

Introducing Information Technology in Small and Medium Sized Enterprises

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1. introduction

Information Technology (IT) is said to be one of the driving forces of today's rapid development. With regard to industrial production, IT is believed to provide the companies, and especially the small and medium sized enterprises (SMEs) with the weapons needed to fight the battle of world wide competition. It is said that IT makes production transparent, increases flexibility, reduces stocks and leadtime, improves the communication with suppliers and customers, etc.

Reality however looks somewhat different. Several surveys carried out during the nineties showed that IT often did not deliver what was expected. A Swiss survey found that approx. 50% of industrial enterprises were not satisfied with their IT tools. Out of these 50%, 10% were totally disappointed [1]. Other surveys showed that even though the level of usage of CAD and MRP in European industry was quite high, the level of satisfaction was not: only 60% of CAD users were satisfied, and only 50% of MRP users were satisfied [2]. Also a recent report states that most US companies do not know what they really gained from the introduction of IT, and sometimes they may even have lost [3]. A financial justification of the investment made just seems to be impossible.

If any other product would provide its customers with such low degrees of satisfaction, it would soon be out of the market. But the IT market appears to be still growing, and the question is not: „Can our company afford to buy new IT?“ but rather „Can we afford **not** to buy it?“

In fact IT is a powerful technology. Whoever has started using it is unlikely to let it go again. Just imagine you had to write a paper like this one without the use of a computer: difficult to

even think of it! Too obvious are the advantages of computers. And while 50% of industrial users are not satisfied, there still are 50% who are satisfied!

So the question is not: Use IT or not? The question is: What is necessary to be part of the 50% of satisfied users? As very often with technology, the problem is not the technology itself, but the proper way of using it.

2. Reasons for Failure, Recommendations

What is the proper way of using IT in industry? Why did so many CIM (Computer Integrated Manufacturing) projects fail in the past?

The following considerations are based on surveys and on personal experience acquired during 6 years of work at *Bremer Institut für Betriebstechnik und angewandte Arbeitswissenschaft an der Universität Bremen* (BIBA), where I was responsible for technology transfer from research into industry. My own experience is restricted mainly to manufacturing industry, more precisely to discrete parts manufacture, and most of the projects were developed in co-operation with SMEs. The area of IT application was more or less restricted to production management and control, mostly shop floor control. I believe that my experience and the conclusions drawn can be transferred to other areas of application and to other industry sectors, but I am insecure to what extent a transfer from West Europe to Central and Eastern Europe is possible.

In 1994 a team of German researchers studied a number of failed CIM projects and found that approx. 80% of the failures were due to one or more of the following reasons:

- insufficient awareness of organisational issues
- insufficient involvement of end users

- inadequate training of users

From my own experience I would like to add:

- insufficient link of IT introduction to the enterprise strategy

Therefore the following recommendations seem to be appropriate to guarantee a smooth and successful introduction of IT:

- involve the future users as early as possible, and provide them with sufficient information and training so that they can contribute effectively,
- do not expect too much from IT, especially do not try to solve organisational problems by merely introducing technology
- see IT introduction in relation to the enterprise strategy (which of course requires that there is a strategy).

In the following sections, these recommendations will further be explained, and a methodology will be presented, which was developed at BIBA Bremen and successfully applied in a number of German SMEs.

3. The Relevance of Enterprise Strategy

Generally speaking, a strategy can be seen as a means to achieve long term success. Since every company wants to be successful, it seems to be clear, that every company needs a strategy. Unfortunately, many enterprises, particularly many SMEs, do not have a strategy. They are too busy solving every day problems and never find the time to think ahead.

There is a beautiful fairy tale in Germany: "Hans im Glück" where a young man starts with a big piece of pure gold, makes a number of excellent deals which all offer short term advantages, and at the end of the day he finds himself empty-handed. Clearly a lack of strategy, and therefore no long term success.

What makes an enterprise successful? In principle the answer is very simple: the customer. As long as he buys the products or services offered by the enterprise (at a price which allows the enterprise to continue), the enterprise is successful. So the starting point of

defining a strategy is the question: who are our customers, and what products and/or services do we want to sell to them? Which of their problems do we want to solve for them?

The answer should be as precise as possible. Empirical studies [4] show that the most successful enterprises world-wide often have a very narrow customer base and sell them very specific solutions - solutions which are optimally tailored to this narrow range of customers and therefore cannot be replaced by anyone else. Their customers need them. Obviously it is better to have a strong position in a small market than a mediocre in a large market. In other words: To 'own' customers is more important than to own products or technologies.

Of course a strong position in a narrow market requires permanent innovation and adaptation of products and services - however not driven by technology changes, but by changes of customer requirements. An innovation which does not matter to the customer is not important and maybe should be avoided.

The second question therefore must be: „Why do our customers buy from us and not from our competitors? What makes us 'attractive' to them?“ Once you have found the answer, you should make every effort to strengthen this attraction.

Finding a strategy is not easy [5], and it cannot clearly be done by just adopting fashionable messages and buzzwords such as "Lean Production" or "Virtual Enterprise". These fashions change too quickly, are too general, and tend to over-emphasise just one aspect of industrial production. To follow them may be very dangerous.

To give an example: It is said today that delivery time is becoming more and more critical. The faster a company can deliver, the more attractive will it be to customers. This may be true in many cases, but not in all cases. A Danish company produces harvesters. These harvesters are typically ordered by the farmers at the end of the cropping season, i.e. October or November. However, they do not want them to be delivered before May or June next year. So why should this company try to shorten delivery time?

In fact, a strategy should aim at strengthening the distinguishing features (the features that are most appealing to the customer) of the enterprise rather than following general recipes.

A strategy is, to a certain extent, "beyond" daily practice, however it must guide and shape daily practice. To make this happen, it is important that all major decision makers in the enterprise understand and agree on the strategy. This common understanding and agreement can best be reached by involving them all in the process of strategy definition. BIBA has developed methods and techniques supporting this process. The aim is to integrate and harmonise the many different views and objectives of different persons, e.g. production manager, sales manager, financial manager, etc., who normally have conflicting opinions and often fight each other instead of co-operating for the benefit of the entire enterprise.

Ideally, the strategy should be reviewed and updated periodically, and every major activity - such as the introduction of new technologies - should be related to it [6].

4. A Methodology for IT Introduction

In this Section a method will be presented for introducing IT in manufacturing SMEs [7]. It will be presented as a method of introducing production scheduling and control software, since this is the area where it has been applied most often, but it is with minor changes also applicable in other areas.

Let us start with a brief look at what I call the „conventional“ procedure of introducing IT. One day the company management discovers the need to innovate and use modern technology for improving production and in particular in-house communication. They select an area to start the introduction. Then they carry out an analysis of the current situation in order to understand the company's needs. This is often done with the help of an external consultant, because one believes they see the weak points better than own personnel. (In fact they do sometimes!) All kinds of data are gathered, and big reports are produced. Then experts are asked to propose soft- and hardware solutions. Vendors come and present their products. Their proposals are compared by the company management, and a decision is made. The selected provider is then asked to implement the solution, to train the future users, and the bill is paid.

What is wrong with this method? None of the above recommendations is followed: There is no clear link to the enterprise strategy,

organisational matters are not taken into account, and the users are involved only in the last step, and only in a passive way, as trainees. They have no say in the whole process. Of course they notice that something is going on - meetings of managers, consultants running around asking questions, vendors coming and presenting tools. But what does it all mean? Will their work change? Will they have to work harder, or will they even be fired in the end? Rumours will go around, fear will grow, and opposition against the innovation is almost certain. Once the new technology has been installed, the management has a hard time to convince the employees that it is helpful to them. On the contrary, the employees will do their best to prove that this technology is not an improvement at all, and that everything was better before. And they will certainly find ways to prove it!

From my point of view, this conventional procedure means missing a unique opportunity - an opportunity to involve the users, and through involvement get their support not only for the new technology, but for the enterprise and its objectives. The main point is to involve them actively, and to make sure they understand what the goal is. This has been achieved in many cases by following the procedure described below.

As said in Section 3, every major innovation should be linked to the enterprise strategy. Hence, the starting point of IT introduction should always be a clear goal: in which area does the enterprise want to improve its performance for the customer, and how can IT support this improvement? Unless this goal has been defined, one should not waste one's time evaluating technical options.

Once the goals are clear, the process to be improved needs be identified. Then a team should be set up which has the task of analysing the process and identifying the gap between the AS-IS (current situation) and SHOULD-BE (desired situation). This team should mainly consist of persons involved in the process, someone from the management, and maybe some external expert. The persons involved in the process are likely to know best what is wrong, and they are likely to be the future „users“ of the technology which will be introduced later on.

This team will produce a report on the weaknesses of the analysed process and estimate the potential for improvements. It will report to the company management which then

has to decide whether to go on or to stop the project.

In case of continuation, the team may have to be re-configured. The next task now is to develop solutions. It is important here to look at organisation first, not at technology yet. The first attempt should be to simplify the process. One problem often is to reduce the number of „interfaces“, i.e. the number of persons involved in a process. If you have one person making a decision, and a second person executing the decision, you have one interface more than necessary: ideally the same person should make and execute a decision. Another problem often is to balance formal and informal communication among employees.

A very powerful method for the evaluation of newly designed SHOULD-BE concepts is gaming, sometimes also called "social simulation": Once the division of labour and responsibilities and hence the role of each person are clear, several persons can „play“ the process in a simplified way. Simplification must be done in such a way that technical problems are ignored, but organisational features are preserved: instead of producing a real car, they may just assemble some *Lego* blocks or glue some pieces of paper together. Instead of processing a customer order, they may just fill a simple form. What matters is the interaction within the team, not the individual job. Playing the interaction, it can easily be found whether the overall process is clear and simple and interfaces are well designed, whether all information is available at the right moment, and whether there is a good balance of formal and informal communication.

Later on, gaming can also be very helpful in training the team. It helps everyone to understand his own role, and it can also be used to make everyone understand the role of his/her colleagues. And finally, it encourages a process of continuous improvements (KAIZEN).

Once the organisational structure has been fixed, the next step is to look into supporting tools and techniques - for the communication as well as for the individual job.

At this stage, the team will certainly need expert advice from IT engineers either from within the company or from outside (consultants, vendors). The requirements for products regarding functionality, interfaces, platform, price, etc. will need to be fixed, and a market survey carried out in order to identify candidate solutions for a more thorough

investigation.

For a detailed comparison of candidate solutions, it is often insufficient to ask the suppliers for a presentation of their products. They will naturally choose a demo case which highlights all the power of their solution. It may however not answer the question if the solution is suited well for the company's specific situation. Therefore every provider should be asked to demonstrate the application of his solution to the company's specific situation. Only then is a fair comparison possible.

Presentation must be done in front of the future users, and they must be given the possibility to work with the tool, try several operations, etc.

BIBA Bremen has developed a lab where various shop floor control tools can be tested and compared by future users [8]. The idea was to make the test situation as realistic as possible. To this end each tool was fed with precisely the data it had to process later on in real life, and it was coupled with a simulation model of the company's shop floor - exactly the shop floor that was meant to be controlled with the help of the tool in consideration. This simulation model was communicating with the control tool: it sent status information to the tool and received orders from the tool. It executed these orders, calculated the progress of work, sometimes generated disturbances, and returned the corresponding messages to the tool. Thus the user got a precise and lively impression of the way of working with the tool, and how well it was suited for the specific situation of the specific company.

Our experience showed that the users were very excited about this possibility, and actively contributed to the selection and configuration of the final solution. Needless to say that the acceptance of the final solution was very good and training of users was much easier after they had gone through this exercise.

5. Preconditions and Required Skills

The method described above requires more time and effort than the „conventional“ method sketched at the beginning of Section 4. Especially the workload of the own staff is much higher, since most of the work is done by company staff. It is essential for the success of the whole effort, that the time needed is not

underestimated. Employees must be given the time to concentrate on the project and not be disturbed by their daily duties.

The success of the described method depends on the creativity and commitment of the staff. However, nobody will commit himself to a project which may in the end eliminate his own job or lower his income. Management must make it clear, that the aim of the project is not to delete jobs, but to save jobs. Some companies gave a guarantee to their employees that during and within three years after the project nobody will lose his job or earn less. This was of course very effective, but I do not believe every company is in a position to make such promises.

Finally, employees must be trained in order to be able to carry out all the steps of the method. They will need basic knowledge about:

- analysis techniques (data gathering, documentation)
- creativity techniques (e.g. brainstorming)
- evaluation techniques (e.g. cost-benefit analysis)

6. Comparison of This Method with the Conventional Method

The Table below summarises the „conventional“ (first) and the recommended (second) method. It is obvious that the first is cheaper: it involves less steps, and most of the steps involve less people. However the advantages of the second method are very important, not only for the success of the current project, but for the company's future. The main advantages are:

1. It starts with clear goals - goals not only

Conventional Method		Recommended Method	
Steps	Actors	Steps	Actors
-----		Define Objectives	Management
As-Is Analysis	(Management, Consultant)	As-Is Analysis	Selected Staff Members (= Task Force 1)
-----		Develop organisational solution (simplify!)	Task Force 1, Involved Staff Members, Management (to accept)
Requirement Specification	Consultant, Computer Department	Technical Requirements Specification	Involved Staff + Computer Department (= Task Force 2)
Market Survey, Recommendation	Consultant, System Suppliers	Market Survey Pre-selection	Task Force 2, System Suppliers
-----		Testing and Simulation in User Specific Scenarios	Task Force 2, System Suppliers
System Selection	Management, Computer Department	System Selection	Management, Task Force 2
Implementation and Training	System Suppliers, Users	Implementaion and Training	System Suppliers, Users
-----		Evaluation and Improvement	Users plus Management (= KAIZEN Task Force)

- techniques of team work (discussion, moderation)

for this single project but for the entire company. The existence of such a clear

strategy is a benefit in itself which should not be underestimated. It may have an effect on every company activity, particularly when it is accepted by all people at all levels.

2. It solves organisational problems by organisational means, and technical problems by technical means. It does not attempt to use IT as a remedy for other than technical problems of communication and data handling.
3. It involves the users and their experience about the daily work and its problems. The chance that the developed solutions really meet the user needs and are accepted by them, is much higher with the second method. They will see the solution as "their" solution, and in case of problems they will probably try to solve them rather than reject the whole project.
4. Many staff members have received training in methods such as team work, analysis, evaluation, etc. They feel more confident of their contribution to the company's success, and they are likely to make more contributions in the future. This may well lead to a substantial change of company culture and to a process of continuous improvement.

7. Conclusion

The presented method may at a first glance seem to be very expensive, time-consuming and difficult. In fact it is much more than just a method for selecting and introducing suitable technologies. It has a number of desired side effects which in the long run may be much more important than the success of a single technological project. It often leads to surprising solutions with unexpected results on the performance of the company. Experience shows that sometimes the project which was set up in order to introduce IT ended with a solution which did not contain any IT at all (disappointing for the researchers and suppliers, but of great benefit for the company!).

The recommended method emphasises the role of employees, their experience and creativity. It requires investment into their education, and it requires to trust them. It may be seen as too

optimistic, but we firmly believe that investment in people always pays back - sooner or later, in one way or the other.

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