

# **Business framework for simultaneous engineering using the transaction cost theory and the concept of intranet**

## **Abstract**

According to the author of this paper, there is a need to enlarge the definition of simultaneous engineering. It no longer deals with only technical departments but with a system view covering all the partners inside and outside the organisation such as R&D, marketing, sales, production, suppliers and clients.

The environment is characterised by the following trends and conditions:

Globalisation, high level of uncertainty (behavioural and technical), high level of quality, innovation and market-driven, shorter product life cycle and shorter product development cycle, the evolution of computers and the growing use of internet.

Under this wider definition, there is to redefine the organisation taking into account a business view involving the permanent development of information technology (IT) and emphasising its integration in the organisation.

The simultaneous engineering approach considers organisations as a network and focuses on every transaction that is taking place, on the level of uncertainty of each transaction, on the nature of the relationship between the parties involved in the transaction (hierarchy, market and team) and on the human and technical costs of the transaction.

According to this approach, communication means depend on the organisational arrangement and change from one transaction to the other: from EDI to groupware and from email to intranet.

IT, with its dual role of automating or informing, is seen as a means to reduce transactions costs, thus enabling economic organisations to operate more efficiently.

Integration mechanism is a mixture of organisational arrangements and IT whose purpose is to raise the level of integration in the work flow in the organisation.

This modular approach defines users requirements and may be implemented at every step of the process: from new idea (or modification of existing product), development, prototyping, production, launching of the product and after sales.

## **Introduction**

The present paper is based on consulting work made in various companies in Israel and abroad during the past years along with personal research . After reviewing some of the main trends in the business arena, and defining concepts connected to the nature of the organisation and to information technology (IT), we present a method that integrates management and technology in order to reach simultaneous engineering.

## **Trends**

Most people in the business arena will agree that organisations' environment have become more complex and more prone to sudden expected changes. For the relevance of this paper, we have taken into account the following trends and conditions:

### **1. Globalisation:**

It is crucial especially for Israel which heavily relies on the foreign countries for marketing her products.

### **2. High level of uncertainty:**

Organisations are complex open systems and the environment is changing very rapidly. This is the reason why there is a growing interest in the chaos, non-linear systems and its use in the day-to-day management.(2)

### **3. High level of quality required**

### **4. Market-driven & Shorter product life cycle:**

Nobel Prize winner Arno Penzias of Bell Labs says that new advances in information technology are shifting the locus of value from individual products to integrated services, allowing every customer to become a product "designer" interactively choosing product options at the point of sale.(3)

### **5. Shorter product development cycle**

It requires a much quicker transfer of information between the different departments engaged in launching the new product. However, there is to learn from Toyota's apparent paradox. The manufacturer learned to make cars more quickly by actually slowing down the development process, using "set-based concurrent engineering." The basic idea is the following: you don't plan a meeting until you know everyone's schedule, and you don't design a product until you know all the design options.(8)

### **6. The evolution of computers:**

The adoption of computers in large organisations has gone through four distinct phases: large central mainframes, personal computers and distributed data processing, the networking of microcomputers, and the networking of networks. There is now a new phase which is the introduction of the network computer (NC); data and software will be stored on server computers and downloaded over the Internet (or an organisation's own intranet) as needed. This will dramatically reduce the investments in the endless upgrading of PCs.

## 7. Growing use of internet:

Indeed, the internet has its good parts such as a reduction of transaction costs, the access to databases, the hypertext and multimedia concepts, the potential for the marketing of products through servers, work groups etc. and its bad parts such as the difficulty to make business transactions because of the hackers, its sense of anarchy, workers no longer "work", etc.

What is interesting and really revolutionary is the intranet: you can use the programs, the technology and the concepts spread all over the internet and implement them inside the organisation thus setting the technical platform for simultaneous engineering. For a more comprehensive view of the internet, [see \(7\)](#).

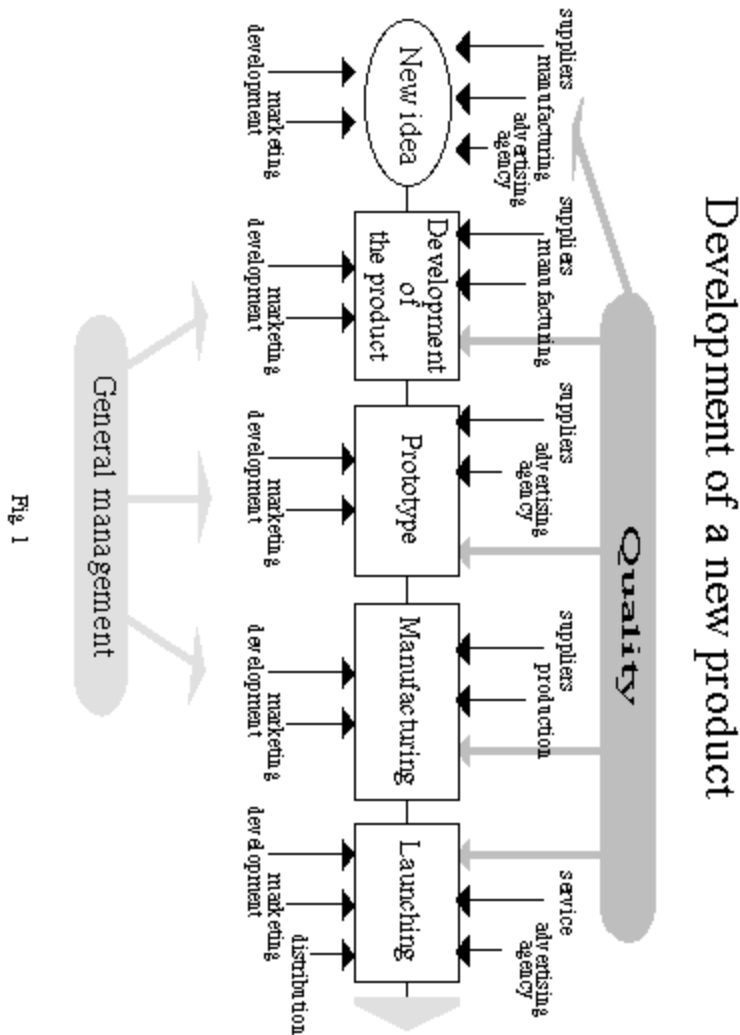
## Organisation

The following definition gives a framework to successfully integrate information technology to the company. Organisations are no longer seen as pyramids but as a network of contracts which govern exchange transactions between members having only partially overlapping goals. (Ciborra) Members may also be situated beyond the boundaries of the organisation, i.e. suppliers, clients, competitors, Governmental institutions etc.

## Nature of relationship

A business transaction is not a neutral act and it can generally be expressed according to the following model:

- Market - Invisible hand: the market system requires very little knowledge of the participants, i.e. their own needs and the prices. Ideally, market forces (invisible hand) make sure that the transaction is being made properly.
- Hierarchy - Visible hand: in a firm market transactions are eliminated and in their place we find an entrepreneur-co-ordinator who is the authority who directs production.
- Team - Invisible hand-shaking: network of exchanges are governed in a stable manner by informal relationships of trust (rituals). There is a strong interaction ( large volume of information) between members.



## Uncertainty

The natural uncertainty and the behavioural uncertainty are the main factors affecting the organisational arrangements (market, hierarchy and team). Uncertainty can be expressed in terms of complexity of the transaction and level of trust between the parties.

## Interaction between organisational arrangement, IT and uncertainty (1,4,9)

Task uncertainty varies in that the more uncertain the task, the greater the amount of information required to be processed by the members for co-ordination purposes.

The following table describes what is the best organisational arrangement according to the level of uncertainty (complexity & behavioural) of the transaction and the quality

level.  
Fig 2.

Quality Level	Hi	Market 1	Hierarchy 2	Team 3
	Lo	4	5	6
		Lo	Hi	
		Complexity - uncertainty		

- Position 1 The market mechanism is ideal when the complexity is low. It is possible to automate the task: e.g. checks to suppliers are replaced by electronic banking.
- Position 2 When the complexity rises, hierarchy is a better mechanism than the market place and a control system will be put in place in order to reduce the behavioural uncertainty.
- Position 3 When the complexity is high, then hierarchy is no longer the best arrangement: the control system is too heavy and it is an obstacle for performing the transaction. Team arrangement is then preferred and there is a need for more information.

## Integration mechanisms

Integration mechanism is a mixture of organisational arrangements and IT whose purpose is to raise the level of integration in the work flow.

From the positions 4,5, and 6: there is a series of arrangements that can be made. As an example, we'll take the situation of the relationships with suppliers.

- Reaching position 1:
  - There is to automate the transaction by setting up solutions such as EDI
  - There is to outsource the transaction
- Reaching position 2
  - A market situation may not be adequate: there is to set up a control system (technical and organisational). For instance, a manufacturer may require to enter the intranet (database) of its supplier.
  - A team situation with suppliers may become a problem: the supplier may take

advantage of the situation and will not deliver on time.

- Reaching position 3

There is a cost to build up a team. For instance when a Car Manufacturer is setting up its core team of suppliers, there are several steps: search of the supplier in the market place, negotiations, control of the transaction (it can take several years before the level of trust is high enough and a hierarchy is thus set up), maintenance and completion of the transaction.

## Analysis of fig.1

The objective is to reach concurrent engineering where all parties can work simultaneously. Thus, quality performance and rate of innovation can be raised. If we use the technology and the concepts taken from the internet, there is a common platform for every player. We have set up this graph with the basis that every player needs to be involved around the product. After all, there is no company without a product or a service. The new idea is a series of information: it may be just one sentence or already a package of information gathered by various players and that can be represented as a hypertext (including multimedia elements). Then, this series of information is transformed to a complex distributed database (intranet) equipped with forums, electronic mail, web sites connected to each other where parties can intervene during various steps of the development up to the launching of the product.

At each phase, there is a certain number of people involved and, as we have seen, their interaction changes according to the level of complexity.

Using the methodology described in the previous paragraph, it is possible to determine the user requirements and thus define the workspace, the desktop of each user and its needs in bandwidth. As an example, we can describe the transactions performed by a marketing manager when she comes to her office in the morning:

- She turns on the workstation
- She gets a welcome message (voice or text)
- She gets the daily report (Executive Information System) printed out for her (if she prefers hard copy)
- There is a corporate message -Progressive Networks Inc. is licensing a new application for its RealAudio software that allows corporate intranets to broadcast sound, such as company announcements and training presentations, to workers' desktops.
- She gets the list of electronic mail messages; there is a filter so that they are classified in different mailboxes. The important messages first appear and the others may even be sent to the secretary
- She gets the voice messages
- She gets the press review concerning the competitors thanks to the use of an intelligent agent (software and eventually news agency) where specific parameters have been set up.

- She gets the draft video clip of the advertising company: actually the clip may not be physically located in the premises of the company (link).
- She is able to view an image or clip from yesterday's video conference
- She can access information concerning the status of the development of a product
- She can answer messages using either voice, text or even video if she has a camera connected to her workstation.
- She calls a mechanical engineer and they remotely discuss details of a drawing: they share the same file and they each can annotate the drawing. However, she does not need a workstation as powerful as his.

Note: When the marketing manager is away of her office, she can access the same information (if there are no security obstacles) or part of it with just a phone or a fax machine (there are products that send web pages to phone or fax).

- The marketing manager is involved with a team of salesmen spread all over the world. It may indeed become a team: they face almost the same problems, they share the same goals. On one hand, there may be a hierarchical situation toward the marketing manager, where they have to send report. On the other hand, it is a give and take situation: she has to provide them with enough information (e.g. multimedia presentation of the company that can be dowloaded and which is constantly updated) in order to be credible to them and she should be part of the discussions that are taking place in the bulletin boards and ... IRL ("In Real Life").

## Conclusions

The paper has tried to draw a framework for combining organisational arrangements and technology in order to reach a simultaneous engineering. The technology today (intranet) allows such a methodology and there is no need for high investment in the equipment. The first companies have only started last year to set up their intranet: lessons should be gathered.

However, there is a need to work with the various partners in order to bridge the communication gaps. Moreover, there is to create new functions inside the company such as the info centre manager, librarian and to set up new corporate rules.

Last, a special effort has to be made concerning the graphic user interface. An idea that is worth investing is to use the concepts of Neuro Linguistic Programming along with possibilities given by multimedia to fit the information received by the user to his own way of perceiving the reality (through the 5 senses).

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