But the technicians somehow succeed in producing and implementing these computers. Their products were snapped up by industry and offices. The client organizations were very eager to have computer capacity: it was the age of astonishment anyhow! This situation made that the client organizations had to depend on the activities of the supplier companies. This was the basis for the power of IT during the next decennia. Technological change (and, in its wake, organizational change) was laid in the hands of technical experts within the IT-branch. In terms of organizational strategy we may say that the client organization developed a very defensive strategy with regard to the supplier market of IT: a total dependency on developments that occur out of their reach.

When in the middle of the sixties the price/performance ratio of computers improved - which was partly due to the decrease of the costs for hardware and to the increase of the computing capacity itself - the nature of the problems of the IT-branch changed likewise. In the *second* period, that runs up to the early eighties, attention shifted form hardware problems to software problems. The supplier market for IT was growing and many hardware suppliers were in competition with each other, trying to price their competitors out of the market with faster and bigger machines. All these machines needed their own specific software. The hardware producers therefore had to develop individual software systems for their clients. In this period the investment in software systems grew faster than the investment in hardware.

Especially in this period of software constraints the power of the IT-branch expanded, because developing sogftware is a core function of the IT-branch. Developing specific software for individual clients therefore increased the dependency of the client organization. The power distance between IT and user organizations became bigger and bigger. The bastion of the technological experts expanded and started to look as an 'ivory tower'.

'The A-team'

There is a similar ivory tower inside many user organizations as we may recognize in the daily practice of IT development. Let us take a close look at the power position of the four most important parties. What kind of wishes and interests do they have and what chances do these groups have to realize their wishes?

The *management* of the user organization has interests in the organizational aspects of technological change: does automation provides a more effective and more efficient organization? Will the new information system give the management better information in order to steer and control the organization?

The question is whether the management is able and capable to make these wishes come true? Obviously, this is often not the case. Although formally the manager is the most responsible person in the project organization, the management often has *no influences* on the system development process. Most managers do not have the capability nor the time to impose their wishes: "It is up to you," they say, "I do not understand this project entirely, and besides, their is more work to do! Just write a master plan and I will put my signature on it!"

The *staff*, responsible for organizational change and personnel management, should play an important role in the decision making process, according to the handbooks of organizational change. It belongs to their job to pay attention to the social and organizational components of technological development. In daily practice however, this staff is 'conspicuous by its absence'. They pop up at the end of the process when the new system is about to be adopted, to provide training courses etc. Research in The Netherlands shows that in many organizations this staff is not invited to take part in the project organization at all.

How about *end user participation*? We all know that end users in most cases have little influence. Technical experts only need user participation in order to get specific information with regard to the work flow. They need this information in order to develop a new automated system. User participation is definitely not a form of 'organizational democracy' in which the users have some kind of power. Therefore there is no need for a 'user representation'. All the technicoans need is the assistance of a *superuser*: someone who knows both the technical procedures and the work processes in the user organization. Superusers exist in every organization: John (see page 2), for example is the superuser in our insurance company and Chris, the technical expert only wants to work with him.

It is obvious. Speaking of power, of all parties involved, the *technical experts* form the most important party in the decision making processes: the system analysts, the programmers (to some extent), the system managers. The activities of these persons steer and manage the process. Together with the superusers they form the *A-team of IT*.

Perhaps you know the A-team: a tele-production in which time after time four persons, well trained and their activities well geared for another, succeed in fulfilling the most dangerous tasks within 50 minutes, without being killed by their nasty enemies.

It is the A-team that in many companies steers and conducts the IT project (look at John and Chris in our case). And please notice again: this power position is not based on manipulation; it seemed quite natural to solve problems this way. The power of the A-team is based on the power of self-evidence.
If you read again what happened in September in our case, you will see how successful such a team seem to be ("they did it again..."). However, much later - in our case in from December on - problems come to light: the system the A-team had made was sufficient in a technical sense, but did cause a number of organizational and social problems. And our A-team had no answers to such problems!

Success and failure of IT is not just a technical matter. Therefore the decision making process should not be dominated by the technical experts. Successful technological change demands a more integrated approach.

The need of an integrated approach

Some time ago a staff member of Philips' IT-department gave a lecture on the development of CDI. She told that designers and marketing advisors, dealing with the development and distribution of IT products, had to be aware of the law of the 'diminishing amazement'. Since the early fifties, she said, the public is engulfed by numerous examples of technical miracles, one after another. People get used to technology as the producer of miracles. Therefore, slowly but surely the existence of 'just another technological invention' belongs to the normal way of life. This makes it very difficult to make use of people's admiration and amazement in introducing a new technology or new technological equipment. Clients are less amazed by technology itself and have become very alert to marketing campaigns with regard to technology and very competent judges of the quality.

The law of diminishing amazement does not only work with regard to the individual buyers of technological equipment. Organizations as well have become more alert than they were forty years ago: they do no longer see technological innovation as the panacea for all diseases. This causes changes in the relation between the buyer organization and the IT-branch, or between the user department and the DP-department within the same company. More then ever the technicians (the IT-branch and the DP-departments) have to concentrate on the quality of their products in stead of making use of the "widespread believe in technological change as the only way out". Theses chances imply a remarkable *u-turn* with regard to the strategic relation between the client organization and the supplier market of technological investment goods and with regard to the role and position of the technical experts.

U-turn in strategy
The change in strategic relations becomes visible when we look at the *third* period (from the early eighties until the nineties) of IT development. In this period the nature of IT-problems is on the shift again: from hardware and software constraints to constraints with regard to the relation between the technological experts and the user organization. From the early eighties on, as Friedman and Cornford (1989) argue, the IT-branch was confronted with user relation constraints in an increasing degree. Of course hardware and software problems still exist but these problems are of secondary importance compared with the user relations constraints. The user organizations become aware of the interrelation between the technological developments and the organizational changes. The development of the information technology evokes changes in work flows, in the adjustment between departments etc. All these organizational changes emerge as such, as by-products of technology. The client organizations became aware that the technological development was able to change the vital functions of an organization in a crucial, but uncontrolled way and that is unacceptable.
The relation between organizational demands and technological development tends to invert: the organization no longer adjusts itself to the technological development, but the technology has to prove its ability to improve the organization. 'Quality programmes', 'maintenance', 'system management' became more and more important, more important even than 'mainframe capacity' or even 'technical compatibility'. This change in attitude towards technological change implies a change in organizational strategy. No longer client organizations develop a strictly defensive strategy towards the IT-branch. More and more one can trace offensive strategies trying to steer the development in the IT-branch in stead of the other way around. This, on its turn, demands much more flexibility inside the IT-branch then before.

U-turn in role and position of the technical experts
In the slipstream of this transformation the relation between the technical experts and the users (the managers, the end users) changes. The involved parties in the client organization demand more influence in the decision making process with regard to the development and implementation of technical - and organizational - systems. 'User involvement' becomes a hot issue.
However the problem is that these developments demands totally different capacities and qualifications of the technical experts than in the first and second period. To some extent, hardware and software problems are problems strictly related to the IT-discipline itself. Of course, these problems are huge, but it is a home match for the branch. To solve these problems one can rely upon the quality and capacity of the technical experts. However, user constraints have a different nature than hardware and software constraints. User problems are organizational problems and to solve these problems other expertises are requested (on the domains of organizational change, human resource management, organizational redesign, etc.). The IT-branch - as it has devel-

oped itself sofar - delivers no expertise in these field and other experts (organization advisors, personnel managers, experts in decision making processes) manage to enter the arena of technological and organizational change. That implies that the power basis of the technicians is crumbling. The technician is no longer the only expert, but one of the advisers with regard to a complex reorganization in which the change of technology is one aspect, besides other aspects (organizational, social and economic components of technological and organizational change).

The only way out of these problems is to broaden up the expertise of the parties involved in developing and implementing technological change. The development and implementation of information technology need an integrated approach in which the designing processes are not only technology oriented but also organization oriented. The redesigning of technology and organization is a mutual and interrelated process. Traditional information technology methodology and tools may be insufficient for such complex task. The integrated approach needs new methods and new instruments, in which special attention is paid to the participation of users, management, and staff in the decision-making process of technological development.

Technology and Organization: an Integrated Approach

The integrated approach of technology and organization stands for an overall approach of the management of technological and organizational change. This approach covers four domains:

1. *strategic orientation* (tuning of organizational and technological policies),
2. *project diagnosis* (mapping relevant critical success factors),
3. *integrated design* (the making of an integrated technological and organizational design) and
4. *change management* (the organization of technological change).

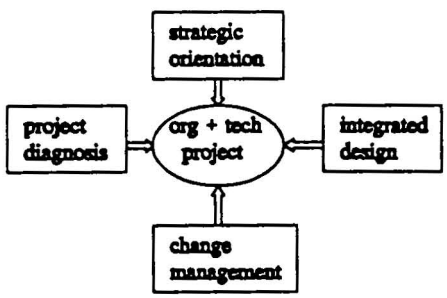

figure 2. Four domains of the integrated approach

In this paragraph we will shortly indicate the contents of these four domains and the kind of instruments and tools requested for this approach. We do not present a new methodology, but a perspective. Analysing the impact of an integrated approach: what would these four domains looks like in order to improve technological and organizational change? Like all perspectives, sometimes this perspective seems at hand, sometimes it is still far away.

Strategic orientation

The domain of strategic orientation focus on 'tuning'. This tuning aims at a consensus between all parties involved with regard to the goals of technological change and the different ways these goals might be achieved.

"Let me explain", the consultant said to the General Manager of 'The Hope', "Before we start another IT project, I want a general meeting with all parties involved: the technical experts, the manager of the user department, the users, the personnel manager, the organization staff. First we have to achieve a general agreement on the overall strategy of this organizational change. We must make clear to all of them that IT is not a product made by the technicians to be used by the users.. not even a product made by the technicians consulting the users, but that IT is a product of the users themselves, supported by several experts, among them the technicians..."

The first step is always a strategic one.
It is important that everybody will agree that developing new technology actually means developing a new organization. This may look like a simple statement, but in the daily reality in organizations the impact of such statement would be a complete swing in the 'normal' way of thinking. Most people still think of technological change in terms of systems, hardware and procedures. Ask members of an organization: "What would be the first thing we should do in order to develop new technology?". Probably, they would focus on 'the investigation of existing systems and packages' or the 'inquiry of the users needs'. Only a few would say: "Let us first reconsider our work processes". Thinking of an integration of technological and organizational change requires a different level of thinking. Organizational change means: new strategies with regard to the environment, new organizational goals, new ways to organize the work flow and - as only one of the organizational components - new systems and programmes.

Several instruments and tools have been developed to achieve such strategic tuning. A 'tuning instrument' has been developed and applied in organizations: participants at strategic meetings give their opinion with regard to selected statements on IT. So doing, they start a process of reconsideration of common knowledge on IT. The same reconsideration is achieved in a management simulation in which distinct participants play several roles in the decision making process.

But achieving the right insight is only the first - though important - step forwards. One can make castles in the air, but those castles need specific fundaments or otherwise they will collapse like houses of cards. Such fundaments are formed by the following three fundaments of organizational change: diagnosis, design and change. These three fundaments form the next three domains of the integrated approach.
The first step is the *diagnosis*, the careful examination of the complex organizational problems; an 'anamnesis' has to be made of the state of the art in the organization with regard to distinct aspects in order to get insights in the conditions for successful change.
Secondly, a plan for the *redesign* of distinct subsystems of an organization has to be made.
Third, this redesign has to be implemented in the organization. This concerns *change management* itself. This fundament deals with the decision making processes with regard to the organizational and technological change.

Project diagnosis
Which critical factors of success with regard to the technological and organizational changes could be traced in the organization? These critical factors do not only focus on the technological component, but also on organizational constraints: the organizational environment, the characteristics of the organization itself and above all the existing constellation of power and interests of the parties involved.

"Let me explain", the consultant said to the General Manager of 'The Hope', "When we start this new project I want to make a full and precise diagnosis of all possible critical factors in the organization. I want to know where things may go wrong. This analysis does not only focus on the technical aspects.. I have read the critical analysis of our DP-department with regard to the proposed configuration. I know the problems in that area.. But I do not know what kind of problems I might come across at organizational and social level. Which departments are involved? Which work processes will change? How critical is the deadline for implementation considering the work load, etc. Who exactly will use the new system? Do their jobs change and to what extent? I need to know more about these things in advance, because I know that especially organizational and social aspects form 'critical factors of success".

There are several instruments for project diagnosis, all developed by the computer service industry and software houses. It is very important for IT-companies to have a clear insight in the problems they might come across before they start a project for their clients. And of course, learned by bitter experiences, these companies nowadays do pay attention to social and organizational aspects. One of the largest software houses in The Netherlands uses an instrument (a set of checklists) that focus on:

- aims of the project
- methodology and standards
- social and organizational aspects
- procedures
- project organization and user participation
- auditing and control
- technical infrastructure
- existing technological expertise in the user organization
- specific project constraints (deadlines)

etc.
This looks fine, but a careful analysis of this instrument shows that, although several social and organizational aspects are mentioned in the list, the focus still remains on technical aspects. The company wants to sell a software product and wants to know under what conditions this product will function. The company has no interest in selling a complex and costly reorganization. They won't be competitive anymore when they do so!
Nevertheless, it is important that social, economic and organizational aspects find a place in some kind of project diagnosis. If we can not in fairness ask of the IT-branch to provide this, the user company must do it itself. First, this requires the active participation of management, staff and users in doing this analysis themselves. Their involvement is important because these groups will be able - more than the technicians ever will - to bring the organizational and social components of technological change into the decision making process. Secondly, it requires 'organization oriented checklists'. In The Netherlands, for example, the STA-methodology has been developed and applied. STA (Social Technology Assessment) is - as the name indicates - a method for the assessment of the social and organizational aspects of technological change. The STA-method can be used by staff management (personnel managers, organization consultants) in order to get more grip on the decision making process of automation.
STA aims at the following
* to collect more detailed information concerning the automation plans, the impact of these plans on the organization, the work flow, the job characteristics and the workers and
* to make a judgment of these impacts in terms of the quality of the organisation and the quality of the working life.

Some checklists of the STA-method are used as tools in a project diagnosis in order to get more information with regard to the economic, social and organizational aspects of the project.

STA appears to be very useful as one user explains: "STA was very important for us: at last we were able to gain insight in the possible organizational and social consequences of the automation project. And we were - and still are! - able to use this stronger position to get things done. We agreed that in the future the system developers and the staff managers will cooperate to use the STA-method (or some parts of it) in new automation projects. Somehow, the STA-vision seems to be adopted

by the staff already: nowadays they refer in their reports to the possible consequences of automation for the quality of the organization and the quality of the working life..."

Integrated Design

Integrated design emphasizes on the interrelation between these distinct components of technological and organizational change.

"Let me explain", the Head of the Department said to the General Manager of 'The Hope', "I do not mind to be the chairman of the steering committee again in the next IT project. But if so, I want to work with a 'multi-expert' group to help us to make the integrated design... I need a technical expert, someone from the financial department to help us to make a cost/benefit analysis, experts on organizational development, the personnel manager to help investigate the exact organizational and social implications of this project..."

An integrated design consists of the following parts:

* Technical design
* Costs/beneits design
* Organization design and Job design:
  a. workflows and organizational structure
  b. job redesign
  c. personnel management

* *Technical design*

Much attention has been paid to this part of an integrated design, not only in the traditional methodology to develop new systems, but also in the numerous experiments to develop a system in relation to the social and organizational context. In the wake of the 'Scandinavian approach' instruments and tools for an integrated technical design have been developed in many European countries. Most examples of participatory design focus on this part (Greenbaum/Kyng, 1991).

* *Costs/benefit design*

Most studies on IT focus on the importance to have a clear view on costs and benefits of a specific IT-project, before the start of the project. However, this appears to be very difficult. First, costs and benefits are not only related to the technological aspects (costs of hardware, software or hired expertise), but also to the other components: organizational change, development of tasks, training, etc. How to calculate costs and benefits related to these aspects? Secondly, it seems to be difficult to make cost/benefits analyses with regard to complex projects, like IT projects, in general: "making costs/benefits analyses is a gamblers job", an economist once said.

* *Organizational design and job design*

An integrated design consists of a sophisticated plan with regard to the organizational and the social aspects of change. What would be the new organizational structure, what do future jobs look like?

a. work flows and organizational structure
   'Developing a new technological system means developing a new organization'. Integrated design needs a methodology (vision, instruments, tools) in order to redesign the organizational structure closely related to the development of the technological structure.
   This is a very important subject. There is a structural affinity between the principles of technological and organizational design. Research shows that the design principles normally used in system development (bases on data oriented or process oriented methods) have a very strong resemblance with the design principles of a Tayloristic organization (highly divided work flows, small jobs). This implies that technological development somehow forces the organization towards a Tayloristic organization.
   However there is a strong tendency to redesign organizations in a different way: decentralization, functional integration, all round departments, highly autonomous business units and contract management, etc. There are well developed methodologies to restructure work flows and organizational structure according to these new organizational principles.
   But the new organizational principles do not fit with the traditional principles of system design! There seem to be more resemblance with some so called object oriented design principles. This subject requires more research.
* Job redesign
   Plans have to be made to redesign jobs: job redesign concerns the job contents (small or complex) as well as jobs autonomy and control structure. It is important to have this part of the integrated design ready before the construction of the new technical system. Job redesign might lead to other specifications of the technical design. There is a long tradition in the development of methods and instruments with regard to job redesign related to technical design.
* Personnel management
   It is important to develop plans for training and education, for recruitment, selection, replacement or retrenchment, etc.

Change management

The domain of change management focus on the decision making process with regard to the technological and organizational change and on the process of actual implementation of the new structures.

"Let me explain", the General Manager of 'The Hope' said to one of the staff members of the Department of organizational development, "We are dealing with a very complex operation, as you can see. Several groups are involved in the new project organization: the user management, the users themselves, different experts, etc. We need someone who coordinated this complex process. We need an architect of the integrated approach. That is a fine job for you!"

The integrated approach makes high demands to the role and position of all persons involved and to the new project organization

* *User management*

The management has the final responsibility for the project. These managers need to work in the core of the new project organization. Any attitude of rejection ("I am not involved") would be disastrous for the success of the project.

* *Staff*

The organization staff, the personnel manager and the DP-staff will play a new role in the project. This implies a reorganization of the staff itself. According to Taylor's ideas of functional management most of the larger organizations in Europe have specialized staff experts: personnel management, DP-management, organizational development, etc. The integrated approach requires a very close contact between specialists. Diagnosis, design and implementation of the distinct subsystems have to be supported by a *multi expert team* of staff members, who constantly 'tune' the several components of technological and organizational change. This expert team (technicians, organization advisers, financial experts and personnel managers) helps the user organization with diagnosis and design. This support team would function in a more constructive way then the A-team.

* *Users*

Users will have a active part in the development of technical systems and organizational structures. There are many ideas and notions with regard to user participation. Traditionally, system development methodology focus on the participation of the users in order to formulate the specifications needed for the construction of the new system. Other methods indicate that users do also have an important role with regard to the implementation of the new system. They focus on the role of the users in the phase of the evaluation of the project.

The integrated approach requires more than user specification or evaluation activities. Users must play an active role in the project diagnosis and in the integrated design (system, organization, jobs). This is the central notion of cooperative design (Greenbaum/Kyng, 1991).

To realize the integrated approach a project organization should be build (see figure 3), based on so called integrated groups, each consisting of managers/users, supported by a multi expert team. Each group concentrates on the diagnosis and design with regard to the main components of technological and organizational change: the technical component, the organizational component and the component with regard to the personnel. The activitivities of these groups, of course, need mutual adjustment.

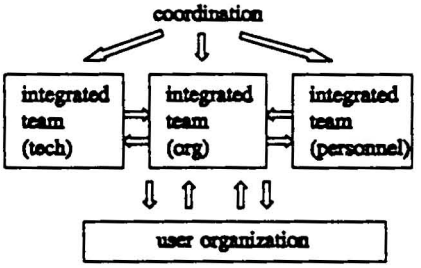

figure 3. Integrated groups

references:

A.L. Friedman and D.S. Cornford, *Computer Systems Development: History, organization and implementation*, Wiley, Chichester/London, 1989.

J. Greenbaum and M Kyng, *Design at Work: Cooperative Design of Computer Systems*, Erlbaum Assoc., New York, 1991.

"ICON (international computer organization network) is a confederation of academics, researchers and practitioners involved in studying the field of computer systems development. Researchers in the ICON organization include qualified specialists in the fields of economics, management, organization theory, sociology, and computer system development. Our working experiences with computer departments form the base of both our practical knowledge of how computer users can be incorporated in computer system design as well as our theoretical starting points in the fields of study we represent. Members of the ICON-group are writing a book on technology and organization: an integrated approach, based on cases-materials from the UK, Denmark and The Netherlands.