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Contribuții la optimizarea structurală a sistemelor de producție

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'Contributions for Structural Optimisation of Production Systems'

Thesis

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1. Introduction

a. Foreword

Within this research a flow and a model for 'structural optimisation of production systems through partnerships' for improvement in business performance - dependent on business situation – is developed. The chapters consecutively contribute to developing the model. The chapters themselves handle one topic a time and are recommended to be read at a time. Chapters 1, 2 and 5 due to their subject can be read stand alone.

The reader may interpret the ordering scheme of figures as follows, that is the composition of 'chapter', 'subchapter', and individual ordering number. Formulas and rules are ordered by 'chapter' and an ordering number.

b. Scope of the Thesis

In times of market saturation and customers getting more educated and liberated in choosing their product of need by their supplier of choice, enterprises have to be structured for coping complexity and dynamics and have to be managed by innovative concepts in order to perform up to supplier of choice.
In this environment rules to conduct business in a structured way of detailed planning and pure focus on production techniques, information technologies and creating the ability to supply customers are getting obsolete.

Structuring of enterprises is a key tool for management for leveraging people's motives for responsibility towards gaining flexibility and increasing speed for results. Besides internal structuring especially external structuring by mergers and acquisitions (M&A) become a more and more widely adopted strategic management tool of structuring in the global high tech industries. The reasoning for this is business reasoning – one company can't build up all required competencies by itself in order to cope with fast and vast growth in capital intensive research and development (R&D) oriented markets. Mergers and/or acquisitions therefore are used for structural optimisation of production by extending the product portfolio and/or extend the value chain in order to achieve a better position of the company within the market.

In fact a lot of the mergers do fail - despite there being wide variety of literature available on M&A explaining theoretical financial valuation methods, legal aspects to take care of, concepts, models and giving examples of successful mergers by describing their post merger business success. Similar to divorces within private life with a rate of around 30%

and above for some countries. For mergers industry consultants estimate a failure rate of about 50%. One of the reasons for failure is within the fields of managing the hidden value of high tech industry - the human resources – in order to gain effective synergy of core competencies to a better strategic positioning in the market place.

The reason assumed for the huge failure rate is the lack of a dedicated process and objectivise decision tools for structuring from selecting appropriate partners for co-operation, partner evaluation and selection of crucial changes for efficient and effective management by quick derivation of quantifyable outputs.

Within the thesis a flow and models are developed for the complete management cycle from analysis of partner requirement to unifying enterprises towards an optimised production structure – derived from theory and business cases, verified with a case study – in order to reduce risk of failure of a partnership.

The thesis focuses on the high tech industry as there are the dedicated challenges of huge investments required and and technology development times are below product life cycles. Therefore this industry has required to find structural solutions for optimisation
The thesis exploits knowledge from different sciences like industrial management, mathematics, artificial intelligence, philosophy, management theory, physiology, biology, business economics, etc. in order to understand modelling and human behavioural action in a way to positively influence and open up motivational factors and suppress mental and physiological barriers. Some singular findings themselves very likely are very well known to many of us, but the combination and the application in management does lead towards new concepts of more efficient leadership processes.

The model developed can serve as a consulting guideline for anyone involved in a merger or network establishment throughout the complete cycle from idea to realisation in valuation and execution methodology.

c. Structure of the Thesis

The first chapter, the introduction, explains the constant change of societies and economies and thus the need for continuous advancement of structural concepts for coping with the challenges of complexity and change within the industry.

The second chapter covers the state of the art theory and practical proceedings in structuring a production system/enterprise. The output of this chapter is the decription of the problem to be solved by the contribution of the thesis. This is realised by analysis of concepts and tools for

structural optimisation by evaluating the potential benefits and legal aspects. Concepts for future oriented management of fractals and networks are discussed in order to classify the problem within state of the art. This chapter is synthesized from discussion with various consultancies, venture capital companies, high tech enterprises, business schools, literature and business experience in managing a network.

The third chapter concludes state of the art in 'structural optimisation of production systems through partnerships' identifying need for improvement and deriving a target for the thesis. The following chapters do represent own contributions

The fourth chapter analyses samples in the industry for data available at point of decision and conclusions drawn for structural change. Those data are abstracted to generalised parameters and attributes for modelling of enterprises within the flow of structural optimisation. The samples are selected in a way to validate the model for a wide framework of applicability for 'economies of scale', 'synergise on competencies' and 'synergise on system'.

The fifth chapter does apply different sciences for structuring and parameter extraction for the model – especially for the management of change. Besides natural sciences humanistic sciences are applied for synthesizing new ideas for executing projects highly efficient in newly structured environments. A simple and effective leadership concept is the result to establish a highly dynamic and responsive enterprise to maintain lead in a competitive environment for satisfying expectations of owners and investors in the long run – by focussing on the customer.
This chapter does combine knowledge from sciences beyond management and engineering to develop a comprehensive understanding of basic mechanisms of root cause and result/target. The findings are applied to identify a framework for parameter selection for identification of optimisation in structure and personnel performance within an enterprise and its management. The sciences applied also are physiology (understanding reactivity of human beings), psychiatry (for correct interpretation of human behaviour) and sociology (for understanding effects on sub ordinance and conformity).

Within the sixth chapter the work flow and mathematical models are developed and described to identify dedicated points for management action as a basis for structured and effective procedure through evaluation up to merger. Based on the milestones a comprehensive model supporting the generation of results for evaluation of partners for networks towards increasing management efficiency during merger is developed. The findings generated of the analysis of case studies and of leadership and management theory are transformed for representation in the model. Fine tuning in its structure and algorithms to be applicable - according to its purpose - in a business environment rather than a technical environment

will lead to a transfer from a formal mathematical technical description to a verbal monetary descriptive language. The model evolutes from a technical effectiveness maximisation to an economic input output optimisation – easily to be applied.

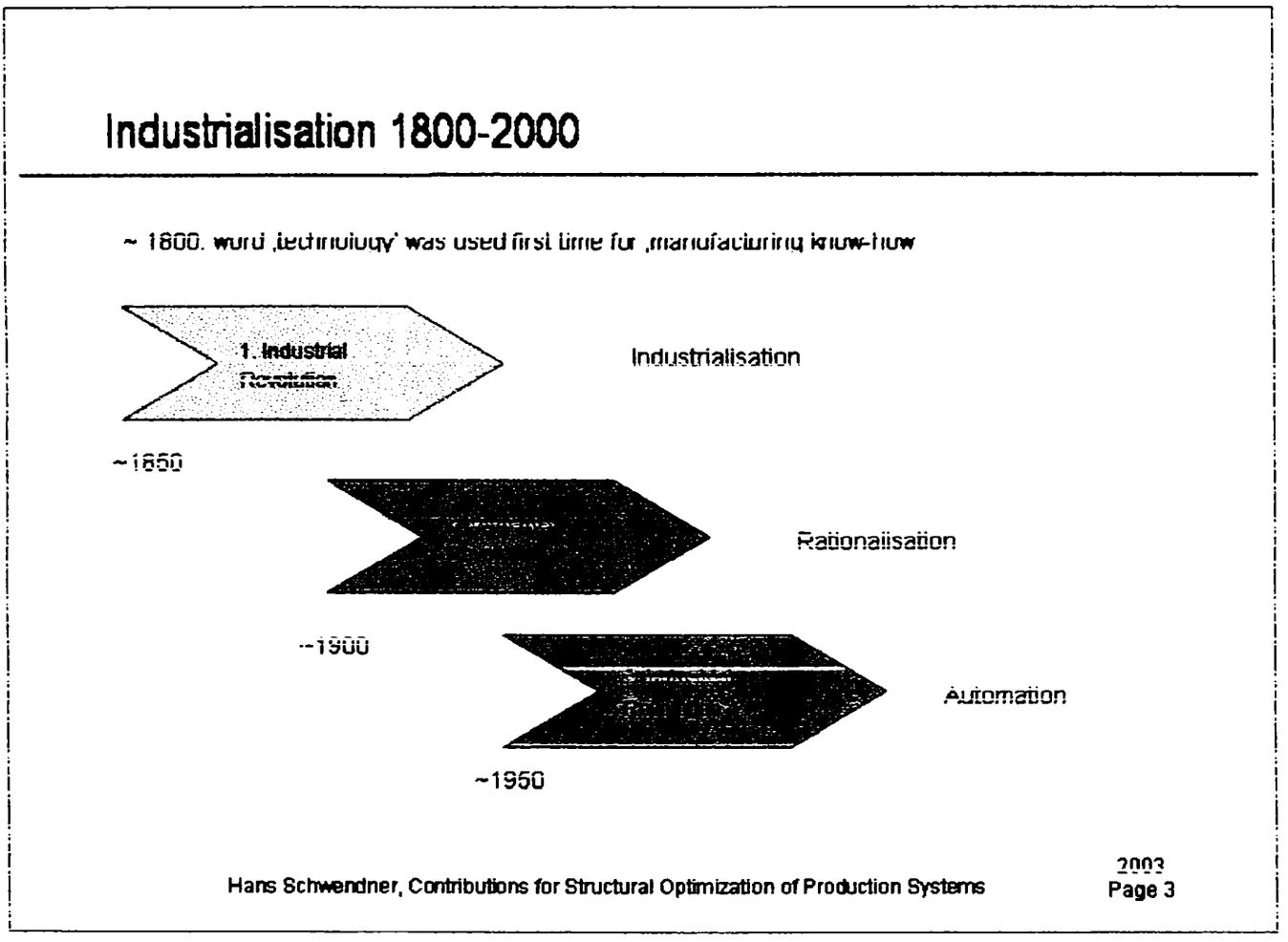
In the seventh chapter a verification of the model with the 'real world' (i.e. case study) is done. The model is applied in a representative case – the acquisition of a business unit from an international large scale corporation by a niche player and their subsequent merger (due to legal reasons those companies remain anonymous). The model is introduced into the management decision process.

The eighth chapter discusses the contributions on improvement in solving the problem of 'structural optimisation of production systems' by the flow and model for rationalisation in decision. The flow and model in structure, behaviour, empiric results and application are discussed for implementation into the management process.

d. Changes of Production Concepts through Industrial Revolutions

About 200 years ago, around 1790 the word 'technology' first time was used to describe production know-how throughout different trades. In between 1750 and 1850 various technical innovations were developed enabling the switch from pure manufacturing (hand crafting) to machine production. An increasing number of machines for all kinds of applications were the indicator for the first industrial revolution – starting from England. Mainly textile manufacturing made use of the new tools and was changed into a high volume production industry – independent of performance of manual work. Isolated inventions were made that did not make use of academic sciences nor were universities supporting technical developments. It did last until early 1900 that engineering sciences were fully recognised within the scientific society. Also social aspects of working class people were not taken care of and exploitation led to worst social conditions of living for working class people. Finally the working class unified and began to fight. Social laws were brought into effect as a consequence.
The second industrial revolution made did combine the individualised manufacturing steps and combined them to a process chain. Conveyor belt mass production with a combined material and information flow was the result of this new kind of manufacturing. New processes for hardening steel were invented that enabled production of standardised iron parts for assembly. The most famous example of application of both of these concepts/inventions was Ford with the production of Tin Lizzy. The industry switched from a high volume production to a mass manufacturing. The increase in productivity did also allow paying higher wages to labourers and a lasting change from an agricultural society to an industrialised society could take place. /WOMACK/, /DRUCKER/

Figure 1.d.1 /WARNECKE3/ does summarise the key dates of the industrial revolutions.

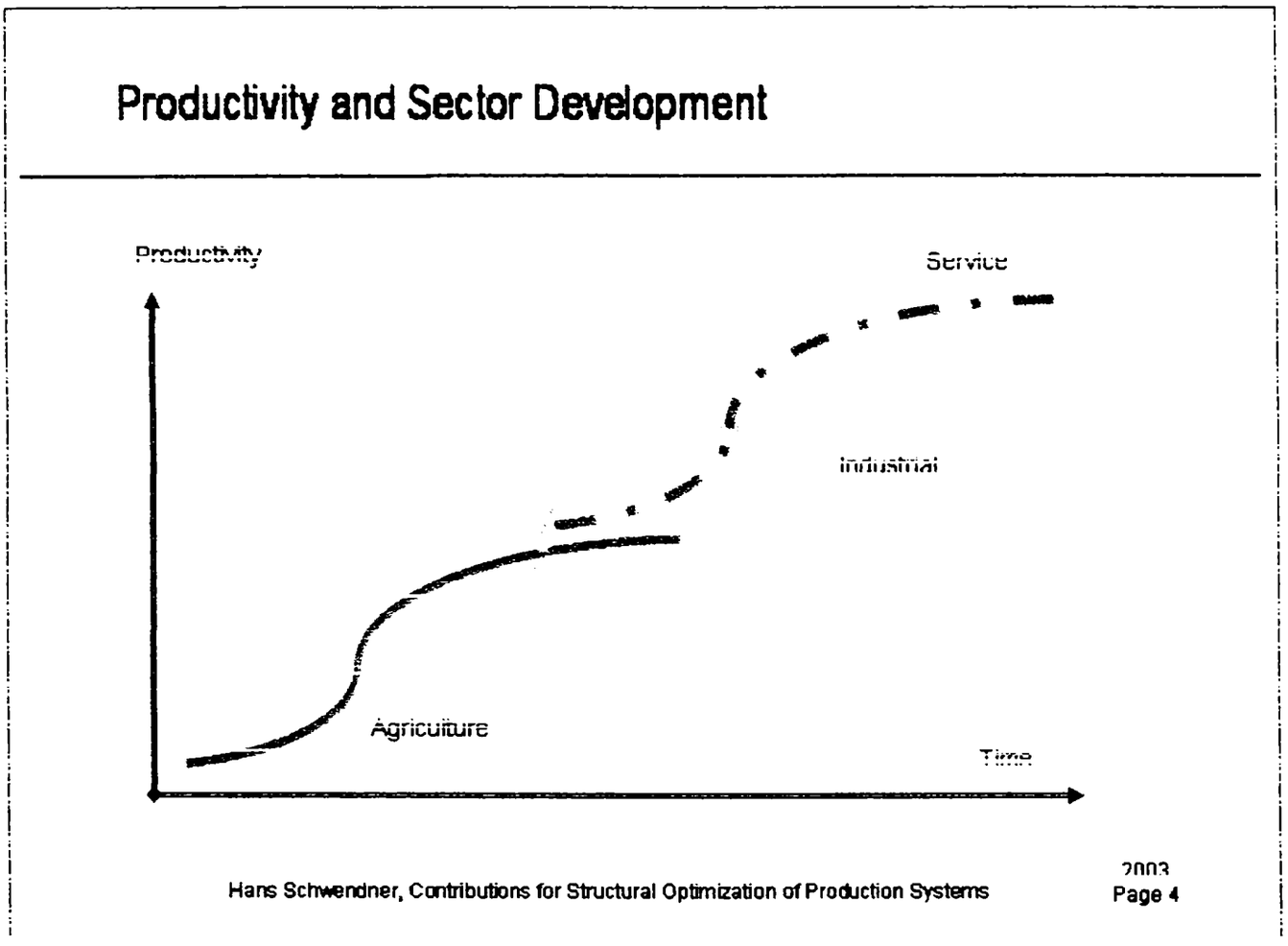


/Figure 1.d.1.: Industrialisation 1800-2000/

Based on the highly automated manufacturing concepts the third industrial revolution could start – the introduction of human mental performance increasing data processing machines. Decision processes could be improved dramatically by interconnecting information flows and making use of the capabilities of computers for performing much faster than human brains on high volume data processing. Mass production could be transformed into flexible manufacturing.

By gaining higher productivity through using machines within the agricultural sector people were available to work in the industry. The increase of productivity within the industry enabled the payment of higher wages and the increase of capability to pay for services. In combination with new technologies enabling knowledge-working that can be applied for further productivity gains an increasing part of the society is able to live within the service sector. Nethertheless the service sector is dependent on

a highly productive agriculture and industry.
Figure 1.d.2. /WARNECKE1/ does show those structural changes throughout productivity gains.



/Figure 1.d.2.: Productivity and Sector Development/

The service industry by nature did also enable a completely new kind of wealth for those working within this sector. Where profits out of productivity gains within agriculture and industry had and have to be used to invest in acquisition of next generation production factors, knowledge and service production does nearly need zero investment in multiplication of volume. For example the hardware value of a software CD-ROM is about 0.1€ *whereas the product value can be orders of magnitude higher.*

The change towards a service structure was also supported by new sciences enabling management of industrial enterprises and analysing economic and sociological structures and phenomenon. Especially the USA did take a lead in management research and education. This management lead did enable the US economy to recover and even surpass in once lost industries. For example the automotive industry did seem to be lost to the

Japanese industry, but leadership could be regained. /DRUCKER/

Overall industrial revolutions took advantage of inventions that enabled decoupling of human performance and industry output. Human power was performed by machines, human machine interconnection was substituted by automation, and supervision and control was delegated to computers.

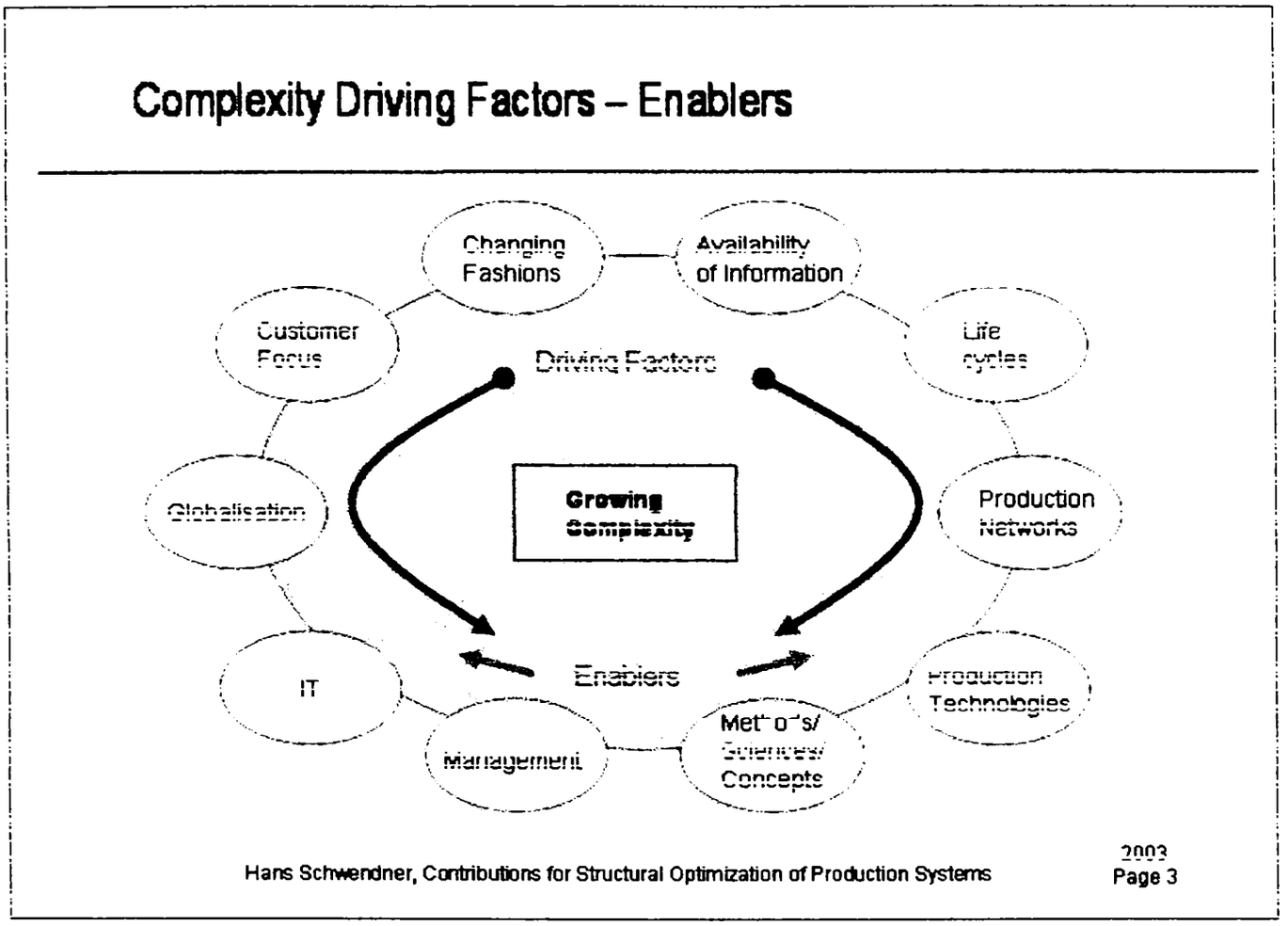
Still a lot of the industry is managed according to the economic principle of maximising efficiency = value/effort with the approach of envisioning the future as a prediction of environmental changes and thereof deducted detailed plans.

e. Increasing Complexity and Dynamics

All occurrences, events, situations in life are phenomenon that can only appear due to the simultaneous co-appearance of other events. In order to understand all phenomenons influencing the business, one must understand also the basic events leading to the phenomenon. /FETZ/, /NESTLE/

Within the last century the amount of effects driving a phenomenon has increased as globalisation of markets, information, know-how, energy and innovation in technology in combination with saturation of markets and thus increasing individualism of customers took place, just to name a few factors.

Overall the influencing factors for decision, the concepts to evaluate options for action and the diversity of execution on manufacturer and customer side have increased dramatically. This multitude of options in way of acting and in change of effects is understood as complexity.



/Figure 1.e.1.: Complexity Driving Factors – Enablers/

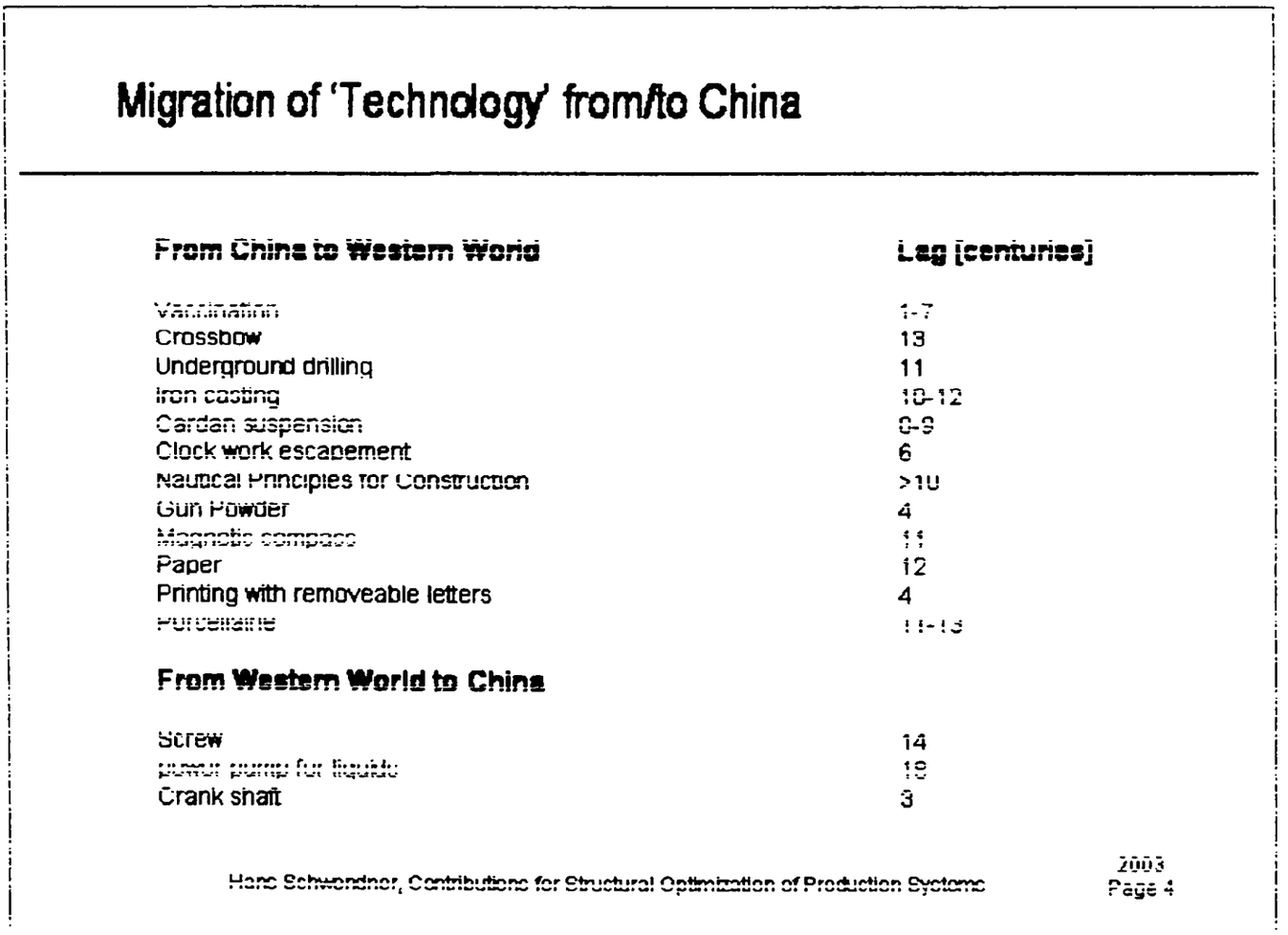
Figure 1.e.1. /WARNECKE1/ summarises complexity driving factors. Obviously the process of increasing complexity has to be taken into account more seriously whenever there is the approach to envision the future and to reduce it to very singular elements. Instead of analysing every detail of any structure and fixing one specific plan it is more important to take a view from the distance in order to understand the basic principles and interdependence of structures. Then those structures can be reversibly interpreted as enablers for new business opportunities.
Simple examples for the limitation of peoples' minds through concepts developed during education and culture are the naming of landscapes according to mental concepts of 'horns', 'faces', 'figures'. One can make the simple experiment himself looking at clouds and trying to discover forms. Most people will discover 'faces' or 'torsos' first and once identified those it will be hard for them to switch that to identifying a different object within the same scene. /VESTER/

New technical interdisciplinary concepts can lead to new product solutions for existing problems. For example in surgery parenchyma are hard to stop from bleeding. Different methods can be applied in order to lead to the

phenomenon dried blood crust or sealed parenchyma. Blood can be crusted through fibrin glue, through heat from electricity, laser or hot air. As a new concept the parenchyma can also be sealed by being heated through absorption of light. By using a special wave length the blood is not absorbing the light or any other liquid within the body but the parenchyma only. Based on this principle of physics applied in medical surgery a successful new product solution was developed that enabled a new quality of surgery in liquid/bloody environments. /NK Optik/

Besides complexity the dynamics of markets is constantly increasing. Dynamics can also be defined in a way that it is a part of complexity, but in the following synthesis those two words are used with independent meanings and dynamics expressing the speed of change and frequency of appearance of new phenomenon influencing complexity.

Figure 1.e.2. /WARNECKE3/ does give some examples on techniques and inventions from the last millenniums. Geographical barriers on the one hand hindered the information flow due to lack of 'international travel'.



Migration of 'Technology' from/to China

From China to Western World	Lag [centuries]
Vaccination	1-7
Crossbow	13
Underground drilling	11
Iron casting	10-12
Cardan suspension	8-9
Clock work escapement	6
Nautical Principles for Construction	>10
Gun Powder	4
Magnetic compass	11
Paper	12
Printing with removeable letters	4
Porcellaine	11-13
From Western World to China	
Screw	14
piston pump for liquids	18
Crank shaft	3

/Figure 1.e.2.: Migration of 'Technology' from/to China/

On the other hand the openness for innovation and experimentation by applying knowledge from one science in another was also very limited. The most obvious example is medical surgery, where the religious believe in the remaining of the soul within certain organs hindered post mortal body opening for research reasons. Or it took 2000 years from the ancient Greek or Egypts to re-establish the research on astrology based on the concept of a 'round world' instead of a 'disk'.

Todays speed in information flow and information accessibility enables to use and generate new products in markets and regions inaccessible or not thought about before. Therefore the dynamics is a threat on existing solutions but an opportunity for any innovation.

Increasing complexity and dynamics also have the consequence that singular intelligence and know-how of one person is not enough to substitute the experience of the executing staff in an enterprise or somehow linked to the enterprise as a supplier, consultant, customer, shareholder, etc. In order to make use of most accessible and necessary know-how for process optimisation and decision improvement the relationship between all those stakeholders has to be shaped in a way where all can and want to contribute in reaching the success as defined by the enterprise. Usually this requires openness and trust enabled by transparency and being informed.
Management then has the key tasks of choosing and defining the targets for the enterprise, to set up a structure where all functions are made available – including external competences - to generate targeted phenomenon and to allocate the resources to define and execute processes for achieving the targets. Generate customer value.

2. Structuring of Production Systems

Structuring of production is an important management task in order to optimise competence set-up for capital returns and to keep competitiveness at an optimum level. In fast and vast growth high tech markets one company can't build up all required competencies by itself, but has to combine with partners to better exploit the manufacturing capabilities by extending the product portfolio and/or extend the value chain in order to achieve a better position of the company within the market. Thereby mergers and acquisitions become a more and more widely adopted strategic structuring management tool.
On the other side internal structuring methods are developed that enable faster processes and constant innovation/change to cope with complexity and dynamics from the outside world. Those methods are based on concepts that support the intrinsic motivation of educated people driving for coping challenges and challenging their projection on success.
Enterprises are systems and therefore can be represented through system modelling methods. The description of the method of frames and of the method of production systems does conclude this chapter. Elements and formulas of these methods are selected later on to serve for developing an enterprise model for structuring.

a. Motivation for Co-Operations – Merger and Acquisition

Merger and Acquisition are structuring tools with most legal and financial unification among partners. In general all intentions and valuations valid for merger and acquisition can be applied for the other kinds of co-operation. For this reason M&A is taken as a superset of co-operation and reference within this thesis to synthesize available models and flows for the structuring process. Acquisition means the complete purchasing of an enterprise by another enterprise. Merger means the complete structural and process integration of the acquired enterprise with the structures and processes of the purchaser.
Following the four major goals for co-operation are discussed.

Cost Reduction through Synergies and Economies of Scale

Within the 70-ies and 80-ies synergy was the key intention for fusions of enterprises. Economies of scale lead to cost reduction especially in production and development. The theory applied is the 'learning curve' /HENDERSON/, posting that with every doubling of production volume knowledge does increase in a way that production cost does decrease by a certain percentage. For instance in semiconductor industry the learning curve has a slope of 25-35% /INFINEON/ per doubling of volume. Any acquisition therefore is an opportunity for a step function in volume increase for any enterprise. Thereby the own cost position can improve in a competitive ranking.

For development there is the experience that for sharing effort for same development goal leads to a proportional decrease of effort and cost, proportional to the number of partners. Every partner only has to bear a part of the complete effort. Key critical for the kind of co-operation in development are the goals for use of developed intellectual property (IP). In joint development of DRAM semiconductor devices for instance IBM, Siemens, and Toshiba the cost of several €100 million for multiple generations were split among the three partners and led to a competitive position – also without legal unification of partners. /INFINEON/
Nether the less there is an overhead involved in any kind of co-operation in production, development, etc. that may not be under estimated. 'Not invented here syndrome', alignment of goals, processes and contributions, management and communication effort lead to an overhead in between 15-30% of the total effort, assuming two partners. Instead of expected 50% per partner each one has to bear 55-65%. /FACHHOCHSCHULE ROSENHEIM/ The overhead does increase exponentially with adding more partners.

Extension of Market Access and Innovation

Within the 90-ies the most important criterion for co-operations were turned away from a pure cost improvement perspective to improvement in market access through extension of product lines and access to new customers. /BOYETT/, /NEFF/ Time to market for fast occupation of markets through innovation got key for valuation. Analysis within the DRAM semiconductor market have shown that a delay in market entry for the latest generation of about six months leads to an EBIT loss of about €250 million. /INFINEON/ This is derived out of the initially high prices in combination with the steep slope of the learning curve within this industry, where prices are to fall 30-90% within three months.
increasing flexibility in getting capital from the stock markets (less regulations for start-up companies in dedicated segments, for example the former 'Neuer Markt' in Germany) led to an over importance of revenue growth potential in valuation for market capitalisation. This is in contrast to credit financed investments, whereby the investors request a justification of potential success primarily by cost-controlling capabilities based on existing revenue. /McKinsey et al./
In markets with moderate growth rates only partners are preferably supplementing the products for a 'system solution'. Existing customers should be supplied with an extended portfolio with the potential to reduce cost in the longer run by combining several products into lesser sub systems.
More start-up type companies with innovative ideas preferably go for established large corporations with established sales channels. They have to find a solution for the intention of fast market access and eventually combining a sole product into a complete system. Vice versa the large corporation can take advantage of the flexibility and speed of the start-up in developing innovative products and realisation of time to market. The

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preferred structuring option for start-up companies is acquisition and merger, as any co-operation with a large enterprise leads to an existential dependency for the start-up. /SSSB/, /SCHRODER/

Access to Capital

Short product life cycles in combination with increasing capital investments for development and production are other motivation factors for partnering. Sharing the financial burden and risk is the intention. For example in semiconductor industry the capital investment for a latest generation production site is €1,5 billion up /IRTS/. A lot of semiconductor suppliers therefore have set up partnerships with financial unifications for investment and its use. The company First Silicon has developed this intention to a business model, whereby customers in return to acquisition of a capital share get a fixed share of capacity with preferred pricing and flexibility. Especially fabless semiconductor companies make use of this model for securing supply for times of short capacities (e.g. in the years 1999-2000).

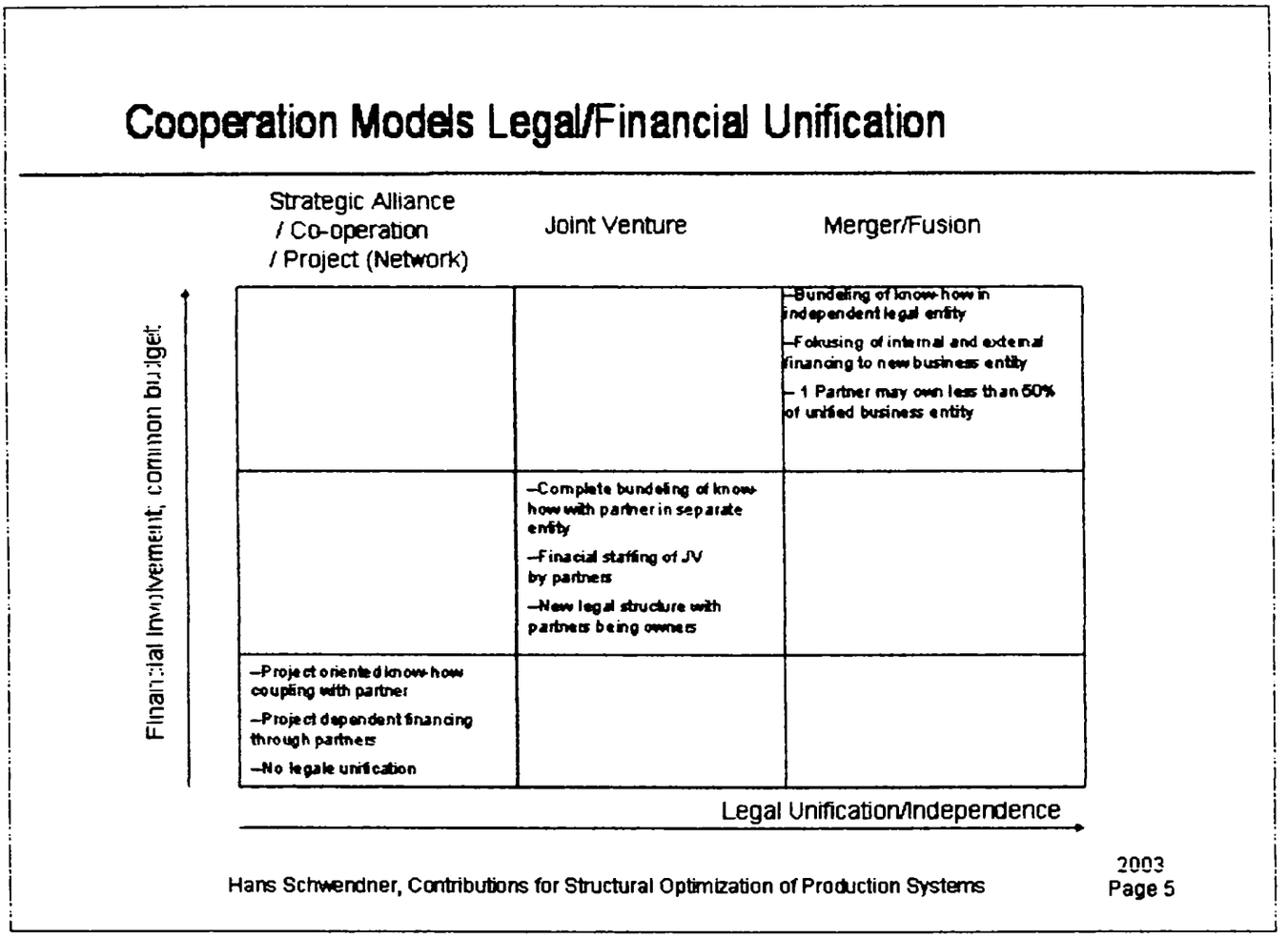
Strategic Market Access

Valuation on business potential or 'strategic market access' are another intention for partnerships. Justification of business potential is done more on a vision in anticipation of future market behaviour than on dedicated cost and revenue plans. Long term investments in combination with huge *initial losses are taken into account. For 'strategic market access' the* vision of Daimler CEO Edzart Reuter can be taken as an example. He wanted to transform Daimler into a technology-mix-corporation. In assumption of later on system synergies within high tech to the core segment automotive, aviation, semiconductors and appliance were bought. After some time it got obvious that the differences in market access and management were definitely overwheiming the internal synergy potentials for corporation internal supply. In the sequential management of Detlef Schremp most of the acquisitions were sold or closed down – refocusing to automotive. /KETS DE VRIES/, /DB/ Another example for strategic market access are the UMTS licenses bought by telecom companies in Germany. €100 billion were invested in licenses only with neither existing infrastructure nor existing consumer equipment. /SSSB/

b. Legal Structuring Options

Legal Structuring Options for Co-operations

Dependent on the intention of the tying together of partners there are different legal structures possible. Those legal structures also mean different levels of financial involvement or dependence. Figure 2.b.1. shows those options. /SSSB/, /BESCHORNER/, /QUESTRA/ et al.



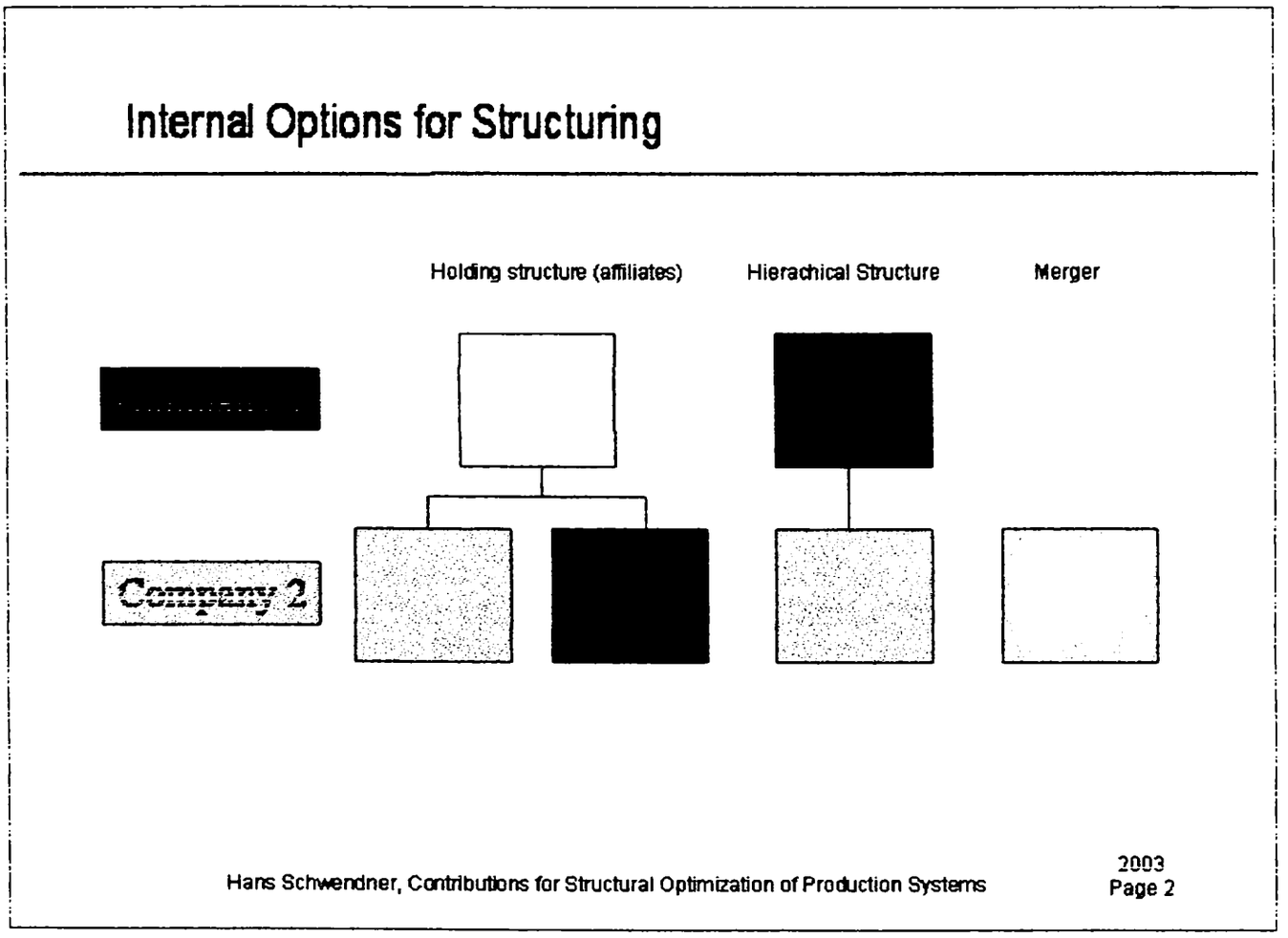
/Figure 2.b.1.: Cooperation models legal/financial Unification/

The most loose connection in terms of legal and financial ties is the simple contract based supply relationship, strategic alliance or project co-operation. Either a product or service is supplied for monetary compensation, or a contract covers a more intensive co-operation along the value chain. For instance in a joint product definition, whereby a supplier can make use the application experience of an innovative lead customer, a *product is defined jointly and later on jointly tested in application. Same can* apply for interfacing with different steps of the value chain for production, whereby the success of high product quality is correlated with the supply of inline soft facts on each others production flow. This project type of cooperation is successfully applied in cooperation across the system value chain and in network type of co-operations with multiple partners.
Co-operations with tying each others financial plans and joining management activities are generally set up as separate legal entities, so called joint ventures. The content of a joint venture is a dedicated activity of the value chain and they preferably serve the owners with their services or results of development. Generally joint ventures can be found in production and development.
The tightest connection between companies is a merger where capital,

management and infrastructure are combined into a new legal enterprise. For further coosing the best fit in cooperation to the reach business target different sources for example /INFINEON/, /EURATIO/, /DRUCKER/, /MICRONAS/, /RADERMACHER/, /WGO/, /BLEICHER/, and /SSSB/ are available.

Options for Internal Structuring

Within enterprise different legal structures can be set up in order to support varying financial or strategic goals.
With equal rights the merger parties can be set up in a holding structure as affiliates towards a holding company. This structure is generally applied when there are no different treatments required for tax (profit shifts) and when the sister companies are about equal in their contributions to the overall value of the holding. This structure allows the reduction of changes at this aspect and thereby might reduce emotional aspects of a merger. Potentially the separation is dissolved later on.



/Figure 2.b.2.: Internal Options for Structuring/

Alternatively a legal hierarchy can be built. Hereby one partner is the owner of the other with the respective rights for giving directions. This structure generally is applied with partners owning a part of the value chain only, for example local and international sales entities.

Any complete integration is realised by a merger, whereby all partners are put into one common legal framework with one common management.

Figure 2.b.2. summarizes those structural options. /RADERMACHER/ The above external and internal options reveal a wide variety of possibilities for structuring competencies, financials, etc. Nethertheless it is important to use structuring as a tool for achieving a goal, not the other way round.

c. Advanced Intra-Enterprise Structuring Concepts

Within the industry and society in Germany and other western states there is a lot of uncertainty about the future economic development. Globalisation, deregulation, education, access to information, low cost and fast transportation, automation, etc. are all very strong influencing factors for the way of conducting business on the one hand. On the other hand basic mental concepts for solutions like the European way of thinking in causality (e.g. Descartes, Newton) and one 'golden way' to achieve success or the American way of case studies (e.g. Harvard Business School) provide a framework for tools to analyse and evaluate those influencing factors for business strategies. The multitude of shapes of economic approaches is probably also one of the most important and obvious pattern within the industry. Recent history seems to proof that this complexity and dynamics is hard to be dealt though even very sophisticated long term and detailed planning approaches.
This sub chapter will investigate on enterprise' internal concepts.

Current Concepts for Enterprises

Successful solutions for enterprises are hardly objective as they do depend very much on the criterion selected for defining success and also on the period of observation. Many companies chosen at a certain period in time for their excellence may have failed a few years later. E.g. IBM which made severe losses in the early nineties after having completely missed the decline of the workstation market. In some cases even companies without a product history were selected as successful examples and failed in comparison to the expectation. E.g. Amazon was for a long time chosen as the model for internet business even as losses topped by far the revenues and even up to today it is not foreseeable when cumulated losses are regained by profits through customers. /WATERMAN/

Nether the less there are some common pattern identifiable that appear in many of the successful companies, selected on various criterion. The most

well known criterion were synthesised by Peters and Waterman within the 7-S-model. Simplified the 7-S can be formulated as /PETERS/:

- The customer is king
- Keep focused on your competencies
- Be pragmatic instead of in depth analysis
- Entrepreneurs wanted
- Staff is key
- Saying and doing is consistent - just do it
- Fight bureaucracy
- As much management as necessary as little control as possible

The measures derived from this framework of recommendation to success are very similar all across the world. They can be compiled to the buzz word of 'lean management' that was widely introduced in the context of Japanese car manufacturing, especially Toyota. /SIMON/, /HINDLE/
The measures usually are:

- Reduction of organisation levels and administration
- Process orientation and value chains
- Optimising material and information flow to process flow
- Initiate continuous quality improvement for products and processes
- Increase flexibility in order to (re)act quickly to changes of market based on economic success

The minimum characteristics of a successful future enterprise are:
- Constant change
- Quick reaction
- Extended quality

Constant change means that competitive advantages are measured in weeks instead of months or years. Any production system thereby never gets into a stable mode but is in constant improvement and adaptation. Quick reaction means access to information anywhere and by anyone who needs to have. Within the enterprise and externally co-operations are required to gain access to all relevant information and competencies. *Extended Quality means more than simply working and reliable products.* It means improvement in the overall customer-supplier relationship.

Successful companies also were able to implement measurables for their goals that enabled change to adaptation or driving of new requirements within the market. From the pure company internal point of view in the past the transfer of the optimisation formula /WARNECKE3/

Maximise: efficiency = value/effort	**(2.1)**

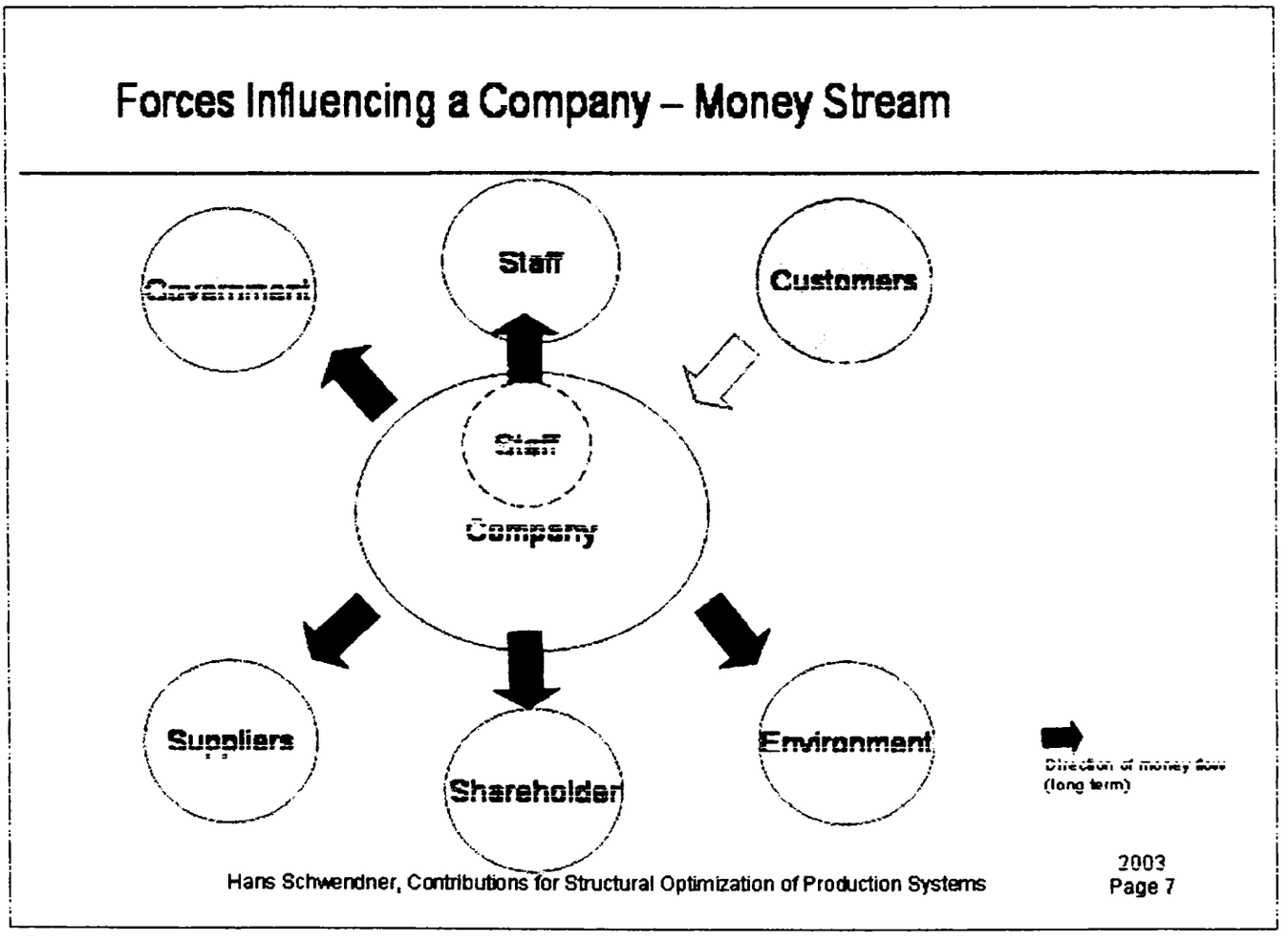
towards

does reflect the ability of change. Here the transition from the second to the third industrial revolution. These optimisation formulas reflect the view about the market being a suppliers market and whatever is produced will be sold.

The saturation of markets does require an accelerated transition to a view that corresponds to the final definition of an enterprise /ZAPKE-SCHAUER/:

Enterprise: at least one produces something for somebody

This definition has the consequence that there is only one reason for a company to exist and to exist from: the customer. In an enterprise is not able to satisfy the customers' needs it can not survive. In the long run there is no possibility for sustaining a company than having a constant money stream from the customer.



/Figure 2.c.1: Forces Influencing a Company – Money Stream/

Other money sources (investors, governments...) do invest, i.e. they expect a return on their investment - usually more money back than brought into the enterprise. Thus the way of sustaining the artificial system 'enterprise' is satisfying the only source for money in the long run – the customer. Figure 2.c.1. shows some of the most important influencing factors on/within a company. Hereby the question whether staff is company internal or external will be discussed later, but in respect of revenue streams staff is definitely outside the company as they stop working or being part of the company when payment ends. The direction of arrows representing the long term money stream.

The formula that interprets the relationship towards customers best is /ZAPKE-SCHAUER/:

Optimise: cost of operations < customer price < customer value **(2.3)**

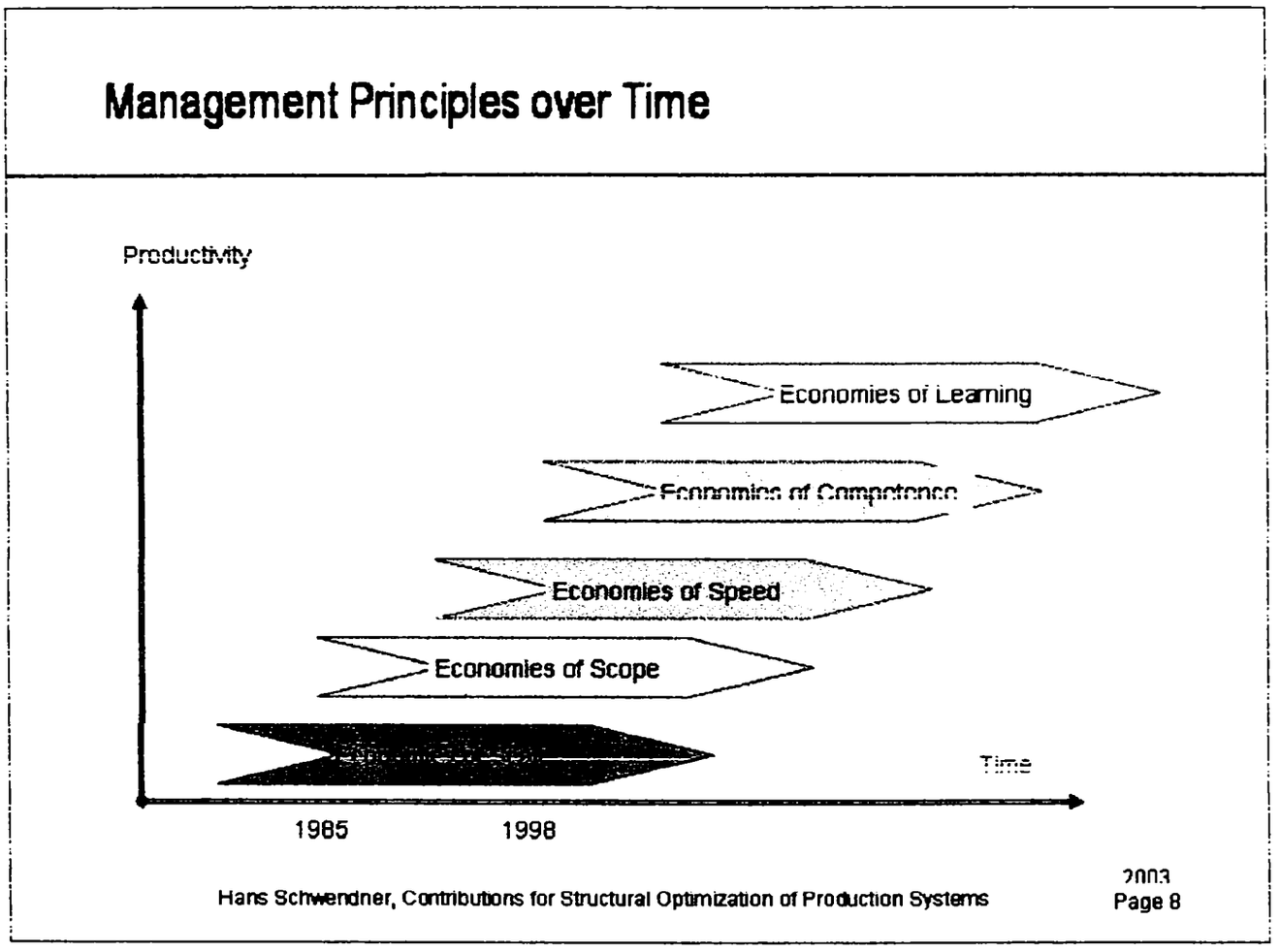
This formula is widely independent of the production volume. The customer buys a product with a perception of value he generates individually. The value of usability might change after having the product 'in hand', as it usually first time gets into effect when being available. For example the value of a convertible sold in winter will be fully transparent to the buyer not before the first warm and sunny days of spring. Therefore new concepts in marketing have to be introduced in order to influence the perceived value at the time of purchasing decision, and consequently new concepts of manufacturing that allow concentrating on the perceived value in order to optimise cost of goods manufactured corresponding to features realising the perceived value.
Further interpretation on this formula will be done in a subsequent chapter about networking.

The ability to act and promote change did make the management principle for mass production, economies of scale, obsolete. Other factors besides cost reduction through high volume manufacturing get more important to drive cost down and are reflected in the management principles developed and applied throughout the last decades.

Especially with the principle 'economy of speed' it got important that companies started to learn from each other. Benchmarking was widely spread and especially western companies started to learn from Japanese lean models.

Future oriented principles must be based on enabling constant improvement within all sectors of management: selections of task of enterprise, structure and allocation of resources. This means constant and expedited learning.

Figure 2.c.2. /WARNECKE1/ summarises the development of principles of management over the last decades.



/Figure 2.c.2.: Principles of Management over Time/

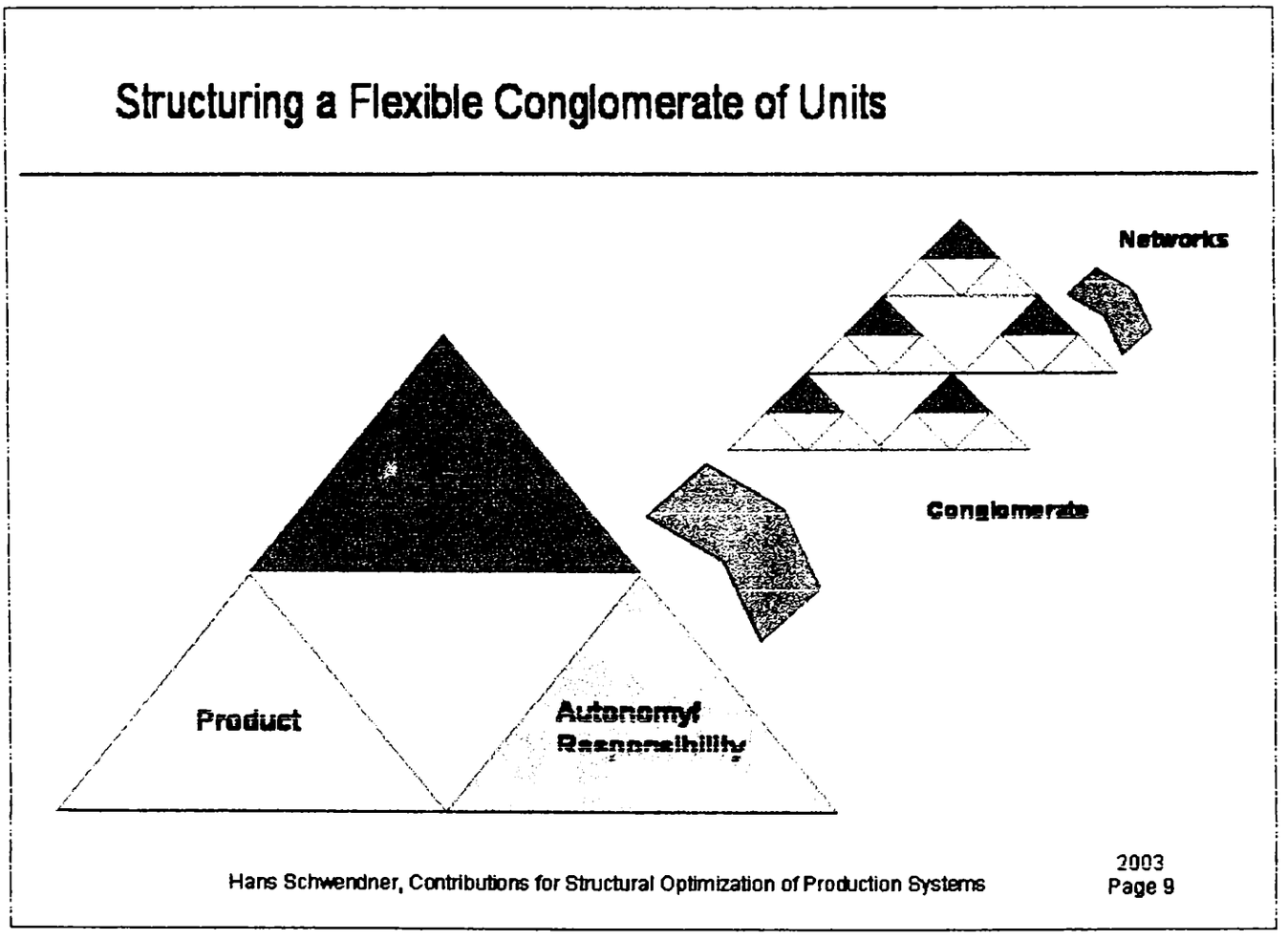
All samples and evaluations so far proof that there is always a solution to cope with the challenges in the industry. Management can achieve good company performance when applying knowledge either from other companies or from other sciences. However simply learning from competition will lead to avoid disadvantages, but it won't lead to leapfrogging competitors. /PETERS2/

Building Structures as Key Management Task

An enterprise is an artificial system that requires constant communication and execution according to the 'purpose' as per definition (at least one produces something for somebody). The system is kept alive by certain functions (competencies) that have to be put together and have to be aligned. This is done through the process of strategic management whereby the business manager defines and select the business to be

active in, structures the activities and allocates resources for execution.

The way how flexible a company can act upon dynamics and adapt in complex environments is very much dependent on the structure it has. This is very similar to the comparison of a huge battle-ship and a fleet of speed boats. There was and very likely will always be a purpose for battle-ships, but then it might be necessary to work on new concepts to make it faster and more manoeuvrable.
Small decentralised units are seen as more reactive upon change or deviation. Therefore any company could be structured into decentralised units defined by their value generated that act dependent on the requirement of the external market and the internal overall target. Centralised only minor support functions for enabling access to required information and legal management are required at an extreme point of view. This conglomerate of minimised modules could have not only very short feedback loops for the modules itself, but also in the alignment of the modules and thus the complete structure could be rearranged very fast. Responsibility and decision power are to be delegated to shorten ways of communication and to eliminate overhead from decision processes.



/Figure 2.c.3.: Structuring a Flexible Conglomerate of Units/

Similar to a control process the dynamics and complexity of the system is not just defined by the speed of the feedback loop, but also by the number of control parameters and inputs. Figure 2.c.3 /WARNECKE1/ shows the factors that are to be taken care for structuring.

Size: the individual units should be able to operate widely independent but not too large in order to form structures that are complex enough again to be split into smaller units. Criteria are the division of labour, the levels of management and simplicity in structure.

Product: All units should follow the definition of an enterprise and thus be identifiable by a product that is produced according to the customer value requirements defined by this unit. The unit must integrate the necessary influence to define, decide and control the customer value – also in cost of product generation. Processes for value generation and revenue generation must be supported by the unit structure and not interrupted or new processes generated in order to 'integrate' the unit.

Autonomy/Responsibility: The units must be responsible for their activities and their economic success, thus they must be profit centers.
Responsibility must be transparent and motivating to the people involved, thus clear definition and assignment of responsibility is required.

Through decentralisation enterprises can gain lasting positive economic effects on optimisation. For example the enterprise can focus on core products and required core competencies for manufacturing. Control and administration effort can be reduced for non core products as they are decentralised in decision and responsibility and have to optimise business results in competition to core products. Agility and competitiveness can improve by decentralised product and process innovation.

The strict building of units finally leads to a fractal company, and for any product solution that can not be done within the conglomerate the company gets a network element.

Dynamics of Enterprises by Integrated Management - Fractals

Enterprises - in order to enable inner dynamics for acting upon a dynamic environment - have to structure themselves.
The mathematical structures of fractals do describe many real world objects that do not correspond to simple geometric shapes. Fractals describe structures of a high complexity and high inner dynamics. The word fractal is derived from a Latin word meaning broken, fragmented /MANDELBROT/, /MANDELBROT2/. The characteristics of fractals they can be subdivided into fractals which structurally similar to the total - all fractals are a reduced size copy in structure of the total. Fractals are

generally self-similar and independent of scale. Samples for fractals are formations of mountains, surface of broken metal, coast lines or Mandelbrot-Sets. Each of those natural formations seems to reveal new details when observing them through a magnifying glass or a microscope. New levels of complexity seem to appear – they don't get simpler. Fractals enable the description of similarity of the detail with the total. There is no need to be the same – similarity is of importance and completeness in terms of structure.
Transferring the concept of fractals into geography, biology, management, etc. those seemingly complex and highly dynamic structures can be handled more easily. The characteristics of the concept have to be extracted and to be applied within the organisation of enterprises and business models.
From an external point of view fractal enterprises may not be different from conventional enterprises – at the first glance. The potential and the value are mostly within the potential they release from an inner structure and approach.

Applying the model of 'fractals' to enterprises leads to the capability to cope with complexity and dynamics better than conventionally set up enterprises.

Characteristics of Fractals and Clusters

Fractals are characterised by
- self organisation
- self resemblance
and through intensive feedback during forming of clusters a multitude of shapes can appear as an expression of the high dynamics.

Applied in management the fractal is an independent business unit which has clearly identifiable goals and products.
Fractals are:
- self resembling and provide services/products
- self organising as their processes are optimised internally
Fractals drive a dynamic process of defining their goals and setting up their internal and external interfaces and relationships. Fractals form themselves, get formed or dissolved or dissolve themselves.
The overall goal is assembled out of the targets of the individual fractals. Those targets are well aligned.
Fractals make use of a high performance information and communication network whereby they determine the kind and effort for retrieving data and thus determine their speed or dynamics.
Performance of fractals is measured and evaluated continuously.

A cluster then means a conglomerate of fractals that offer similar kind of products. This in between level is important to larger corporations that have a very wide spread portfolio of products, or products where the value chain can be split into individual steps representing a product on its own.

- All above elements need to be considered for setting up a fractal production and this is called an integrated concept.

Self Resemblance: The characteristic of self resemblance does not only reflect the organisational set up but it covers the set of enterprise functions necessary defining and enterprise. Especially the way of providing a product and the way of defining targets and their pursuance is important for the overall company.
In the course of the chapter it got obvious that future oriented companies *have to establish the ability for entrepreneurial thinking and acting within all* parts of their organisation, even down to the shop floor. Correlating independent business units with fractals and taking the contents of the words for synonymous this means that fractals themselves are similar o the total fractal production unit/enterprise. This can be taken for granted as the only requirement is similarity but not equality. As part of the entrepreneurial thinking fractals can decide on their priorities by deciding on eliminating the unimportant and focusing on the important things in their point of view.
According to fulfilment of a magnitude of different tasks and the multitude of potential inputs and output streams the structure of fractals may even deviate dramatically from each others.
Consequently a fractal must not necessarily remain within the legal framework of a company but can be tightly connected to it.
Fractals still require centralised services – or can receive a higher value from centralised functions than doing it themselves. For instance planning support or services that are not constantly required within the fractal – but again provide value add. Minimisation of central functions (overhead) should be the overall target in order to enable fractals to an optimised product generation and delivery.
The relationship between fractals is of key importance for enabling efficiency on the next level of fractal. This has the consequence that information no longer is allowed to be a monopoly but is a matter of availability. Also the consequence of individual action towards the overall enterprise goals must be transparent and available as an input to the affected fractals. Therefore fractal decision making and communication internally and externally is required to evaluate and determine the *consequence of decisions and doing. For example the decision on* choosing order A or B as priority for production no longer is a matter of purely internal optimisation factors but has to take into account what the effect for the customer is when choosing A or B.

- **Self Organisation**: The characteristic of self organisation of a fractal production does cover operations to strategic management. The integration of all levels is important to realise a process of continuous improvement and to enable execution of improvement ideas whatever the source may be. The consequence for fractal manufacturing is that various fractals may use different processes to produce their goods, optimised for their special requirement.

In practise that can lead to different production set ups or fractals that produce the same product but one is the standard high volume version and the other is a more custom specific lower volume version. The two fractals may be set up in parallel or horizontally. In semiconductor industry this separation is done for high volume standard DRAMs and highly specialised logic ICs. In companies like Infineon these different 'fractals' are even different production locations. Even the very low volume research and development production within those clusters and within the individual fractal may be operated individually and may get an own business responsibility by providing research wafers also to external companies for new applications like silicon substrates for multi chip packaging or to silicon suppliers.
The concept of fractals enables thereby an optimisation for manufacturing different product versions without building barriers for learning from each others or driving common advancement.

The concept of structuring fractals then will take into account the different levels of an enterprise:
- culture
- strategy
- relationships/sociological aspects
- economical/financial aspects
- information flow
- process and material flow

and an optimum structure then is assessed primarily around processes, material and information flow with a valuation on overall optimum management on the other aspects.

Business Dynamics – Vitality

The concept of fractals so far is a company internal structural framework for enabling dynamics. Nethertheless besides the concept within a fractal certain know-how or spirit must be available for survival as an enterprise. The ability to survive and to live is called vitality. Insufficient vitality will lead to insolvency of the enterprise in the long run. Measurables are for example net profit or market share.
The fractal therefore must have the spirit to permanently influence vitality positively by improving their success factors internally and externally like cost position, production know-how, R&D, management efficiency, customer access, financial independence, logistics, location/infrastructure, human resources, product portfolio, and change in markets, supply, competition and legislation.
The critical success factors for the fractal have to be determined and require constant improvement – in alignment with the targets of the fractal.

The concept of fractals may look very similar to various structuring concepts so far applied and described in the industry. Also looking at practical realisation of structuring according to the general criterion

- product
- processes and tools
- information and communication interconnects
- material flow
- human resources (competencies)
- innovation

the fractals may look as they do not reveal anything new.

But the key effect of fractals is the recognition of changed and wider range of capacity of action and changed goals for fractals than on segments or functional structures. The consequence of application of mathematical methods can be a more objective process for assessing the options of structuring (building fractals). The more 'neutral' approach of fractals does allow enable the view to other options for structuring that may be assessed due to the immediate view on the most widely used principle of structuring: product.

The structuring of fractals does focus the structural analysis on the requirement of interconnection/interfacing/relationship between functional units (material and information flow, human resources). Fractals have to be assembled of all relevant functions with optimised interconnects between each others internally and externally.

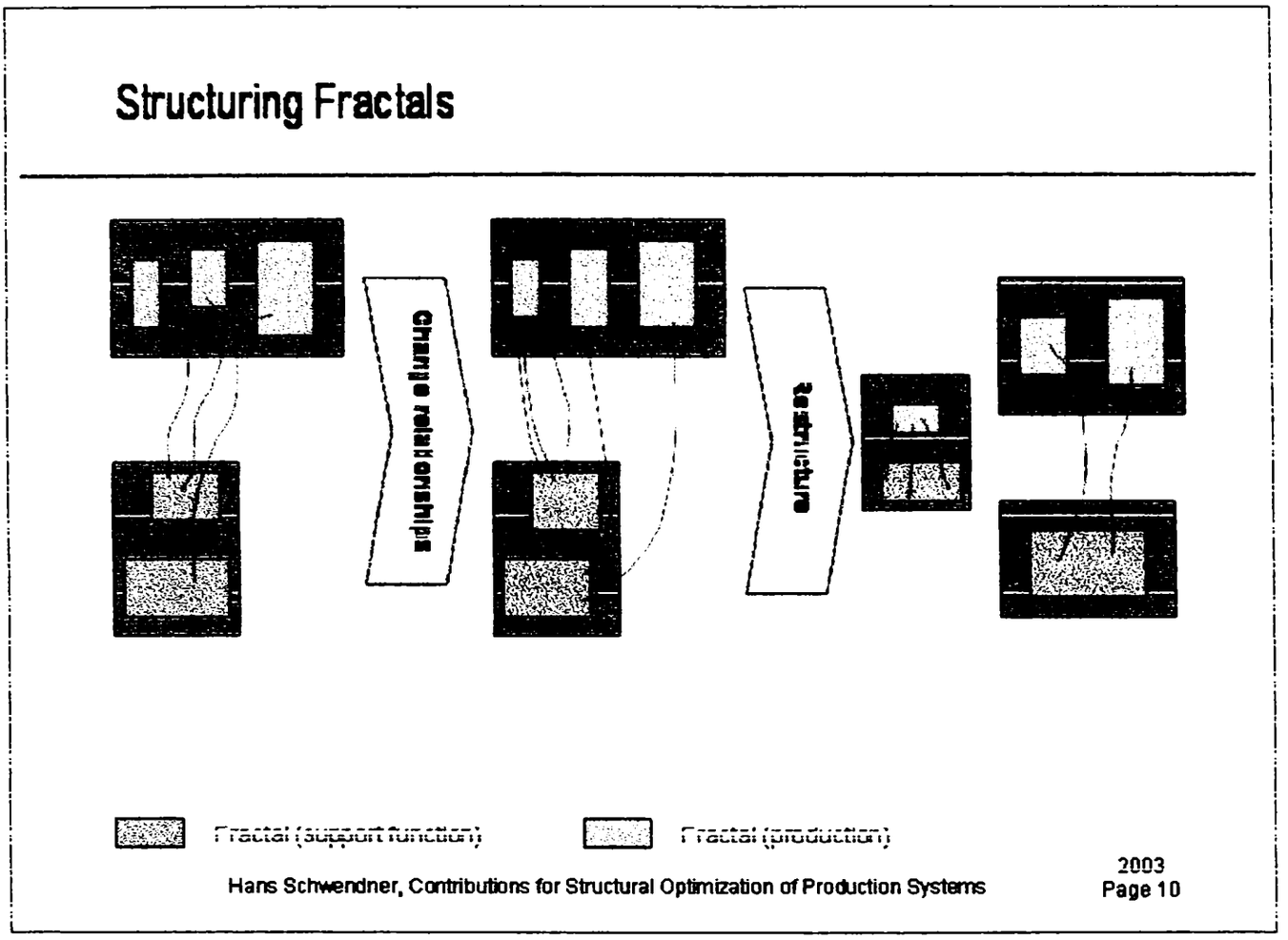
The most objective approach then is a process that is open to all kinds of structuring and enforcing to evaluate and assess the interfaces between the to be built fractals

- definition of structural objects and their variables (interface valuation)
- assess comparability of variables (importance and standardisation)
- calculating deviation per option (interfaces per option)
- deriving new options and optimisations according to first results
- assessing results for decision

The structuring of the fractal then follows the principle optimum of /WARNECKE3/:

Fractal:= optimum aggregation of internal vs. external relationships
Test: Internal relationships are stronger than external relationships.

Figure 2.c.4. summarises the key elements of structuring fractals. The interdependencies in information and material flow are optimised and then the arrangement and structure of fractals is optimised to material and information flow.



/Figure 2.c.4.: Structuring Fractals/

Following the definition of fractals they are derived as a concept for simplification of complex environments. By describing one element the other elements can be derived by a similarity function. Within the industry this is the approach to automation: simplify (= reduce the requirement for information to a minimum) then automate.

Communication and Information

Processing and distribution of information is a key element of the fractal production – one of the principal optimisation factors. Thereby it is important that communication is not for its own sake as it is very often perceived by too intensive CIM priorisation. The application of fractals requires not the optimisation of interconnecting all and everything and generating accessibility to all and every data – this generates an inflexibility in its own IT infrastructure and consequently IT is a manufacturing tool rather than a continuous process optimisation decision tool – but requires IT systems that supply information on process chains and actual/target deviation analysis. The necessary data for decision on input factors and relevant information for advancing the fractal in a competitive environment

have to be supplied by IT systems.
There is a shift in focus from utmost detailed control to assessment of result oriented parameters. Through modelling of the fractal and capturing the key performance data IT must advance to a managerial navigation tool. IT in a fractal CIM environment consequently means to optimise the fractal internal information flow and to have clear rules on data responsibility distribution and storage throughout the enterprise.

IT in a fractal production therefore has to advance in:
- application software/programming that supports the modelling of fractal functions
- improvement of the human interface of CIM systems
- expert support/learning for data gathering and valuation
- simulation systems for evaluation of options
- knowledge based processing and control systems (human interface !)
- intelligent control for quick feedback/corrective action on process deviation.

Even as there is the requirement for improvement in many aspects and solutions are not visible, the fulfilment of these improvements is not a requirement to introduce fractals. They would improve their performance, but by definition to a higher degree as they would improve with conventional structures.

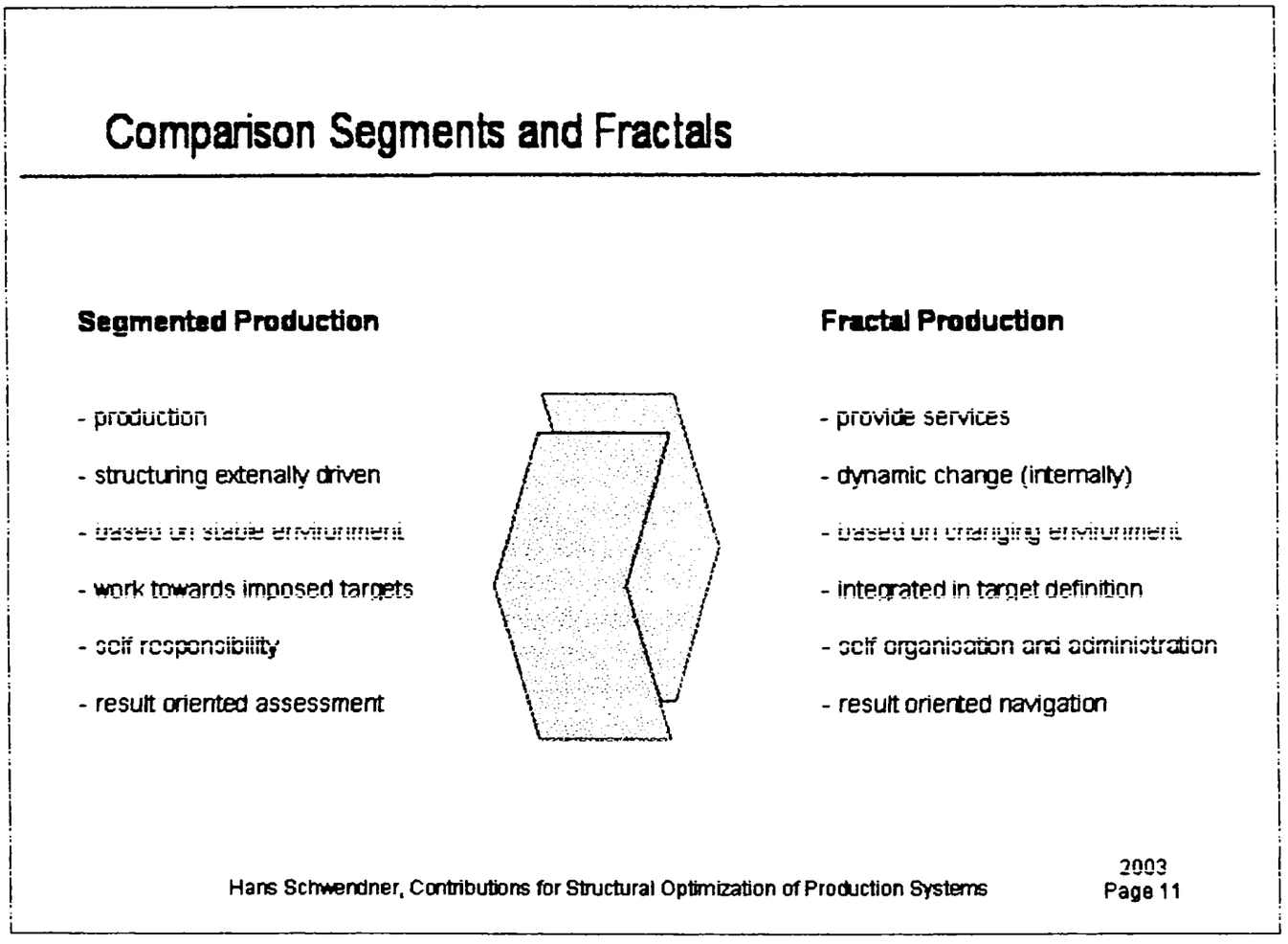
Summarised the IT tooling of fractals is shaped according to
- distributes data sources and data retrieval within the network
- process oriented
- solution oriented
- adaptive

More detailed evaluation on this topic will be done in a following chapter, as production networks require even more sophisticated information and communication optimisation steps in order to cope with complexity and cost. Fractals' requirements represent a subset of network requirements then.

Comparison Segmented Production and Fractals

In contrast to conventional manufacturing segments the fractals cope with complexity and dynamics by being a flexible structure with the perception of being an enterprise on its own within an enterprise. Consequently fractals have no valuation on operational tasks or value add but providing a product/service with a measurable customer value. Their structuring does change to external more than internal requirements despite the principle of optimisation according to internal relationships. The management of fractals requires new processes for target agreement and different way of leadership of staff for motivating to flexibility and optimum processes for the overall fractal enterprise.

Figure 2.c.5. /WARNECKE1/ shows the comparison of segmented production to fractal production.



/Figure 2.c.5.: Comparison Segments and Fractals/

There are various management concepts that are dedicated for certain business situations (turn around management, lean management, shareholder value...) and therefore may lead quickly to specific business instances. In contrast fractal production is a concept with mid term to long term but lasting effects due to its overall approach.

d. Advanced Inter-Enterprise Structuring Concepts

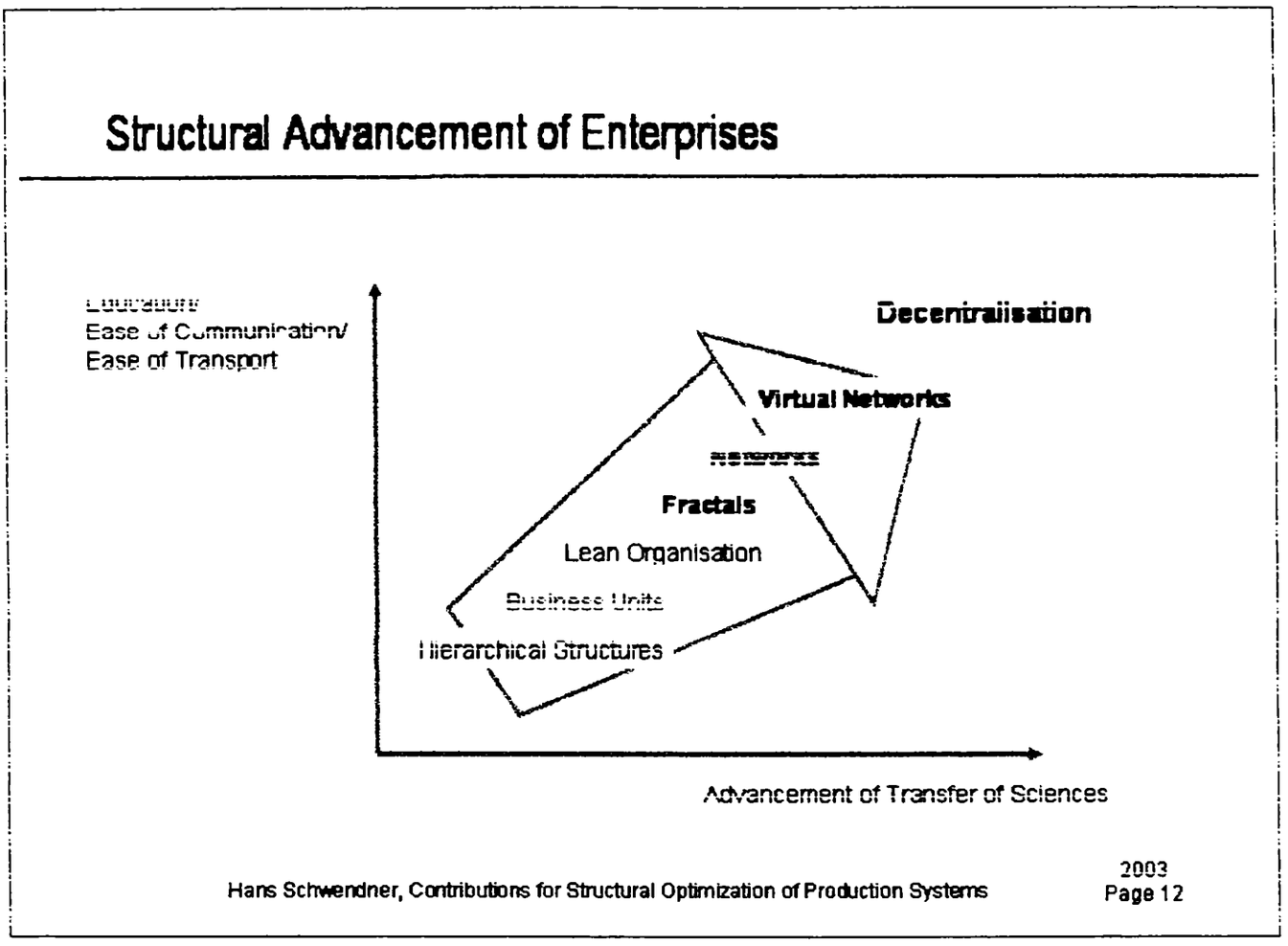
Galileo Gailei was one of the most important persons in the development of modern sciences and its physics based concepts of earth. Galileo thereby was the first to recognise that it is not the movement of a body is of importance but the change of movement is the key to observe and to discover. In combination with the law of physics that mass stays constant scientists started to concentrate on materialistic concepts and neglected or

reduced activities in philosophical rationalism and thinking.

The universal concept was a globalisation of an unreduceable substance that appears in always changing forms spread all over the universe. *Substance as such is without value, reason and goal /FETZ/.*

To some extent some of that philosophical discussion on physics can be applied to economics and the development of structures of enterprises. Have enterprises at the beginning of the century been viewed upon as something mechanistic where everything and everyone had to work as a part of a 'clockwork' in every hierarchical structure derived from large 'organisations' at that point in time – the military. Until now the point of view upon enterprises has changed through the advancement of different sciences whos' concepts were transferred to business, like biology, physiology, etc. Enterprises were compared with organisms that have or have not developed a capability to survive in harsh environment – Darwinism - and thus were taken as new concepts for their structuring. *From the philosophical approach it can be seen as similar to physics that* the movement is a given and one has to observe change in speed and complexity. Thereby the substance is flexible but requires unified direction, values and goals – all principles fractals do follow.
What kind of structuring is well suited to survive in a future environment of higher speed and complexity? Flexibility, feedback control and speed of action must increase. The most advanced concept proposed is 'networks' with advancement to 'virtual networks' independent of location.

Figure 2.d.1 shows the advancement of enterprise structures through advancement in transfer of scientific concepts on the one hand and on the other hand the increasing education of people leading to more individualism and know-how for value and the ease of communication and *transport that enables split or combination of individual competencies and* elements of the value chain.
Through innovation in technologies and building of infrastructure decentralisation might lead to virtual structures. For example virtual networks that are independent of location, inter company related project oriented solution networks. They get formed for a project and get dissolved when the project is done. Independent of location the experts are connected by advanced IT.



/Figure 2.d.1.: Structural Advancement of Enterprises/

This chapter does develop a network concept with the elements structure and abstract 'purpose-process' discussion.

Network Framework and Elements

For description of the elements the definition of 'enterprise' is the basis:

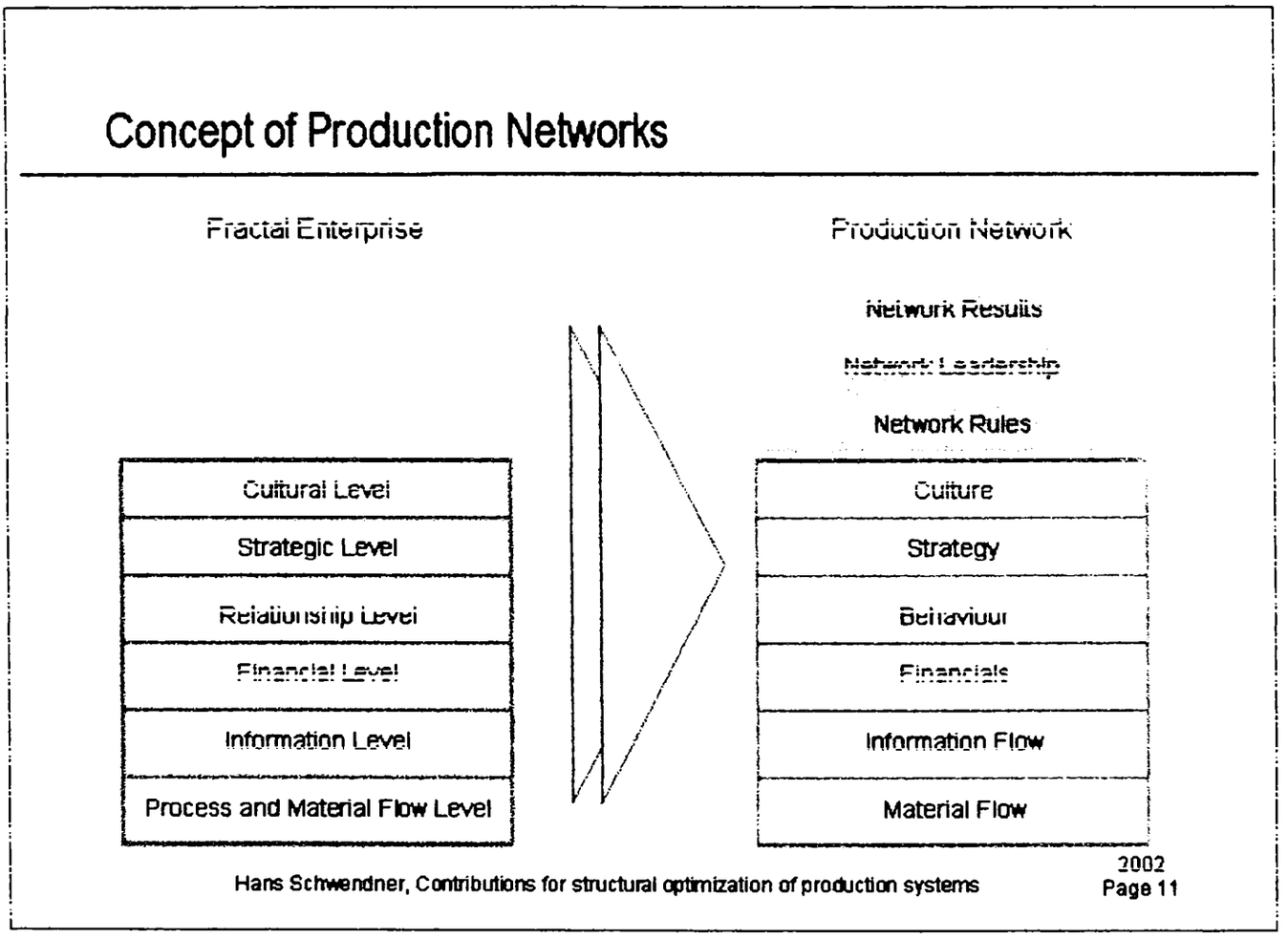
Enterprise: at least one produces something for somebody

In fractals the word 'one' was interpreted as 'company'. Within networks the same word will be interpreted as 'conglomerate of multiple companies and *individuals*'.
The purpose remains the same as any production results in something for a customer. Therefore the key issue for any network is that each individual partner provides an identifiable value for the customer and the sum of all is of higher/new value than the sum of the individuals' value.

Networks take advantage from the dynamic configuration of processes by

composing competencies from wherever they are available best.

Figure 2.d.2. /WARNECKE1/ does give an overview on the concept of a production network. Additionally to the fractal production concept a network has to deal with the ethical aspects of live. These are the contributions of the individual members to 'overall result', to behave according to 'network rules', and 'network leadership'.
The key elements for establishing the network will be the common 'network result'.



/Figure 2.d.2: Concept of Production Networks/

i. **Network Result**

What is the purpose of the network and the value generated for each individual partner?
The network must enable in some way an improvement in terms of cost, performance or time towards the customer.

The valuation criterion for a company to search for network

partnership is very similar to searching a partner for merger&acquisition:
- Cost reduction by economies of scale in production and development
- Extended market access by supplementary products / customers / innovation
- Reduction/spread of investments
- Strategic market entry

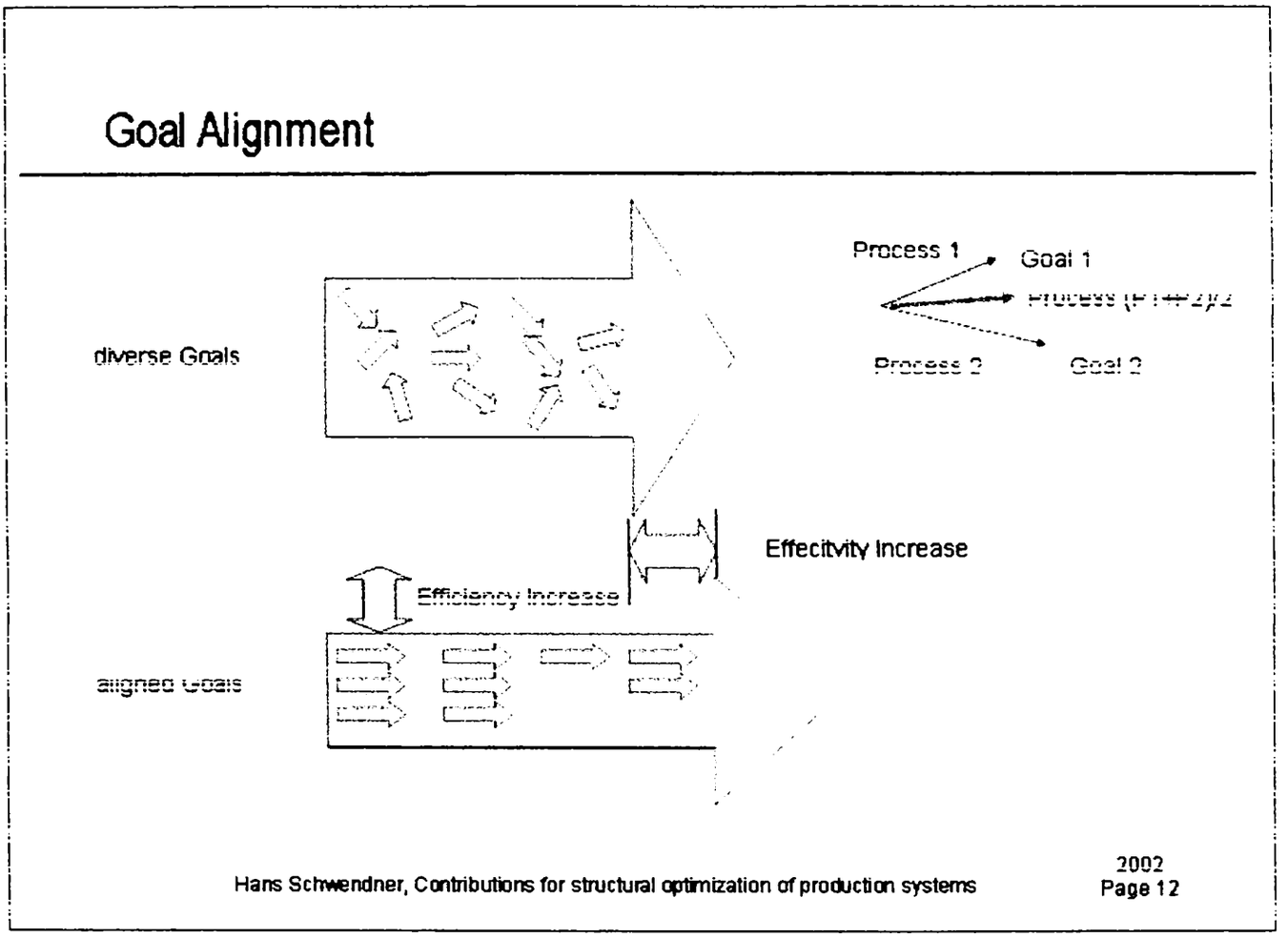
Due to the not yet defined level of legal ties within the network in comparison to a merger or acquisition there are additional options for valuation. These are based on the potential low level of risk for starting a network with one partner first or adding a small partner to an already huge network. The low level of risk is defined by the barrier of entry and exit into/out of the network.

The criterion can be within the field of access to information about products, markets, competitors, technologies etc. Any information might be gathered faster for improvement of the network result by either higher quality in decision or improvement in value added processes.

ii. **Network Leadership**

Network leadership generally is an overhead necessary for a network. It is established in order to align the activities of all network members (organisations, individuals, partial organisations, associations, etc.) towards the goal of the network. Leadership therefore requires all elements that are required within a regular company or fractal for leadership from target setting, delegation control, performance evaluation and incentivising to decision making.

Especially goal alignment is a key task within networks as the different partners usually have very diverse interests driven by their original enterprise. Being in a network does diversify their goals and thus decrease their efficiency due to the fact that either goal may not be completely the same as the original one. Therefore the process to reach both goals requires some adapted processes that by nature of not being optimised generate conflicts with either management interest. Figure 2.d.3. does illustrate this, as the company may have goal '1' and the network may have goal '2'. They are not far apart from each others, but there is always just one optimised process to reach one goals with maximum efficiency.



/Figure 2.d.3.: Goal Alignment/

For example one network partner (a) is customer to another partner (b) in a field outside the network. (b) is responsible for financials within the network and due to some reasons (a) does not pay network contributions. How tough can (b) act on (a) for payment as it might be contrary to his interest as a supplier to (a)?
The combined process is less efficient in the perspective of both goals.
For the total of the network partners the misalignment of the goals does lead to a decrease in effectiveness. In worst case even new partners may be necessary to compensate for the contrary interest of one partner.
For example in the teleweb network (see chapter 4.d.) it is key for one special TV manufacturer that they do always get a competitive solution from their in-house IC supplier. Even as it was not the original intention of this IC supplier to join the network consortium, as a product like this was not on their roadmap, they finally joined the network. They did start also to develop an IC solution in parallel to the two other IC partners on board the network. At the beginning this activity can be viewed upon as overhead and not necessary in

order to reach the network goal due to the fact that there was no principal need for product availability reasons, other than for political reasons.

The discussion on this subject reveals the key issue of leadership in networks: managing people that by nature of the network get into a conflict of interest through being in the network and in an enterprise in parallel.

iii. **Network Rules**

Network rules in this context are understood as the legal framework of operation for the network. It must consider the different laws to be applied for taxation, liability, intellectual property rights, international trade, etc.
According to German law the association of several individuals ('natural' or 'juristic persons') for executing on business purpose does found a company according to BGB (Bürgerliches Gesetzbuch). Thereby all members are fully and unlimited liable for the company.
The choice of the appropriate legal form for the company therefore is important in order to govern certain subjects that are necessary by law:

- liability (limited, unlimited by nature of the legal form)
- trade and taxation (gemeinnütziger Verein or enterprise)
- cartel laws
- labour laws (when hiring personnel)
- privacy data protection laws
- intellectual property rights

and to set a framework for internal network goals:
- network result/purpose
- liability based on input
- voting rights/participation in management
- financial contributions on expenses/ participation in success
- duration of partnership (acceptance of partners, giving notice, dismissal)

All those elements are usually documented by a 'Gesellschafter Vertrag' - statute of association - and governed by a board with clearly defined responsibilities, rights and obligations.

In general the same rules and same flexibility for the selection of the optimum form do apply as for a single company foundation. Nethertheless the prioritisation of factors allowing judgement on duration and individual partner flexibility is higher then the delegation

of responsibility and financials to an outside network – things that are usually critically viewed upon by any company or institution. For example some public institution (University) may not even have a financial structure to control individual budgets and thus contributions or money received may be spent completely different than intended by the network.

For some networks it might be important to have a high number of 'members' (the word partners would already express a too high degree of connection) without giving them management rights. Therefore OHG – offene Handelsgesellschaft - with 'silent associates' might be an appropriate solution; if it were with limited liability an AG – Aktiengesellschaft - would have to be formed with non voting shares.

Trust and transparency therefore are absolutely required within all partners and partners' organisations for success, but this does not make any contract obsolete.

iv. Network Culture

The culture within an enterprise generally governs the way of behaviour at conflict of interest and its sanctioning (positive and negative). The culture thereby is the set of unwritten rules that has been developed through several years. The culture thus is directly related with 'leadership' and later on 'conduct' and does bear the same potential for conflict like the diverse 'goals' of a company itself and as being part of a network.

Most management literature and research does perceive culture as a key element of management that requires certain attention as an element of its own and therefore an own process for establishment.

In the chapter on leadership there is a different approach discussed that views upon culture as a subset of a process in reaching goals and thus an element that is generated on its own by intrinsic motivation of people to reach their goals.
Putting culture 'aside' by prioritising other elements and applying some methods for transparency and conveying those facts as vision of concept, efficiency can be gained through avoiding of conflict and eliminating effort caring about this.

v. Network Strategy

Strategy within a network in its abstraction is very much dependent on the interference of the members with each others to produce the product. The strategy does influence the processes required to

achieve the network goals best and thus may directly affect the independence of the members of the network in decision on resource allocation as a separate company.

The network strategy therefore must stop at the abstraction layer where the contribution of the individual member starts. In addition to *most management literature the statement here is that the strategic* management process for a network is different at the building of the strategic plan.
Within networks the abstraction of the strategic plan does stop at the level of the contribution of the individual partner and does not influence his ownership on selecting the best process. The efficiency ought to be achieved and controlled by the select of the right members that can provide competitive processes already. In case they reveal their processes and allow interaction for common advancement this is certainly not negligible but for successful control and operation of a network is may not be a requirement.

vi. Network Behaviour

Network behaviour does discuss on the aspects of human relations within the network. As the number of informal contacts through a network generally increases the complexity of relations increases in the same way and may reach a level where completely new levels of *requirement are to be dealt by the individual person.*

Working and behaviour in networks requires people who have the capability for self management and flexibility in combination with the capability for taking decisions and solving problems on their own.

Even as lot of international companies already work in similar kind of organisations and their staffs already has to cope with several of those challenges within matrix organisations, networks require something on top in terms of:
- communication skills
- communication tools
- work ethics
- *representing a network*
- negotiate and control of contracts

in order to generate the appropriate behaviour.

Communication skills are extended in respect of more quickly understanding the targets of the partner and to be able to understand the mental concepts of the partner very quickly. Same words may be used in different companies with a different content and therefore are the basis for mislead expectations. For example a 'plan' in one company is set unreachable aggressive, in another it is

very relaxed but expected to be topped. In case both planning concepts appear in a network there is the basis already for conflict on interpretation of targets reached. Methods for solution are discussed in a later chapter. Some simpler examples are language skills that have to be available. For example Asian or Arabic pronunciations of English may vary widely and the capability to understand the other may be nearly zero.

Communication tools have to serve in a by far wider extent the local and timely flexibility requirements of a network than in a company. Working locations in a network may lead to outside 'Intranet' and different time zones where infrastructure maybe down. The respective tools do widely exist already (video phones, mobile phones, remote/mobile internet/intranet access, E-mail, answering machines, etc.) but they have to be provided, trained and used.

Work ethics is the principal understanding that any action done should be in order to support the partner towards the common goals. This does imply the basic understanding of support or hint when getting obvious that the capability (know-how, capacity) for appropriate action is missing.

Representing a network bears the risk of understanding that one has to represent all individual members of the network. But due to lack of knowledge he may not be able to present. Clear cut descriptions of values provided for the different stake holders (mainly customers and shareholders) allow to focus any representation to network services.

Negotiation and control of contracts may affect the human behaviour through general missing knowledge on legal matters or proper execution of control. For example the misperception of viewing a contract as not necessary can appear out of an incorrect understanding that everything is already governed by laws and therefore requires no additional burden of a contract. In contrast the negotiation of a contract can be understood as a very neutral (based on the neutral words of jurisdiction) discussion and alignment of goals and interpretation of decision criterion on deviation. The contract then is a tool only for serving as a guideline in case of material breach of interests of the network.
Similar elements are to be applied for 'control' neutral processes and reports give transparency and generate trust and openness.

vii. Network Financials

Generally there is the say 'when it gets to financials fun is over'. Following literature for networks and the management of financials

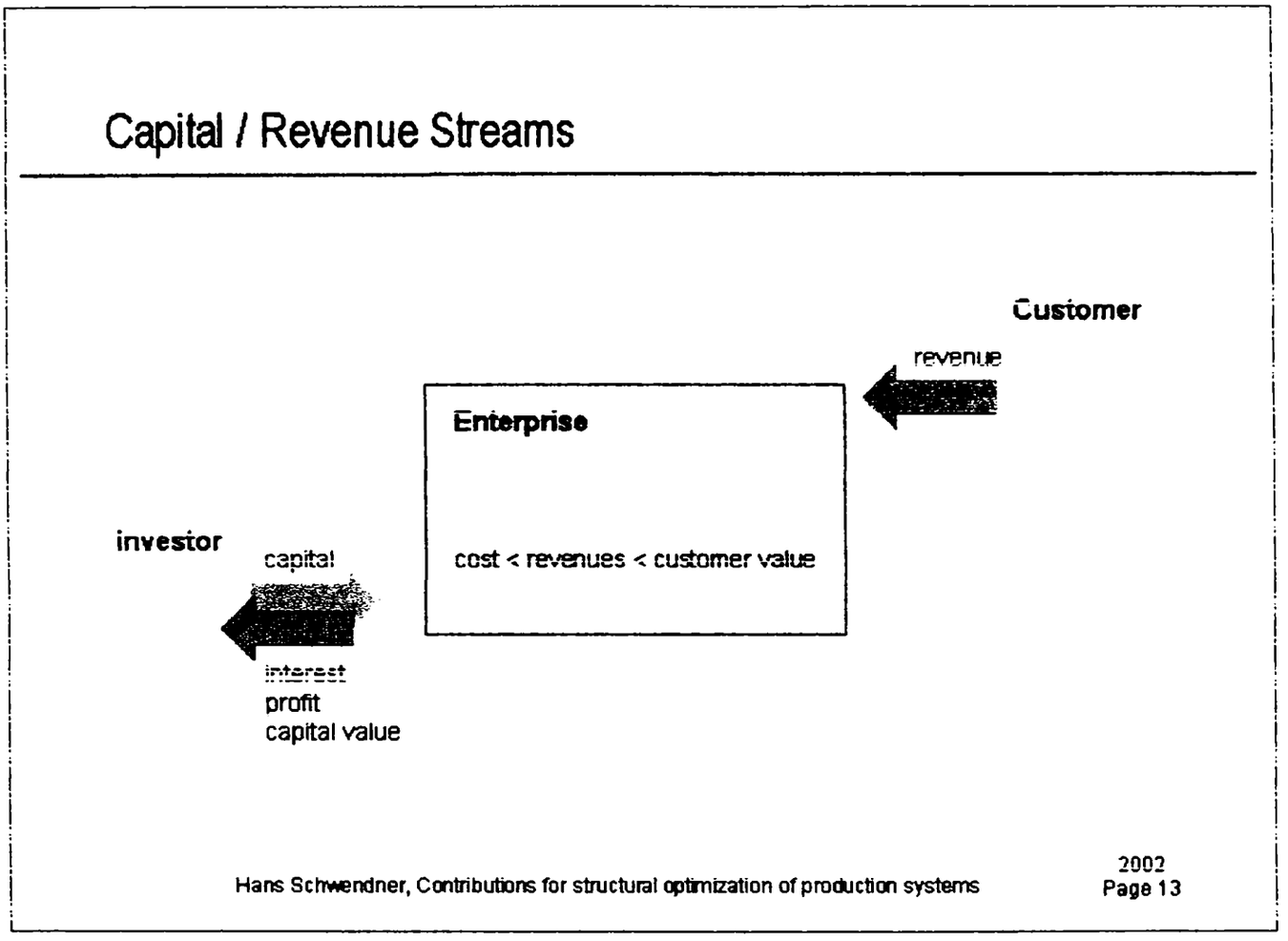
therein this say can be valuated as 'true'. The problems of:
- inter network payments on services
- the calculation of internal and external prices
- principles of accounting
- investments
- raising of capital,
etc. are referenced as potential barriers for introduction of networks. Financial management may be reluctant of releasing 'confidential information' etc.
These doubts may be very well valid and have to be overcome. Thereby on e can not find very detailed rules or guidelines yet, as this field is not widely explored or practice proven.

The general approach will be based on the concept of the definition of an enterprise and its purpose to produce for a customer. Then it gets obvious that for any revenue stream and financial activity network partners have to define the customer value provides and challenge how to optimise the formula

'cost < price < customer value'.

Then the internal cost can always be referenced against external benchmarks and the commonly derived rational on sharing success also may lead to commonly sharing risk.

Figure 2.d.4 /ZAPKE-SCHAUER/ does illustrate the financial flows for an enterprise. Investors clearly are no continuous source of capital, apart from rarely investing on certain activities in order to gain higher returns than the put in capital. Only customers can provide a constant revenue stream.
By applying the same principle for a network (= application for each individual partner) financial management is clearly a tool to describe needs of partners, investors and customers and not a matter of blocking reasonable business generation and networks.



/Figure 2.d.4.: Capital/Revenue Streams/

viii. Information Flow

Networks are to a wide extent enabled by the information flow among the partners. Any decision and change is possible only on availability of information.
Thereby one has to distinguish between data and information. *Information is data already gone through a value added process of* analysis for a certain purpose. It can be defined as knowledge for a once it gets mixed with experience in a certain contexts for a certain purpose.
This definition carries the answer already to of a lot of problems in conjunction with the flood of information (or better: data) and its handling. Nethertheless it requires a change in the mental concept of the value of individual information towards:
- the ability to select the kind of data required for generating information
- the value of processing the data to information according to a certain purpose and
- identification what kind of experience (knowledge) forms an

enterprise conscience for further advancement.

This leads to a 'natural' pre selection of data acquisition, its focused processing, storage and distribution as the data themselves have no value.
Then the network management has to concentrate on processes for knowledge generation, transfer, storage and access.
Hereby the target and process oriented thinking can be of support. Any knowledge should be used for process improvement respectively increasing the capability to act. Therefore the owners of the processes also have the responsibility then to these knowledge oriented questions. The information technology does serve then as a tool only, but IT departments can be sparring partners for process owners in identifying methods on using the tool for the best knowledge management.

ix. Material Flow

The material flow is widely discussed in the literature and logistics management already that this no longer is a major barrier for coping with distance or organisational borders. Within enterprises and in between enterprises a huge amount of concepts have been developed for optimisation, like Just-In-time, Kanban, Continuous Improvement, Supply Chain Management, etc. New technologies and tools can be applied for data gathering and distribution, like internet.

The key to success is the correct understanding and subsequent concept of what enables what – or what results in what. Within the second presentation for this thesis the target was time and processes had to be selected to measure time.

Same concept can apply to networks. Dynamics are a matter of time and complexity is a phenomenon out of the results of various processes.

Structuring of Networks

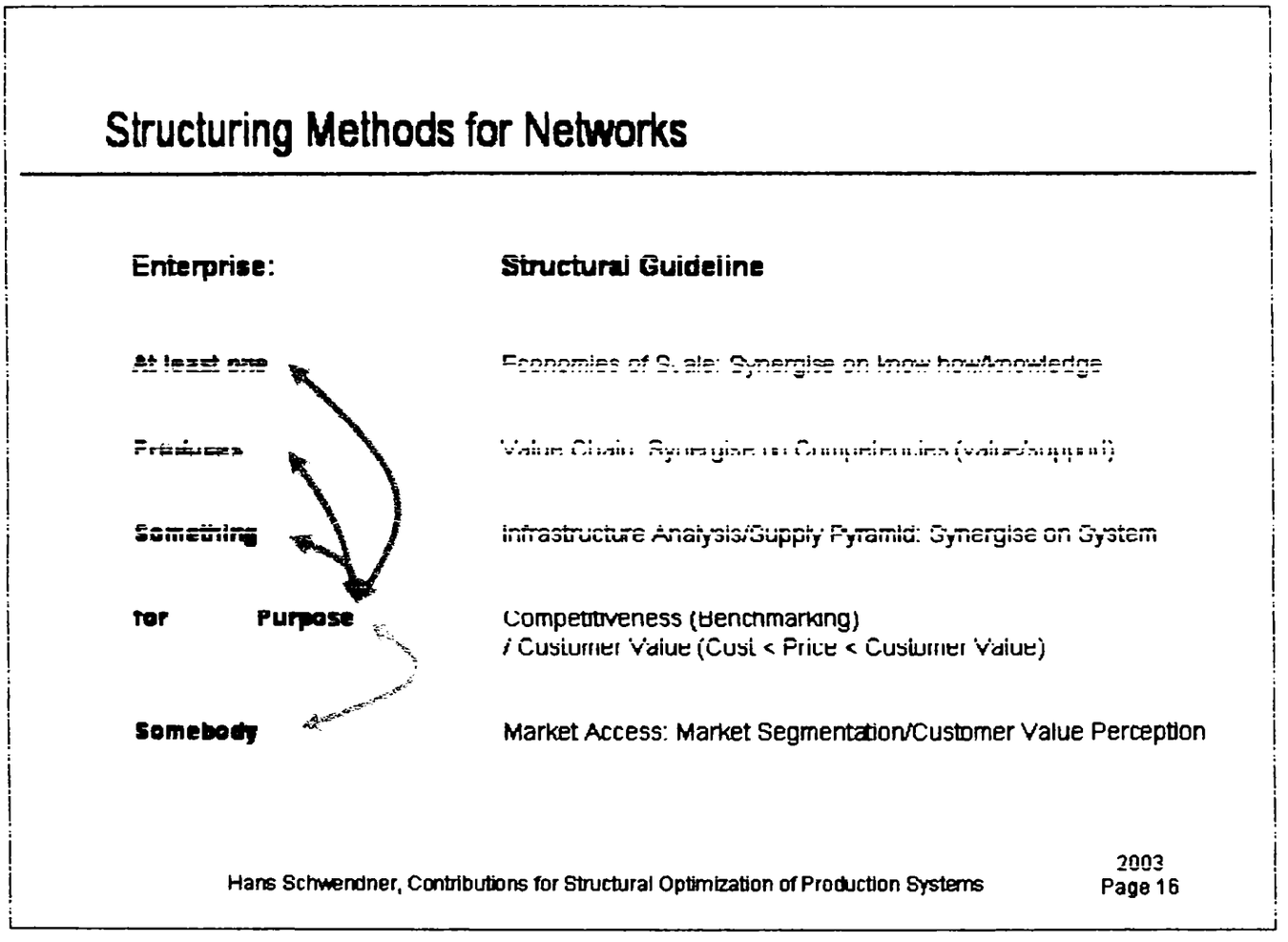
The structuring of a network means the composing of elements (enterprises or parts of enterprises) towards a new enterprise.

Therefore the definition of 'enterprise' is resumed:

enterprise: at least one produces something for somebody

The structuring can be done along the elements of the definition (Figure

2.d.5.) and the 'for' realises the relationship between all elements: the purpose of the network.



/Figure 2.d.5.: Structuring Methods for Networks/

This structuring does give a very simple model for analysing all degrees of freedom for structuring an enterprise. Consequently due to its simplicity the sanity check on the coherence with all elements of the definition can be done immediately.

- At least one: through a network of more than one economies of scale could be achieved in production or development leading to a cost advantage or knowledge advantage – finally generating a competitive customer value

- Produces: along the value chain not necessarily all elements need to be done by one enterprise; the combination of individual competencies does allow a more efficient production or support functions are provided in a better way than doing it on ones' own. For example the outsourcing of

logistics for international business to one international partner within the network might make sense to a more local focused enterprise.

- Something: the combination of products might generate a new customer value and thus generate additional revenues to the network partners. For example bakery and the butcher next door where they find an agreement like: the bakery supplies rolls for sausage and meat for producing walk away food and in addition recommends the butchery to his customers. The butcher may recommend the bakery for additional sweets or coffee. Thereby they can generate additional value by using each others competencies and extending their customer relationship.

- Somebody: finally one must get the perception of receiving a value that is worth paying for – the customer.

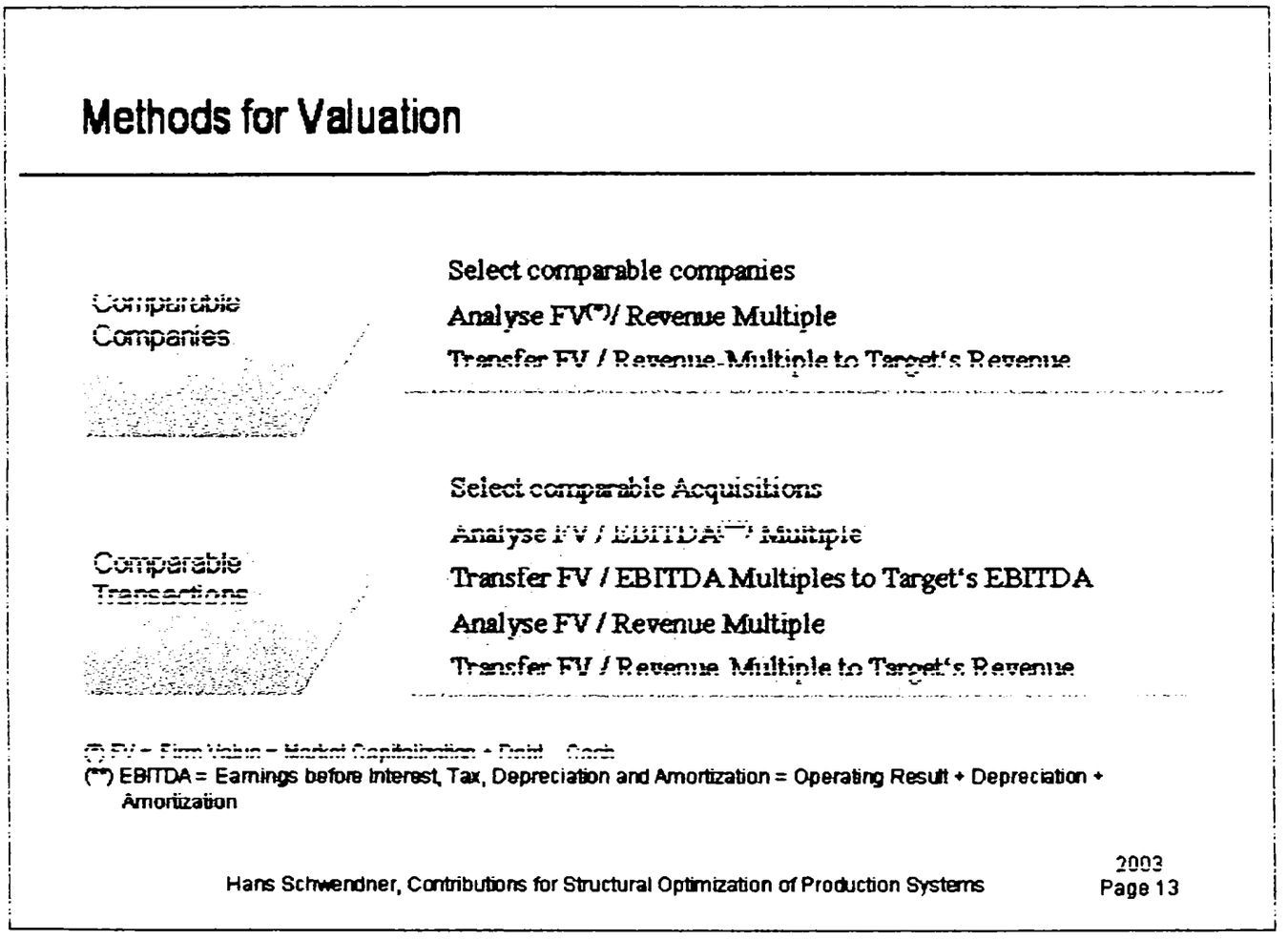
- For: an enterprise finally does not exist for serving economic sciences or fitting to mathematical formulas. It must be described by a purpose. The concept to evaluate and to measure the purpose is 'customer value' with the respective unequation cost < price < customer value. Therefore the customer value must be produced at lowest cost with benchmarking being the concept for evaluating the overall lowest cost potential.
Benchmarking can be applied from different angles. On the one hand best practise methods can be analysed for comparing processes on potential overhead one might have. On the other hand substitution solutions can be analysed for serving the purpose of the customer and their potential to enable completely different price points. For example a price tag in a super market can be made of stickers with the price printed, it can be a barcode system, it can be a contact less identification IC with additional security features, etc. Differences may exist, but then they must be explained.

There is no general rule or one and the only one way for structuring a network. The approach here is to supply a very simple concept that has the power of quickly generating options for proceeding and for fast assessment for decision. Thereby it is important to have a 'plan B' to be able to act properly and quick on changes.

e. Merging Enterprises

This subchapter summarises additional findings - in literature and interviews with consultants that were done either recently or within the own management of company internal and inter company mergers – on valuation for a merger partner and execution of a merger.
The available literature supports theoretically and based on case studies the analysis of premerger motives and their evaluation in terms of potential cost advantage gains (e.g. learning curve) through economies of scale, scope, etc. along the line of 'motivation for partnerships' discussed in previous subchapters. Through the increased influence of the stock market

a lot of analysis for methodology is performed also in the premerger phase on valuation based on stock market comparative cases for the merger target and thus deriving potential valuation of the merged enterprise, as can be seen in figure 2.e.1..



/Figure 2.e.1.: Stock Market Related Methods for Valuation/

For example Cisco nearly can claim to have cultivated this procedure for the stock market as their acquisitions were prepared in a way that the target was paid in stock and within a short period (sometimes within hours) of announcement of the acquisition the market capitalisation of Cisco increased by even more than the virtual capital expensed for the target.

Nether the less it is important to mention that in the previous analysis the speculative aspects of a merger are represented stronger than the investment perspective. The speculative approach is stock market behaviour oriented and tries to predict its development while the investor does look at the enterprise 'inner values' derived out of business and its fundamental behaviour. The 'inner values' for example are calculations on discounted cash flow for future business, etc. /HAGSTROM/. The

combination of both approaches allows to generate a view on a company's respective value calculated (worth to be paid for on a rational basis) in contrast to a value of comparable businesses (value of company that could be achieved in certain market conditions).

Analysing literature and case studies on merger processes, it gets obvious that there is a lack in real supportive theory and synthesis on how to manage a merger. All financial pre analysis and technical/market/product fit evaluations do provide only measurables on merger success, but do not describe the process. Most of the mergers do fail as the success is dependent on management capability to do the right things and to intrinsically motivate staff with an adequate vision. The respective process must be set up to lead towards goals enabling the vision.

The elements of unification of processes, techniques for valuation, set-up of teams, functional elements for change, behavioural pattern and emotional status of staff during a merger are generally available as knowledge and know-how. But the way to effectively achieve the targeted behavioural pattern and to avoid contra productive emotions is the critical element for reaching full speed on the 'new ship'.

Three elements for successful execution of mergers can be synthesised:

- a valuation of the merger partners individually in detail and for the resulting enterprise as an abstract must be available. The valuation aspects are criterion on synergy for cost savings and/or market advancements in terms of customer value generation.

- the merger must be set up as a project (limited in time and effort) covering all functions in order to improve processes in respect of increasing customer value

- the process must have an underlying methodology of a 'leader' instead of a 'manager'. The framework for staff is objectivity and focusing on the staff for their input on detecting and changing all critical elements. Staff changes the enterprise without principally changing personal values.

The analysis leads to the result that in a merger there are three critical milestones after merger kick-off that can be observed also from a company outside view (further verification in chapter 4.):

- *about 100 days*:
a commonly living organisation has been established that follows joint goals. The criterions are the availability of a new road-map for products with improved customer value; this means that the individual road-maps of the former companies are no longer identifiable as separate, but unified. Current developments are already adapted to the new road-map.

- about half a development cycle later:
(a development cycle from idea to production release in the high tech industry is about 1,5-2,5 years) the management does execute on the product road-map. The criterions are that new products are successfully introduced into the market and new customers are accepting those products.

- about 1,5 development cycles later:
after this time span all legacy effects of former management of the individual companies are gone and only the results of the new enterprise are in effect. Criterions are that there are only products in the market available based on the new road-map and customers are tuned towards the company. Reverse it can be said, the merger is successful whenever customers do not turn away from the company.

f. Modelling of Systems

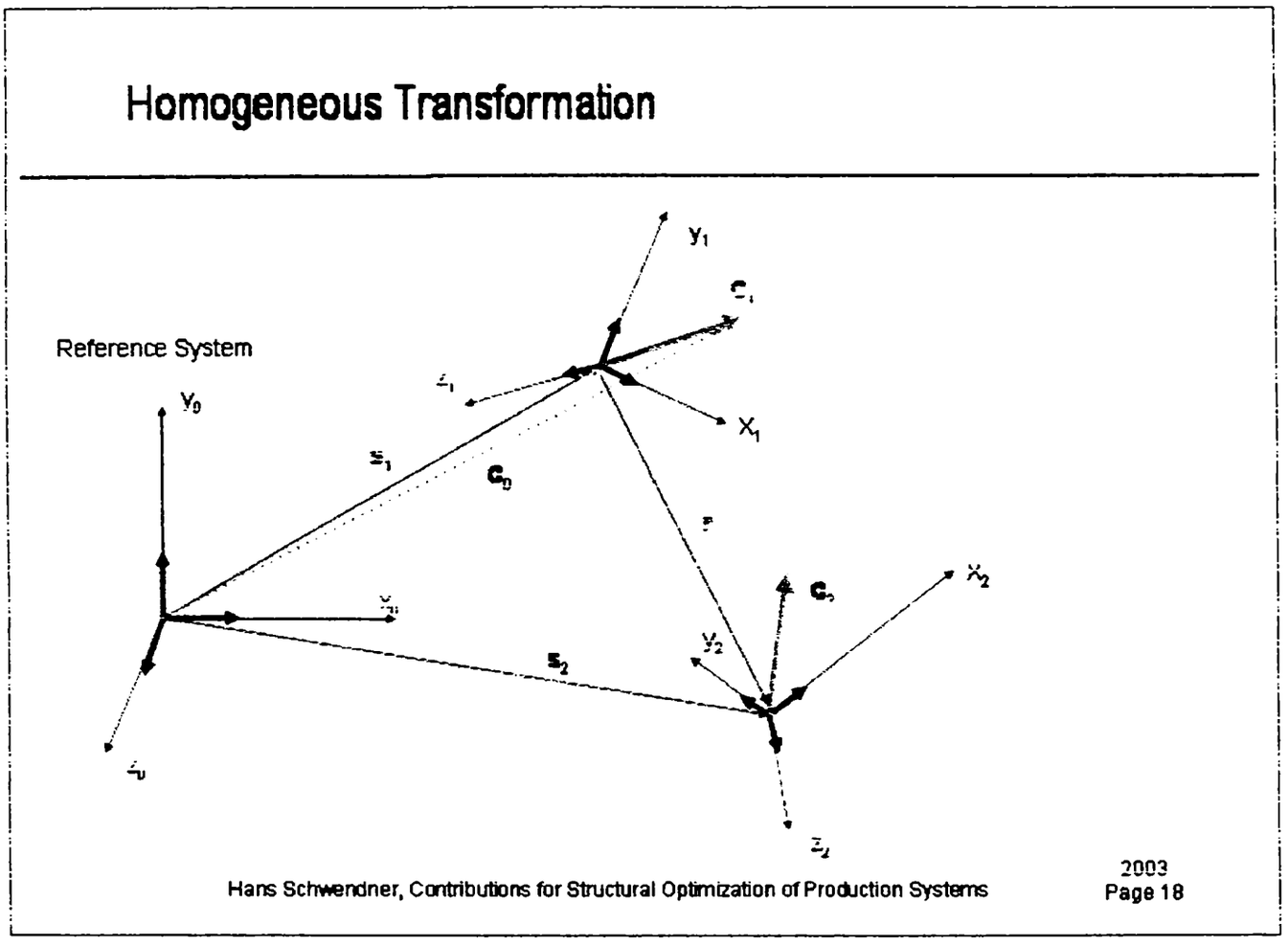
(Note: the notation for vectors and matrices is described in chapter 9.c.)

Enterprises are systems. Therefore in this subchapter different mathematical methods are explained that are used for modelling systems. Within chapter six especially the representation of systems as frames will be used for development of a valuation tool.

Mathematical Model of Frames – Homogeneous Transformation

The mathematical method of homogeneous transformation describes relationships between systems. Each individual system is represented by a frame. Each frame is described by coordinates and angles of their coordinate axis in relation to a reference system. This model of frames is a representation to describe relative positions very effective. For translation or transformation frames = systems may be manipulated by virtual movements and turns in perspective, scaling or stretching.

The following figure 2.f.1. shows the transfer of coordinate frames and vectors with a reference system. This is an abstraction of the representation that can be applied for interpretation of a business situation. Hereby the individual companies can be represented as vectors. The target vectors and the relative position can be well described by mathematical models. Also the 'limited capability' to get information about certain business parameters can be reflected in the number of dimensions. Two vectors may head towards the same direction, but in reality they might be completely divers. The mathematical formulas enable interpretations of the company view with its relative position to the reference, the dimension of the coordinate frame and the scaling of vector entity.



/Figure 2.f.1.: Homogeneous Transformation/

The representation of one coordinate frame in point of view of another frame can be realised through a transformation method. The transformation will be applied for the coordinate frame of company 1 and will transfer the vector $\mathbf{C}_1$ into a representation of the reference system.

For the transformation of coordinates one has to know following components /BLUME/, /PAUL/:

- $\mathbf{S}_1$, the vector describing the translation from the reference origin to the origin of the frame customer 1 with its components $[s_{x0}, s_{y0}, s_{z0}]$

- $\mathbf{x}_{e1}$, the vector of the customer frame representing one unit for the x-axis. It is described in the reference frame with its components $[x_{1x0}, x_{1y0}, x_{1z0}]$

- $\mathbf{y}_{e1}$, the vector of the customer frame representing one unit for the y-axis. It is described in the reference frame with its components $[y_{1x0}, y_{1y0}, y_{1z0}]$

- $\mathbf{z}_{e1}$, the vector of the customer frame representing one unit for the z-axis. It is described in the reference frame with its components $[z_{1x0}, z_{1y0}, z_{1z0}]$

- $\mathbf{C}_1$, the company vector within the frame customer 1 with its components $[c_{x1}, c_{y1}, c_{z1}]$

The transformation then is described through a matrix built from the components of the translation vector and the coordinate frame vectors of the original system:

$$\begin{vmatrix} Cx1x0 & Cy1x0 & Cz1x0 & sx0 \\ Cx1y0 & Cy1y0 & Cz1y0 & sy0 \\ Cx1z0 & Cy1z0 & Cz1z0 & sz0 \\ 0 & 0 & 0 & 1 \end{vmatrix} = E \qquad \textbf{(2.4)}$$

(Cx1x0 in E is equivalent to x_1x_0 and does represent the cosines of the angles between the unit vectors)

E represents the transformation matrix from a system '1' into '0' as all coordinate vectors and translation do describe frame '1' but are represented in frame '0'.

Therefore the coordinates of a vector $\mathbf{C}_1$ in the reference frame '0', described by $\mathbf{C}_0$ are calculated as follows:

$\mathbf{C}_{0'} = E\,\mathbf{C}_{1'}$; with $\mathbf{C}_{1'} = [c_{x1}, c_{y1}, c_{z1}, 1]^T$ and $\mathbf{C}_{0'} = [c_{x0}, c_{y0}, c_{z0}, 1]^T$ **(2.5)**

The transformation is independent of the dimension of the system. The dimension is simply a matter of parameters relevant for description of the system. The equations for calculation of the transformation remain the same, $\mathbf{C}_{0'} = E\,\mathbf{C}_{1'}$; with $\mathbf{C}_{1'} = [c_{x1}, c_{y1}, c_{z1}, \ldots, 1]^T$ and $\mathbf{C}_{0'} = [c_{x0}, c_{y0}, c_{z0}, \ldots, 1]^T$. E has the dimension (n+1)x(n+1) and the vectors $\mathbf{C}_{1'}$ and $\mathbf{C}_{0'}$ are of the dimension n+1. *E* again is a representation of the components of the *translation vector and the coordinate frame vectors in perspective* of the original system.

There is a special case of transformation, that is called stretching or scaling, whereby the origin of original and target system coincident and also the orientation of both coordinate frames coincident. The only difference is scaling of the x,y,z-axis. The respective matrix *E* is described as follows for the scaling factors a for x, b for y, c for z:

$$\begin{vmatrix} a & 0 & 0 & 0 \\ 0 & b & 0 & 0 \\ 0 & 0 & c & 0 \\ 0 & 0 & 0 & 1 \end{vmatrix} = E \qquad \textbf{(2.6)}$$

$$[ax, by, cz, 1]^T = E\,[x, y, z, 1]^T \quad (2.7)$$

The transformation then is independent of the dimension of the coordinate frame and can be interpreted as a translation of the original frame to the target frame and rotations from the original frame around the final target frame.

The advantage of this representation is, once the individual frames, the relative position and the company vector are known, all elements can be transferred into the other coordinate frame. Conveyed in an enterprise environment this means that another enterprise, once its details are known, can be interpreted from one's own perspective. The disadvantage is that all 'data' have to be known about the other enterprise, an assumption that is *practically not realistic, but therefore additional methods can be applied to* make those data as complete as possible or available as 'necessary'.

Another advantage is the graphic representation.

Mathematical Model of the Structure of Production Systems

Modelling always has to abstract a system in a way that the relations to its complement (= world outside the system) are optimised in relation to the *purpose of the model on the one hand and on the other hand to consider* advancements within the system through evolution and through interference with the outside world, i.e. time dependence of the system in relation to the environment. The environment hereby may consist of a multitude of systems that are in a relation to each others. Those relations also do change over time as in a market partnerships may be arranged among different players, or enterprises may diminish through bankruptcy, etc. The model of production systems does support - giving mathematical tools - description of the relationship (connections) among different enterprises. This representation could be applied for representing connections within networks for example.

For the formal description of a system there is the definition according to a system being part of a set that unified with its complement (environment) forms the total set. The system interferes with its environment through input and output relationships. For the case those relationships do exist it is called an open system and in case they do not exist, it is a closed system (in business there is always at least one relationship: to the customer).

A system can also be interpreted as a set of subsystems that by a certain structure and functionality are connected with each others /ROPOHL/.

The following figure shows on the left side the functional part of a subsystem C. It is described by its inputs composing the vector:

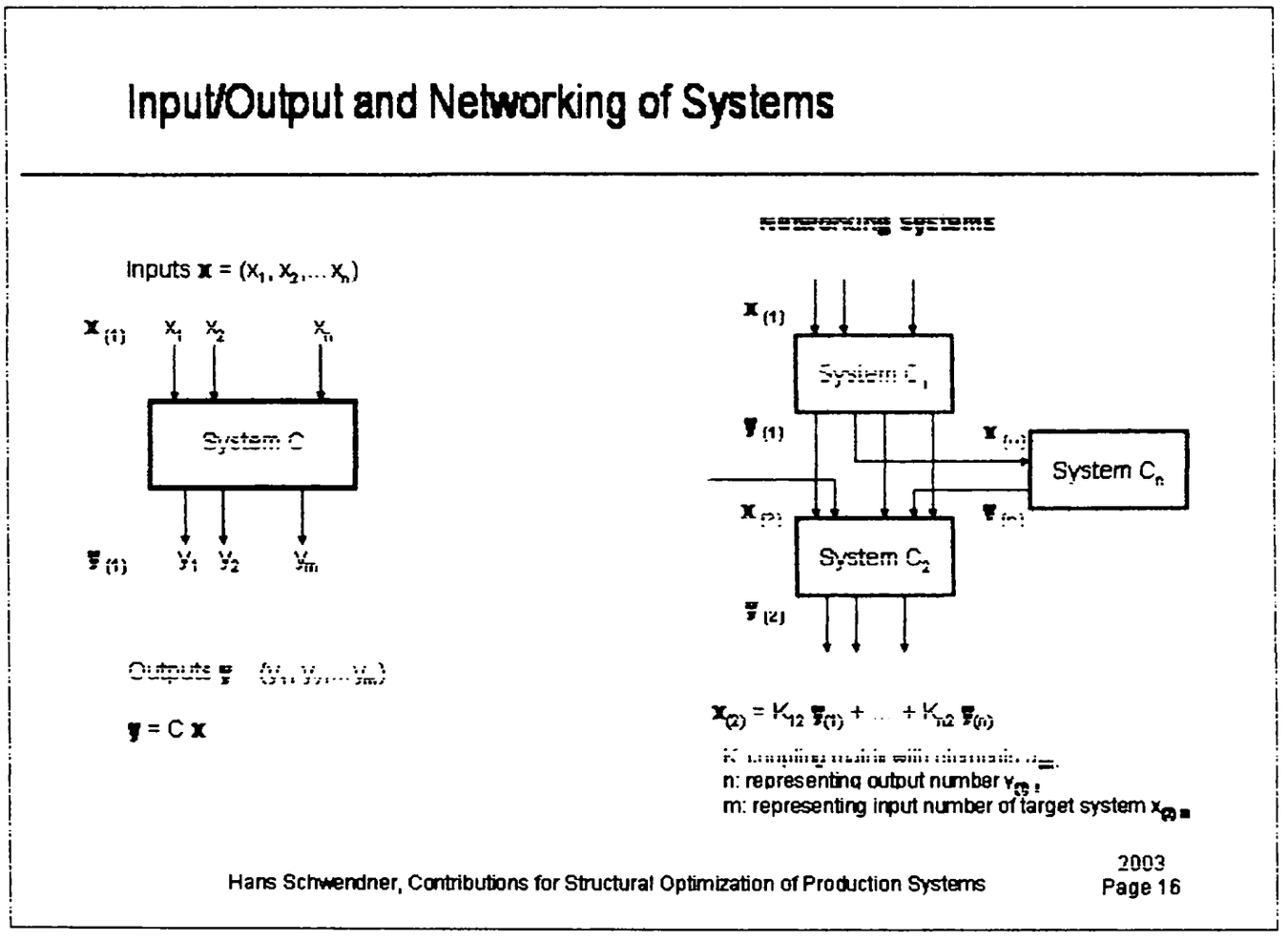
$\mathbf{x} = [x_1, x_2, \ldots x_n]$

and its outputs composing the vector:

$\mathbf{y} = [y_1, y_2, \ldots y_m]$

The function of the system 'C' is described by the transformation-operator C of its input vector into its output vector:

$$\mathbf{y} = C\,\mathbf{x} \qquad \textbf{(2.8)}$$



/Figure 2.f.2.: Input/Output and Networking of Systems/

The figure does show on the right hand side the networking of subsystems. It is a system that is described through the structure of its subsystems and their relations in-between.
The subsystems themselves are described by their input and output vectors:

$\mathbf{y}_{(1)} = [y_1, y_2, \ldots y_m]^T$ as the output vector of subsystem (1) **(2.9)**
$\mathbf{x}_{(1)} = [x_1, x_2, \ldots x_n]^T$ as the input vector of subsystem (1) **(2.10)**

There is a relationship between subsystem (1) and (2) if there is at least one $x_{(2)m}$ and one $y_{(1)n}$ with:

$y_{(1)n} = x_{(2)m}$

Out of above equation a matrix can be set up that relates the rows with the output $y_{(1)n}$ and the columns with the input $x_{(2)m}$. The element a_{nm} of the matrix may be either '0' or '1' dependent whether $y_{(1)n} = x_{(2)m}$ is 'false' or 'right'.

For example the 'networking-matrix' for the subsystems (1) and (2) of the above figure 3.d.1. looks as follows:

$$\begin{vmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{vmatrix} = K12;$$

$a_{22} = 0$ as $y_{(1)2}$ is an input to subsystem C(n) and not to subsystem (2).

The above figure already shows a structure (network) of subsystems. Assuming there are no relationships of a subsystem with itself, an nxn matrix can be set up that does contend all relationships between the n subsystems.

The elements a_{pq} of this network matrix [*NET*] are:

$a_{pq} = 0$
for p=q, as per definition there is no relation of the system with itself, or if there is no relation between subsystem (p) with subsystem (q)

$a_{pq} = K_{pq}$
for any relation between subsystem (p) and subsystem (q).

For example for above figure the networking matrix is as follows:

$$\begin{vmatrix} 0 & K12 & & K1n \\ 0 & 0 & \dots & 0 \\ \dots & Kp2 & 0 & \dots \\ 0 & Kn2 & \dots & 0 \end{vmatrix} = NET \qquad \textbf{(2.11)}$$

The matrix *NET* then consists of elements that describe the structure of relation of all subsystems and can be functionally set up to model the behaviour over time, including even changes of structural relationships.

The subsystems themselves are described by their time dependent input and output vector and by their functional matrix.

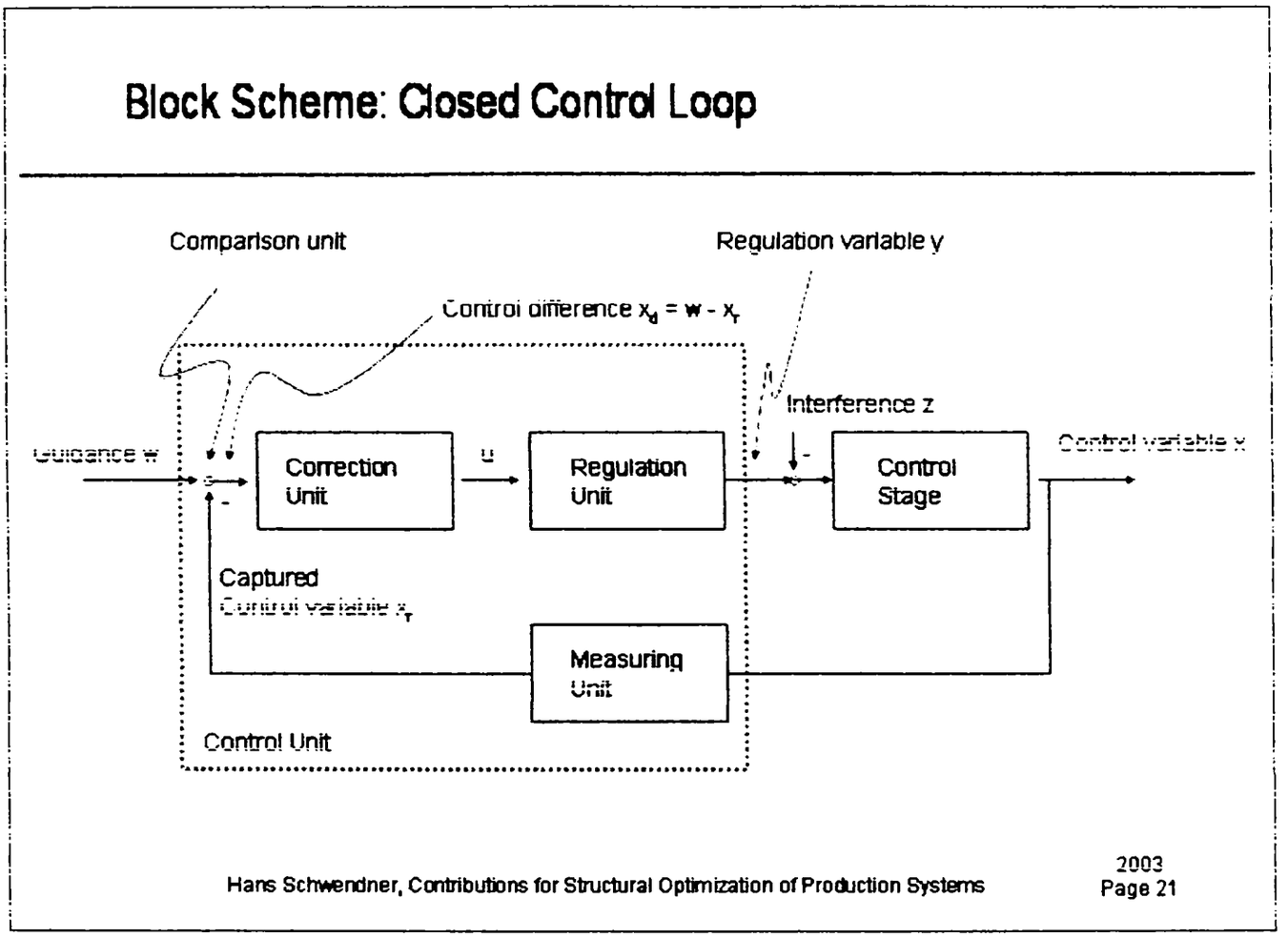
Each subsystem itself could be broken down into a hierarchy of new subsystems, if required. Thereby very complex structures can be modelled to different abstraction levels.
For instance networks can be modelled as a system consisting of the several subsystems (enterprises) but on a higher abstraction level can be represented as one subsystem only that has a certain relationship with its *customers, competitors, society, etc.*.

For executing structural changes, like a merger, there is a target to have certain subsystems and their relations changed at dedicated points in time after a project start. This model is not contradictory to the homogeneous transformation. Nether the less it will not be applied for modelling the networking of enterprises

Closed Control Loop

The transformation of systems in order to reach a certain situation as an enterprise at a certain point in time can also be described by the closed control loop. The enterprise is described by a parameter set, and also the management task to influence the behaviour of a system in a defined way *is described by a function applied to the parameter set. Then the behaviour* is described by a vector of variables in terms on an input (target) and the output vector (parameters) of the system, the enterprise.

Generally for systems unpredictable interferences appear. Therefore it is necessary to observe the output and adapt the input in order to guide it to the intended situation. This procedure is called closed control loop. The observed and to be controlled output is the control vector x. The control stage means the system to be controlled. By a measuring unit the observed signal-vector is captured and transformed into the control vector x_r; the captured vector then is compared to the intended signal behaviour, the guidance-vector w. Through a correction unit and regulation unit based on the difference of the guidance and the captured variable the regulation *variable is built for influencing the control stage directly. The general* structure of a closed control loop is shown in the following figure 2.f.3.



/Figure 2.f.3.: Block Scheme: Closed Control Loop/

The closed control loop has two general tasks:
- keep the output at a defined behaviour independent of interference
- bring the control stage to the intended behaviour and output with a defined input w

Any change of the guidance will lead to an oscillation of the system until the intended signal is reached. In order to achieve a stable situation it is necessary that the closed control loop is:
- stable (decreasing oscillation over time)
- the control difference x_d remains within a certain range

It is the task of the correction unit to 'influence' the output u in a way that the system gets stable and that the oscillation decreases fast enough to the intended values.

When a closed control loop consists of time invariant and linear elements, it can be described in a general way.
The individual units thereby are characterised by their transfer function:

correction unit and regulation unit: $G_1(s)$
control stage: $G_2(s)$
measuring unit: $G_3(s)$

Consequently the following equations are a result:

$X(s) = G_2(s)\,[-Z(s) + G_1(s)X_d(s)]$
$X_d(s) = W(s) - G_3(s)X(s)$

-> $X(s) = -G_2(s)Z(s) + G_1(s)G_2(s)(W(s)-G_3(s)X(s))$ (to simplify leave 's')
-> $X(1 + G_1G_2G_3) = G_1G_2W - G_2Z$

-> Complex equation of the closed control loop:
$X(s) = W(s) * G_1(s)G_2(s)/(1+G_1(s)\,G_2(s)G_3(s)) + (-Z(s)) * G_2(s)/(\,1+G_1(s)\,G_2(s)G_3(s))$

The equation verifies that the output is solely dependent on the two inputs w and z. Is z=0 then the output is solely dependent on w and the equation *for the transfer function is simplified to the term:*

$F_w(s) = G_1(s)G_2(s)/(1+G_1(s)\,G_2(s)G_3(s))$ (guidance transfer function)

$F_z(s) = G_2(s)/(1+G_1(s)\,G_2(s)G_3(s))$ (interference transfer function)

The transfer function F_0 of the 'open' control loop is defined by:

$X_R = G_3G_2G_1W$
$F_0(s) = G_1(s)\,G_2(s)G_3(s)$

$F_w(s) = G_1(s)G_2(s)/(1+F_0(s))$
$F_z(s) = G_2(s)/(1+F_0(s))$

The regulation unit for example can be the model of the enterprise by a time dependent NET matrix – taken of the production system description. The regulation unit then can be interpreted as a management function to compensate for internal disturbance for guiding system behaviour to certain target outputs. Nethertheless external disturbances – the market, environmental factors, etc. – will also influence the output vector. The *enterprise has to generate certain control stages and measuring units to* capture and compare current situation to target. Thus management can be enabled to influence the system in a target oriented way. The set-up of the system could be modified or even interpretation of target could be modified. Execution – the processes – to finally reach the target has to be performed by people – correction unit. At present modelling the overall enterprise environment and leadership for control still is too complex and therefore model development has to focus on certain aspects of enterprise management.

3. Observations, Conclusions, Target of the Thesis

Structuring is a key tool of management for optimisation of their overall value generation and performance improvement. Especially the structuring by external partnership – very often mergin of companies - is widely used in the high tech industry for gaining competiveness. Structuring correct applied can be a powerful tool for leveraging people's motives for responsibility towards gaining flexibility and increasing speed for results – generation of customer value. Despite the fact that there is a wide set of structuring of enterprises theory and praxis concepts and models available – the success of mergers is left to managers' experience in valuation and their competences in preparation and leading the unification process.

Still a majority of partnerships fail, as the existing concepts have deficits in coverage of the complete flow of the merger process, show room for improvement in dealing with uncertain information and therefore do not allow a rational valuation of need and options for partnership, especially mergers, and their execution.

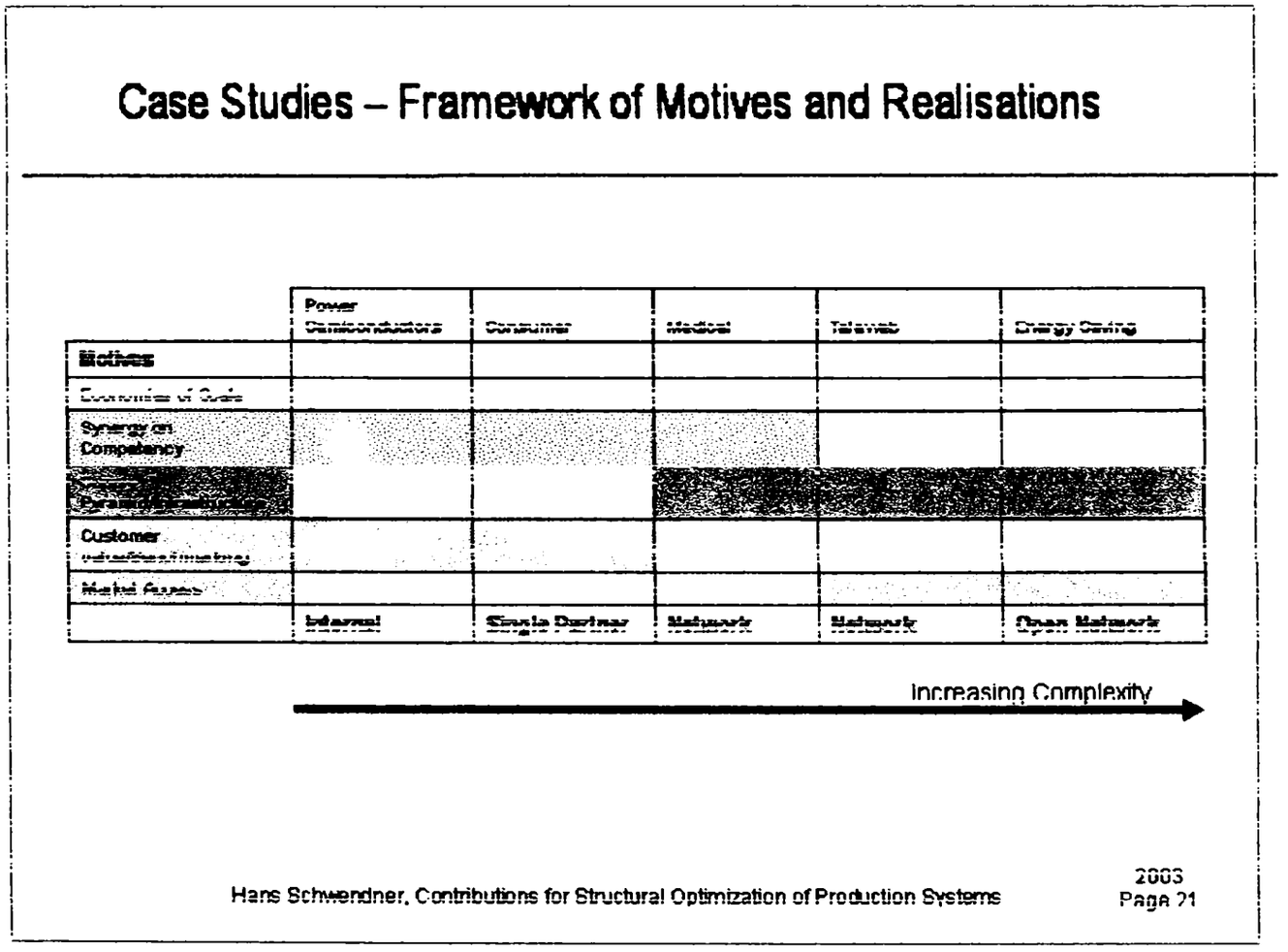
The target of the thesis is to develop a flow and tools for 'structural optimisation of production systems through partnerships' to improve on this situation - to increase management effectiveness in decision and execution of partnerships, especially mergers.

The outcome is based on an advanced concept that focuses the acitivities of an enterprise completely to the outside – the customer and the increase of competitiveness. Thereof derived a process flow that allows a structured approach to all relevant decisions required in analysis of partner requirement to unifying and networking enterprises. The flow has clearly described outputs for further optimisation. For getting a result at each milestone a qualitative toolset is developed for generating objective decision criterion, steering questions to find so far 'unsought solutions', and to result in executable and quanitfyable outputs. Flow and tools is set up that experience gained can be incorporated in the model as knowledge for further improvement in preparation and decision.

The model developed for generation of most outputs is the represenatition of a business situation by frames and the respective processing of information by homogeneous transformation. Concept, flow and model are developed on theory, experience of consultants and business cases recursively by building hypothesises on assumed behaviour. Hypothesises will lead to adaptation of the model while the application of the model in a case study will lead to verification in comparison of predicted result of model with reality/experiment. These steps are done according to /POPA/ with reference to /TURBAN/ to implement flow and tools into the management decision process.

4. Parameter Extraction from Business Cases

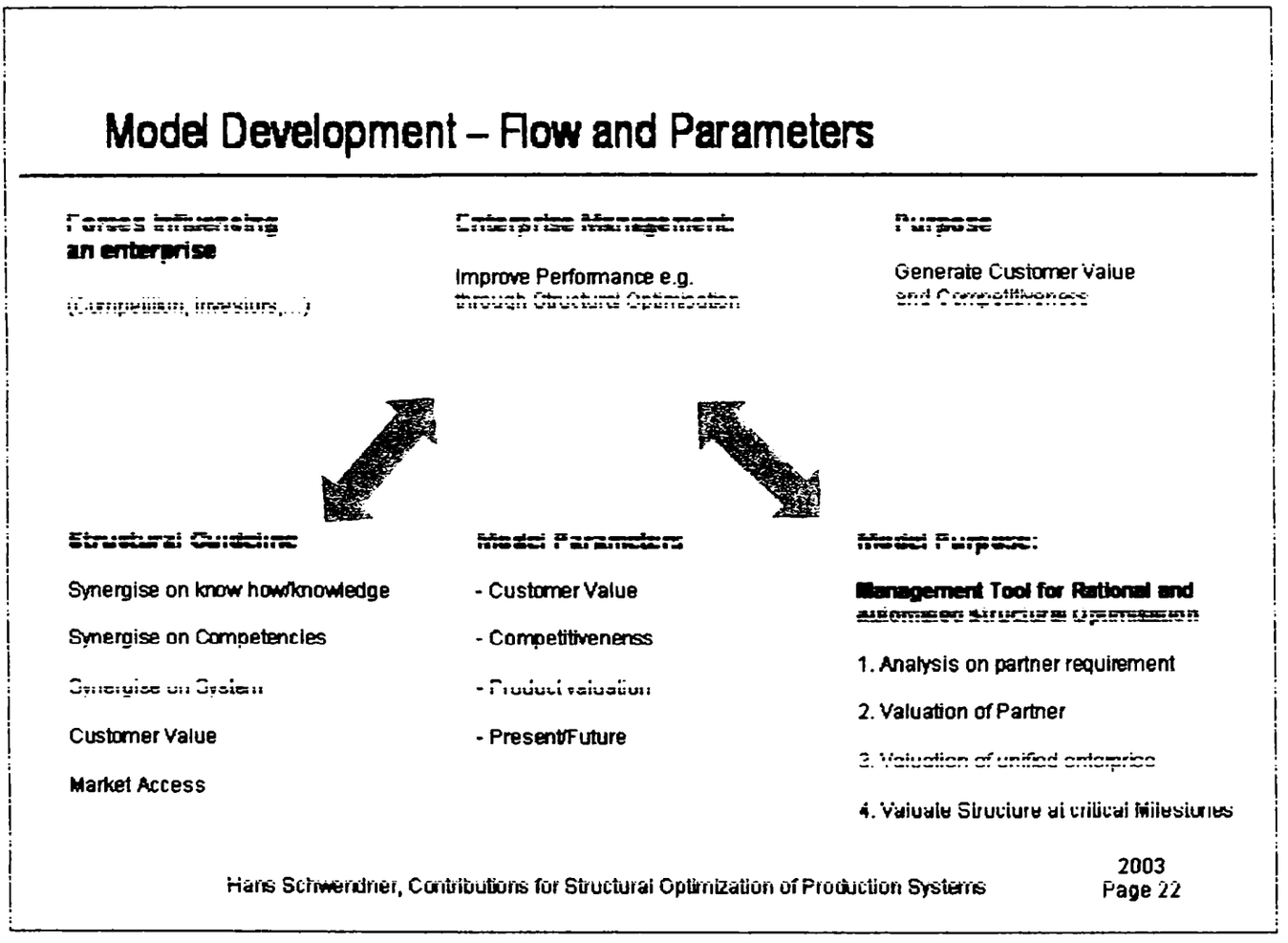
This chapter analyses samples in the high tech industry for data available at point of decision and conclusions drawn for structural change. Those data are extracted and abstracted for serving later on as parameters of the model and being attributes for description of enterprises. The case studies are selected in a way to validate the model for the wide framework of 'structural guidelines', like 'economies of scale', 'synergise on competencies' and 'synergise on system'. The resulting kinds of cooperation also vary from customer-supplier relationship, merger to open network. Following figure 4.1 envisions the framework set up over motives and realisations covered by the case studies.



/Figure 4.1.: Case Studies – Framework of Motives and Realisations/

A process flow for structuring enterprises with dedicated milestones at the defined points of use is taken as a basis for evaluation: 1. analysis for partner requirement, 2. valuation of partner, 3. valuation of unified enterprise, and 4. valuation structure at critical milestones. For step 4. also certain critical milestones are taken for potential to identify certain commonly definable outputs (see 2.e.). Figure 4.2.

illustrates the concept of proceeding for identifying parameters along the flow and appreciating relevant influential factors. Derived of the purpose of an enterprise to generate customer value, management has the task to improve enterprises' performance in serving its purpose. Influencing external factors, like competition thereby contribute further information for stipulating certain decisions for direction.



/Figure 4.2.: Model Development – Flow and Parameters/

The data for enterprise description thereby are descriptive for customer relationship, competitiveness, product valuation, and may contain certain assumptions on the future development.

a. Company Internal Merger – Power Semiconductors

Background and Business Situation:

In 1994 an international large scale semiconductor manufacturer was internally set up in different business divisions. The divisions were set up according to technology focus and were vertically integrated along the value chain with development (technology, product), manufacturing, sales,

and service. Every division consisted out of several business units. The business units themselves were the P&L responsible entities. They were set up according to target markets and did use the common sources of the division in manufacturing and sales. The units themselves had all resources directly for development and marketing.

Division A was covering 'Discrete Semiconductors' and division B was covering 'Integrated Circuits'. The business units of division A were set up according to target markets in a technology driven way. The products themselves were standard mass products (power switches with different ranges of voltage/current to be switched) and sold independent of application. Focuses simply were technical functions and features. The business units of division B were set up according to application market segments (automotive, consumer, telecommunication...) and sold their products into these segments only.

Through technological advancements division A was able to develop products that could integrate simple logical functions onto their discrete switches. In the same way integrated logic technologies of division B got the capability to integrate with their logic function some low power switching components.
Thus two competing 'smart power technologies' were developed that within a certain range could serve for the same products and applications. A competitive situation in front of the customer arose.

In addition both units invested money into R&D with increasing competitiveness against each others. Profit was negative or below average of total divisions.

The market for 'smart power' was predicted as fast growing (above 30% per year) and one major competitor was dominating the field with about five times the revenue of the 'smart power'-revenues of each of the two business units.

Management wanted to find a solution for taking positive advantage of the growing market of smart power in an optimised structural set-up versus the 'internal competition' – or get out of the business, in case no solution was found.

Information Available:

Business units:

- value chain (set-up, competencies)
- cost structure (history and projection)
- products (status and road-map)
- manufacturing (cost and cost projection)
- prices and price projection

- investment requirements

all values were available 5 years backwards and with a forecast over 5 years. The estimated accuracy for prediction on cost was +/- 10% in a two years horizon.

- cost of entry into new market segments
- cost of entry into new customers

The cost of entry was about equal between segment and customer. This is for entering a new segment (e.g. data processing) an adaptation of one of the existing products has to be made. The effort for accessing a new customer was about equal, as a dedicated sales effort had to be taken. Each activity was about one third of the annual budget of the respective element of the value chain.

- management capabilities available

some investigation was done on potential organisation options with respective management team. As any merger was leading to a reduced team over the existing double organisation, there was on one hand safety of having experienced personnel available for a new organisation and on the other hand it was politically not supportive to prepare a fully staffed organisation proposal at this point in time.

Market:

- Market size and projection
The market was not solely looked upon for the segment of 'smart power' bus also the nearby segments of simple power and integrated logic. This was due to the analysis required on trends possible for market growth and substitution of existing solutions. Thereby 'smart power' got a niche with a share of about 15% of a total power market of over $US 5 billion. The overall market was projected to grow with closely to 10% while 'smart power' was projected to dominate growth with about 30% per year.

- Market structure (homogeneous, segmented, fragmented...)
It was analysed that the market was mainly a volume business, whereby the customers were widely distributed regionally and volume wise. There was no border to be identified between customers apart from their application requirement and thus value of substitution (dependent on supply voltage and switched power). In Japan some customers were supplied from their in-house semiconductor divisions – but with simple power devices only.
In contrast the own business units had different approaches from distribution to key account management and from handling it as a standard business to a specialised business with customer specific solutions.

- Customer value of solution vs. alternate solutions
The customer had a cost advantage in terms of space reduction, number of component reduction and thus sometimes an enabling factor for new products that required a smaller form factor (e.g. portable electronics).

The calculations showed that the potential cost advantage over existing solutions was in the range of 15-30% if completely given to the customer. This was in a reasonable relation to the barrier of change at a customer for substituting the existing solution against the 'smart power' device. This barrier of change was in the range of 10-20% of price.

- Value chain of customers
Semiconductors made up for an increasing part of the value chain in the longer run and were in the range of 5-20% of total application cost. Nethertheless the development cost combined with the semiconductors was relatively higher than its percentage contribution in the value chain (up to double of development budget).

- Organisation structure at customers for product decision
Customer generally split development into software and hardware development. Thus simple power was decided by hardware development people and sophisticated smart power with software processing capabilities integrated was decided by software groups.

- Cycle of innovation for new technical solutions (products) with extended customer value
Time for a competitor to come up with a new competitive solution was estimated to be at minimum 12 months, more likely 2 years; own modifications could have been done also in the range of 12 months.

- Production ramp-up cycles
Production ramp could be done within 6-12 months

- Market shares of alternate suppliers
There was one dominating player within smart power and some segments of simple power. This was a very focussed niche player. When extending the market view to a wider area, its market share got reduced to little above 10%; within the same market share especially the 'in-house suppliers' from Japan got visible, but they had limited sales activities in Europe and North America.
The own market share within the extended market view was among the top ten.

- Technological evolution trends on product solution and customer value
Trend towards technological integration of 'smart power' with special developments also in packages for simplified use.

- Cost structure of major competitor

The major competitor did spend about 30% more for SG&A and about 50% less for R&D. Manufacturing cost was about equal. Its business was profitable in the low one digit percentage values of revenue.

- Defendable advantages/disadvantages over major competitors
Disadvantages were the relatively low market share in smart power; in contrast overall advantages were the broad range of technical competencies available for integration and the potential sales channels provided though the overall divisions.

Business Plan:

A vision was generated with a value consideration from customer perspective. A business plan was developed by the responsible 'executors' of a potentially merged business unit. This plan projected a top three market position in the course of five years – profitable above average.

Options for Action:

a) exit due to long term investment requirements (loss) with high risk of counterattack of dominating competitor

b) leave as is

c) new set up of sales channels (co-sales of one division's products through other division)

d) new set up of business units (merger) to focus investment

e) cooperation with external partner to gain size against dominating competitor

f) mix of some of the above

Decision and Actions Taken:

The option decided was most in line with option d), a merger.

The decision was to integrate all 'smart power' activities from division B into division A. The merged activity should be set up as a new business unit in order to focus management onto this activity and to allow a new approach in cross divisional sales channel access.
Market approach should be according to the rules of volume business with some specific developments for high volume customers in the smart area only. Priority was given to exploit existing investments into new markets – through existing sales channels. In terms of competencies over the value chain the responsible management in charge should pick the best available solutions. In addition to 'smart power' products also some simple power

products were added according to the market segmentation.

Option a) was neglected, as the counterattack of the dominating competitor was rated a very low risk. This was due to the larger view on the market with setting this manufacturer into a different reference frame, more suitable to the competencies of the divisions. The risk of high investments could be reduced due to merging and focussing (reducing) investments to low risk market penetration activities.

Option b) due to internal competition in front of the customer and risk of double investments was not reasonable and thus neglected.

Option c) was not pursued, as the risk of double investments was not solved.

Option e) was not pursued, as internal merger should be fixed first. This was kept as an option for the longer run – but not realised.

Option f) the sales activities were reviewed per division and cross divisional sales access got realised.

Results and Valuation:

In fact the business plan was – with minor modifications – kept. The merged unit was growing faster than the market and competitor could not react due to lack of technology competencies available. The business was profitable.

For the positive result of the merger some key items should be highlighted. It was decision to long term sustain a customer value (cost advantage of integration versus discrete components) and setting up an enterprise with the best competencies available and reduction of cost by economies of scale. The plans were developed by the responsible and most knowledgeable people who later on executed their own aggressive ideas – in awareness of having 'won' a company internal fight – the decision for merger. Through the joint team preparation also the barrier of cooperation was reduced to the elements of small local distance to be bridged in a move between buildings.
A proper analysis of the market according to closely related technologies – barriers of entry and exit – did lead to a new segmentation with making the resulting business unit stronger versus competition than originally set up. The rules of the game were changed according to the strengths of Siemens. The priority was given to innovation of business concept rather than taking high investment risks in development.

Discussion on Parameters for Model:

Analysis of Partner Requirement:

Initially each of the business divisions intended to maintain their separate path and independence. There was no intention for analysis of partner requirement. Management has ordered the investigation on analysis for business options for the smart power market mainly on forward looking data. The data referred to were:

- market growth above average growth of semiconductor market therefore it was to be questioned how to participate or dominate this market
- market shares of competitors mentioned were above manufacturers market share
- the product value chain for contributions required
- main customers were identical with customers of manufacturer
- the technological gap against competitors and advantages of individual technologies
- the financial resources of the business units and their derived capability to maintain existing business concept

Valuation of Partner:

In reference of the new definition of the market, all internal potential contributions – in terms of technologies and products - to the value chain were investigated. The potential internal partners were analysed on their similarity in customer value and their respective competencies along the value chain to realise these values. The effort of unifying was evaluated in terms of elimination of overlap and thus rearrangement of personell.
The individual elements were composed and appreciated (risk and opportunity) in terms of 'same – no new value', 'different, but no advantage' and 'different and added value'. Thus a puzzle of competencies was composed to cover the customer value requirements best.

Valuation of Unified Enterprise:

For the unified business a business plan was established with the key parameters for valuation on 'increased customer value' reflected in increased revenue and profit and success versus competition' reflected in increasing market share. Those values were taken and judged with the values of the previous business plans of the individual business units. With the added knowledge of the market analysis the risk of unification and counterattack of competition was put in comparison between unified business and individual businesses.

Valuation at Critical Milestones:

There was no dedicated observation done for critical milestones.

b. Acquisition and Merger – Consumer

Background and Business Situation:

Seller Company:

Seller Company, was spun off an electronics corporation as an independent AG in first half 1999. Revenue was several $US billion, profitable, with about 20000 employees. One year later seller company got a publicly listed company on stock markets in. With going public seller company did focus their activities onto the core segments communication, automotive, chip cards and memories. Those core segments got strengthened through acquisitions. Disinvestments on non-core segments did accelerate the focussing and brought in additional money for financing the desired acquisitions.

Based on this, seller company sold business activities in the area of opto electronics and consumer.

Consumer Business Unit:

Business Unit developed and sold ICs for consumer applications, mainly TV and VCR. The products were targeted to the partial functionality of picture capturing/processing and information capturing/processing (100Hz, video text, and digital TV). Customers were global and local players in TV and VCR. Products were sold through seller company's own sales channels.
It was assumed that for achieving higher growth rates investments into related application segments were necessary and thus profit would decrease.
For focussing of seller company it was decided to sell (or close down) the business unit with its development and marketing resources.
Through a controlled auction Business Unit was sold with the support of an investment bank whereby seller Company evaluated best option for sales with a long term perspective for Business Unit or closing the activity.

Buyer:

Buyer developed, produced and sold ICs for consumer, multimedia and automotive applications. Buyer's revenue was about two times the revenue of Business Unit, but about half of the profit.
Buyer was a niche player with about same customers as Business Unit.
Products were with partial overlap in the area of video capturing, but complementary in the area of audio capturing/processing.
Buyer did focus its development activities in optimising the size of ICs by a very common design style and thus compensate for small chip sizes realised through most modern production technologies. Thus Buyer could save investments in expensive manufacturing technologies and sites.

Information Available:

The following reflects the information made available for potential buyers, in order to decide for Seller Company on the most suitable option. There was a difference in focus of information gathering between strategic investors and financial investors.
For strategic investors the focus was on synergies for customer value and management fit. For financial investors focus was on synergetic elements of the value chain to compensate for loosing centralised functions from mother Seller (global sales, manufacturing, some centralised development functions, service and support functions), and the openness for funding investments into related application areas.
The own activities were to be presented in all and every detail with a +/- five year horizon – including market projections.

Potential Buyers:

- value chain (set-up, competencies, company portfolio)
for financial investors the company portfolio was relevant in order to valuate on potential synergies for lost elements of the value chain (sales, manufacturing...)
- cost structure (history and projection)
- products (status and road-map)
- manufacturing (cost and cost projection)
- prices and price projection
- investment requirements
- financial capabilities for and after acquisition
- cost of entry into new market segments
- cost of entry into new customers
- management capabilities/fit

The information did only partially get available on the status, but projections had to be made on competitive analysis from publicly available sources and benchmarking. The effect on cost structure due to available competencies and investment requirements was estimated for every potential buyer – especially the financial capabilities for and after the acquisition. It was expected to require deep pockets for potential market growth risks and unexpected integration cost. Cost of entry into new customers and markets was estimated per potential buyer in order to develop sales arguments (increase value of acquisition) for better penetration of buyers' customers. Cost of entry was also reviewed on existing relationships, as the appearance in front of customers would change – Seller was a large scale company, while the resulting Business Unit would be a niche player only. This could change points of entry and capability for realising new design-ins on aggressive design – but higher risk for product – dramatically. Through personal talks the 'management fit' was evaluated.

Market:

- Market size and projection
- Customer value of solution vs. alternate solutions
- Cycle of innovation for new technical solutions (products) with extended customer value
- Production ramp-up cycles
- Market shares of alternate suppliers
- Technological evolution trends on product solution and customer value
- Cost structure of major competitor
- Defendable advantages/disadvantages over major competitors

Per buyer the information about market was valuated on potential action of two major competitors (large scale consumer manufacturer with integrated component manufacturing and Buyer) who could severely threat further business plans. The customer value of Business Unit was mainly on providing lowest component cost and overall processing cost for the customers based on most aggressive technologies made available from Seller. Thus the spin-off from Seller made this value very hard to defend. Scenarios were developed to transfer production from Seller to silicon foundries (manufacturing to order) in Asia. Potential buyers did deeply evaluate on Seller's liability to supply services (especially technology/manufacturing) for existing products.

Business Plan and Vision:

A business plan and respective vision was generated by the Business Unit management team plus several 'key people' with a five year horizon. This was to proof and motivate for a financially independent and sound business even as a stand alone company.

Options for Action:

a) close down (cash out) Business Unit business unit

b) sell Business Unit to a financial investor/MBO

c) sell Business Unit to a strategic investor

Decision and Actions Taken:

It was decided to sell Business Unit to a strategic investor – Buyer. The price offered by Buyer was satisfactory – also in comparison to competitors, and management was convinced that the Business Unit personnel had a sound chance for advancement due to overall reasonable business perspective. The gainings for Buyer were rated very high (access to innovation, cost down due to synergies, extended customer value through synergies in products for cost down).

Option b) was neglected, as the risk for failure of a new stand alone niche player was rated very high. Especially as Buyer as a key competitor got deep insights into the weaknesses and strengths of Business Unit during the process of auctioning. This decision was taken very late and only in front of the final stage of partner selection: getting into an exclusive contract negotiation. A lot of time and effort was spent on analysis of potential financial investors.

Option a) was neglected as the first indicative offers from bidders showed a sales price to be realised above decided minimum value of Seller (evaluated on margin and lost opportunity).

Results and Valuation:

Despite a lower than expected market growth the merged business of Buyer and Business Unit was profitable ever since. Also market value of Buyer did not fluctuate as much as comparable high tech companies in the same time frame. In the first year after merger new products, new customer relationships, and a strategic manufacturing partnership were announced.

Discussion on Parameters for Model:

Analysis of Partner Requirement:

For acquisition consumer system manufacturesr, semiconductor manufacturers and financial investors were approached. Therefore situation was described and analysed for the contributions of the product to the system value chain, the individual product value chain and competencies required and the financial parameters for capability of investment into new markets. Based on the current business (revenue growth) projections in reference to other semiconductor markets there was a gap of growth. The business was judged to grow slower due to a dominating position within slow growth narrow market. According to this gap new and different market compositions were investigated to find combinations that allowed a faster growth. There was no combination that had - in reflection of required competencies – synergies to core segments of Seller, but all required significant investments, in case done on one's own. Also for a longer period the growth of profit was above growth of revenue. Players active in the same market were rated profitable but active in other segments also. Therefore it was concluded that through added competencies, that were not available within Seller, business could be turned to higher profitable growth.
Competencies best were to be added through a partner.

Valuation of Partner:

The valuation of potential partners was done on the judgement of

maintaining and improving customer access and value through the added competencies to the value chain – for an extended market. This was done in comparing the individual company situations with requirements for change in required competencies. The fit of targeting the same market was relevant in order to identify potential synergies for complementing each others. This was evaluated from the vision assuming trends in future market development – comparing the two views of the companies with each others. The potential risks for partnering were evaluated in terms of changes in location of personell, adaptation of product portfolio (consequence in customer value) required, and required skills for development processes.

Valuation of Unified Enterprise:

The unified enterprise was evaluated in a business plan. The key parameters were increasing market share, increased customer value reflected in stable pricing (reduced barriers of entry into customers and increased barriers against competition through combination of competencies into a new inline product set-up – investments a competitor would have to do and timely advantage). Those parameters were judged with the risk of competitors' reaction (requirement of investment and time), the risk of failure of merger (management capabilities) and the risk of unidentified product overlap and thus reduction of current revenues. Same descriptive parameters were chosen as for analysis for partner requirement.

Valuation at Critical Milestones:

100d:

Availability of a common product roadmap with an increased customer value. The organisation is – at least on paper – merged into one from an external point of view no distinct enterprises are visible – staff talking one language about proceeding into the future.

0,5 development cycles:

Execution along the new roadmap successful, i.e. new products are realised that had required minor modifications only. Customers decided to apply these new products.

1,5 development cycles:

Execution along the roadmap and new customers gained. Profitable business that allowed diversification into new market segments. Buyer was profitable ever since the acquisition and in 2003 has bought additionally another company for diversification in competence. June/July 2003 (two and half year after merger start) announcements of products were made

along a joint roadmap combining the competencies of the individual merger partners. In addition the existing competencies were extended for synergetic application segments, like digital image display on TV. Despite a harsh consumer market environment Buyer is growing in revenue. Overall this merger can be rated successful.

c. Network – Medical SME – Large Scale Enterprise

Background and Business Situation:

This case is confidential as the process of networking is ongoing while the thesis is developed. A company is developing, manufacturing and selling products for light techniques – meaning transformation of the state of materials (soft to hard) through light. Applications are in the area of cosmetics, dental, construction and medicine. The founder and owner of the company did invent/develop most of those devices on his own during the last decades. The company is a small size enterprise with total around 15 people and revenue of a SME. Sale of products mainly is done through word of mouth, rather than an explicit structure exploiting the global market capabilities.
It got obvious to the owner that there is a larger market potential for the products to be addressed. Nether the less it is his personal goal to focus his activities on inventions and development instead of managing sales. Therefore he is looking for options to sell some of his market proven product lines and in case this is not possible at a reasonable price, to have a partner managing the establishment and maintenance of professional sales channels.

Information Available:

Enterprise:

- value chain (set-up, competencies)
- cost structure (history and projection)
- products (status and road-map)
- manufacturing (cost and cost projection)

all of the above data are available on a 10 year enterprise history. As the production volume is below volume or mass production, all data are to be interpreted as structural with high decrease over volume. The weakness could be identified in marketing/sales and service through the unavailability of market and customer data and relevant sales processes. Sales was done more on a by chance basis rather than a target oriented process.

- prices and price projection
- investment requirements
- cost of entry into new market segments

- cost of entry into new customers

all of the above data were more defined by chance – due to the low sales volume; the analysis for identification of price potential, cost of entry etc. was developed in order to gain information necessary for identifying investment requirements of potential local sales channels versus internationally operating sales channels.

- management capabilities available

the capabilities reflect the competencies available; innovation and development; fast productive realisation for ramp-up volumes

Market:

- Market size and projection
- Market structure (homogeneous, segmented, fragmented...)

the medical market is a very fragmented one, with each hospital and individual doctor being a potential customer; there is a specialisation among doctors, but the general doctors make up for most of the number and have within themselves also their preferences of activity. Over all the potential revenue per customer is relatively low (one or two units), contact is required mainly once (long life cycle per unit) and customers are locally widely distributed

- Customer value of solution vs. alternate solutions

For approaching potential partners value has been analysed

- Value chain of customers

analysed and judged as not relevant

- Organisation structure at customers for product decision

analysed and judged as not relevant

- Cycle of innovation for new technical solutions (products) with extended customer value
- Production ramp-up cycles

(2 years; 6-9 months) required for discussion with potential partner

- Market shares of alternate suppliers

not available

- Technological evolution trends on product solution and customer value

marginally available

- Cost structure of major competitor

not available

- Defendable advantages/disadvantages over major competitors

the methodology itself is only realised by one other company. The company has added some more technical know-how for applicability in surgery and thus leapfrogged competitive solutions by several years in defendable advantage.

Business Plan and Vision:

available from a perspective of potential partner; individually adapted for partner discussion.

Options for Action:

a) exit and focus on other products

b) leave as is

c) *network of sales channels*

d) sale of product to other company

e) mix of some of the above

Decision and Actions Taken:

The decision was to pursue option e). Per the analysis of the method of treatment and existing customers the products were identified for transmitting value in the global market. A highly sophisticated sales channel is required to provide access globally in combination with the capability to support legal requirements for technical instruction and service. The kind of players offering these values is very limited to less *than 10 companies world wide. For the higher value part of the product* spectrum these global players are approached for partnership on either sales or acquisition of the product line and associated know-how.
For the low cost products a network of sales and service channels is approached.
Future management of those sales channels is to be done through another partner, a sales agency.

Option a) is not pursued, as the products can easily be produced and have a comfortable margin overall.

Option b) is always a fall back

Results and Valuation:

Several discussions with global and network partners have been started and did reach contract negotiation level. Especially the approach of *identification of customer value and the linkage to increased value for the* potential partner from customers' perspective made open up doors for discussion. Defendable advantages – inherent to the methodology – interpreted as 'innovation' maintain interest of potential partners at high level. Nethertheless all of the partnerships may be bilateral contracts with the company, but the relevant marketing and some development processes have to be mapped across the individual partners and this has to be managed – as a separate service provided by a consulting company.

Discussion on Parameters for Model:

Analysis of Partner Requirement:

Simply correlating market potential with elements of value chain available to serve market potential. Additionally own resources (financial) and competencies (elements of the value chain: sales, service, partially development) were judged to be insufficient to set up missing elements. The extension of business activities was rated reasonable, as a high customer value is generated and no competitor is active with the same methodology and thus same capability to generate customer value.

Valuation of Partner:

Analysis on availability of value chain for exploiting market potential. Additionally it was necessary to develop a value for the partner in its business by partnering with the company. Once this was brought to a fit, i.e. partner could generate new and own business through the partnership, *then evaluated company was a potential partner.*
There are different options now from a simple partnership or acquisition through one global company to a network of service companies and regional sales companies. For each of the potential partnerships risk was evaluated in terms of dependency on partner and potential to be blocked from better access to the market.

Valuation of Networked Enterprise:

For each of the discussions there was an analysis of a potential market share through the networked partnership and the respective added revenue possible. This is sometimes combined with a vision derived from

the application of gained financial resources.

Valuation at Critical Milestones:

There is no valuation yet, as the network is not yet set-up.

d. Network – New Internet-on-TV Standard

Background and Business Situation:

Teleweb did start as an idea in the year 1996. The TV-based consumer-information-service 'teletext' was reaching technical limitations in performance. New PC based information services (internet technology) threatened the existing players within this market to be substituted by new players from the PC/Internet world. This threat was especially articulated by Siemens Semiconductors Consumer Business – the market leader in teletext ICs. Through erosion of this segment, Siemens would loose its leading role and had no alternate product to sell into upcoming internet-PC.

The idea 'teleweb' was defined by the enhancement of 'teletext' through using its consumer advantages in combination with internet technology. That meant teleweb still was used on TV in the living room, ease in use, free in use, immediate information availability, cheap in equipment and satisfying about 70-80% (= key) of information requirement. This was in contrast to the highly sophisticated office character of the www-applications and their TV-derivatives. The internet technology is for example hyperlink-navigation instead of pages and high resolution graphics with motion pictures instead of simple block graphics.

From its basic performance teleweb was intended to run on existing 16-bit microprocessors (Siemens' 16-bit micro controller). That means the idea was to use existing products with a very small modification only for fast realisation capability.

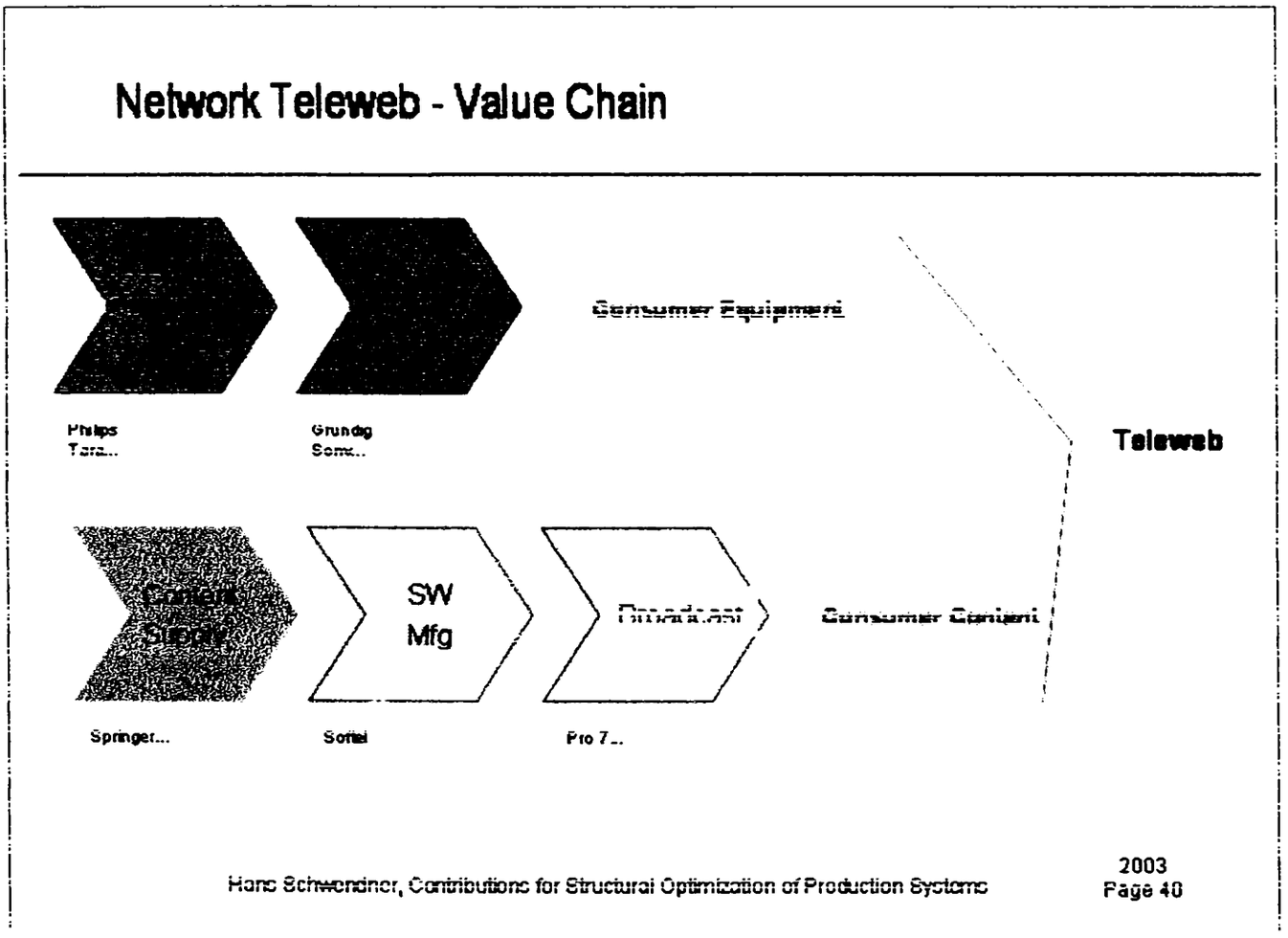
Information Available:

Business 'Teleweb':

- value chain (set-up, competencies)

The realisation of Teleweb as a consumer product nethertheless does require a lot more besides the IC, the TV has to be developed accordingly to serve as a working display device on the one hand. On the other hand the content has to get available for display. Content providers need to get involved for either provision of existing teletext content with the potential for adding graphics and hyperlinks and also to adapt existing www-content for display on a TV screen. The adaptation of www-content is necessary as

the viewing distance is different to a PC and also the use of a remote control is different to a keyboard. Second in this value chain software manufacturers for the respective broadcast equipment are necessary for adapting the equipment for processing capability of teleweb contents. Finally the key to success are the broadcasters to provide teleweb as a service to the viewers. Figure 4.d.1. shows the network partners 'assembled' to the teleweb value chain.



/Figure 4.d.1.: Network Teleweb – Value Chain/

- cost structure (history and projection)
- products (status and road-map)
- manufacturing (cost and cost projection)
- prices and price projection
- investment requirements

All of the above were analysed backwards from a value in € representing the money reflecting the customer value; Investments, manufacturing cost etc. were adapted to the € target and kept at a very low level in order to also survive against in-house competing projects (e.g. digital TV) within some members.

- cost of entry into new market segments
- cost of entry into new customers

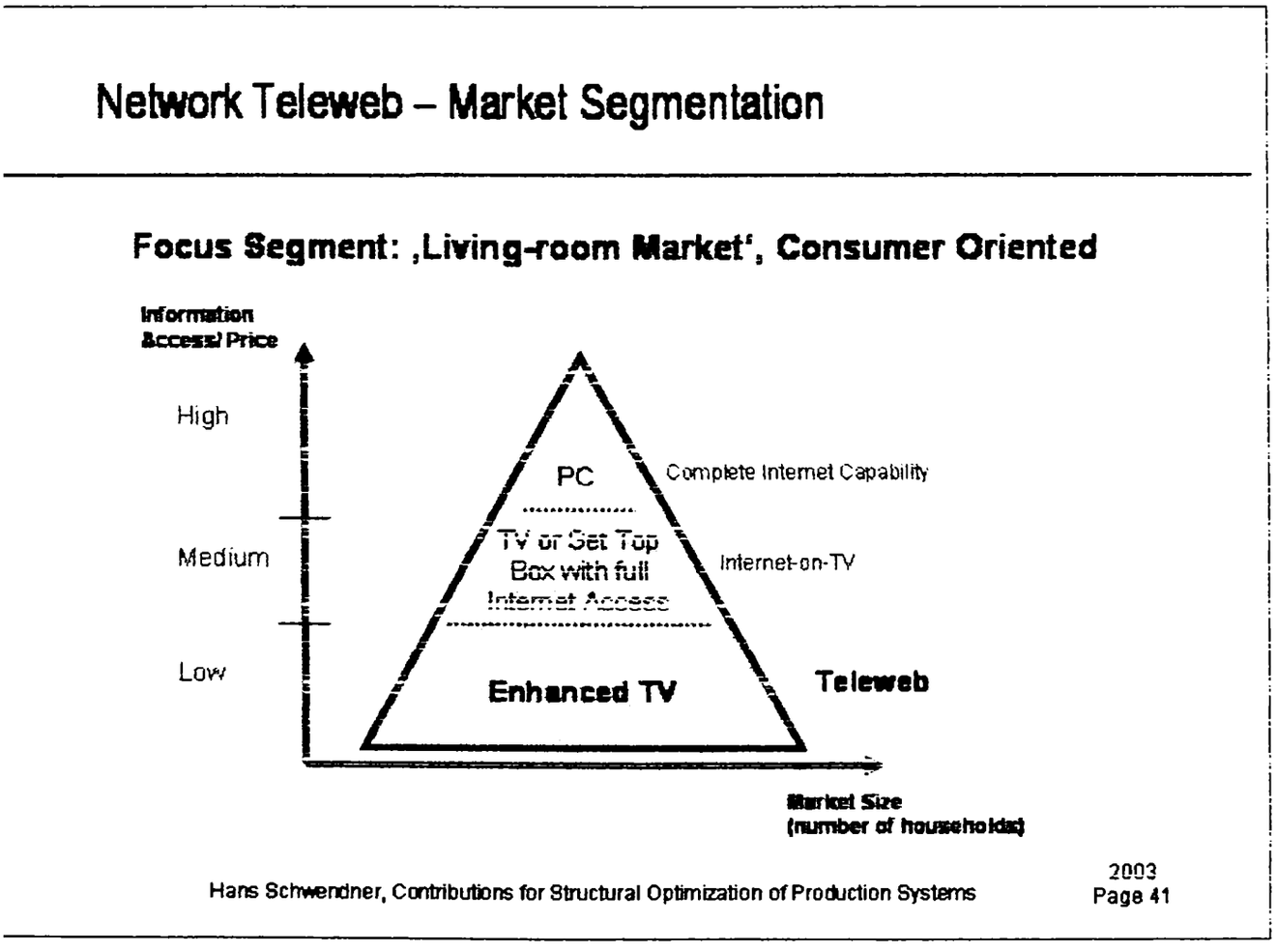
Above cost were not really analysed as the approach was to maintain existing market for the participants and to defend against invaders from the internet camp. Therefore through easing customers' move from existing product to networks' product would increase barrier of entry for competition.

- management capabilities available

The network was professionally managed

Market:

- *Market size and projection*
- Market structure (homogeneous, segmented, fragmented...)



/Figure 4.d.2.: Network Teleweb – Market Segmentation/

The market segmentation was done in a new way within the consumer oriented TV market, that later on was called living-room market in contrast to the office type PC home market.
Within this market segment Teleweb addressed the high volume market of enhanced TV only and there was already a common understanding about the framing segments and a potential path for future development - performance wise. Figure 4.d.2. shows the market segmentation.

- Customer value of solution vs. alternate solutions

The value was clearly defined

- Value chain of customers
- Organisation structure at customers for product decision

The products to be developed did not require a new set-up in the customer structure as they simply intended to maintain customer relationship with increased value.

- Cycle of innovation for new technical solutions (products) with extended customer value

about 2-3 years

- Production ramp-up cycles

about 9-12 months

- Market shares of alternate suppliers

90% of market share (Teletext-IC-manufacturers) was present in the consortium

- Technological evolution trends on product solution and customer value

analysed and required for solid definition of base product for easy enhancement along the technical value trends

- Cost structure of major competitor
- Defendable advantages/disadvantages over major competitors

Cost structure was available and important to define defendable competitive customer value

Business Plan and Vision:

There was a common vision that unified and thus motivated – in combination with the competitive threat - the participating companies.

There was no common business plan. Even some of the partners did not have a business plan on their own, but persons participating had the passion to support the vision.

Options for Action:

a) exit and focus on other products

b) leave as is

c) investment/partnership into PC technology

d) complex network for new service

e) mix of some of the above

Decision and Actions Taken:

A few months after IFA 1997 – steered through Siemens Semiconductors - a group of companies throughout the value chains formed a consortium for further elaboration of teleweb as a technical solution standardised throughout the PAL/SECAM TV world. The group formed a steering board for infrastructure matters, financial matters and final decision body for all aspects of teleweb. The steering board was headed by a chairman. Sub groups were formed for technical specification and for marketing activities, mainly to attract new customers. Most of the marketing group work was required to provide argumentation basis for the participating parties for their in-house discussions for supporting teleweb besides other ongoing activities for digital TV information services. Key element for the positive support was that the contents provided for teleweb was independent of the way of broadcasting (analogue or digital).

Results and Valuation:

At the IFA 2001 teleweb was test broadcasted and was elected one of the top ten innovations announced at the fair.
In 2001 the standard was officially released to and by ETSI and first TV sets were introduced into the market in Europe.
In 2003 partners from digital TV joined the consortium and content is broadcasted throughout several TV stations across Europe.

Overall the network activity was successful in developing the new standard and having the service available for the TV viewers. Nether the less it was not established as an enterprise with a revenue stream from customers, but an enterprise generating a business vision for all participating partners. The financial requirements were funded through the partners and allocated through network management. Within the market this service is more popular and successful in terms of penetration than similar competitive

services for PC-based TV or digital TV – the original competitors with by far higher financial and management support available. For the PC-based approach Intel did even form a network of about 50 companies.

Key for success can be reduced to several factors. The consequent focus on customer value, the evolution of the application towards new benefits with backwards compatibility for the customers, but revolution in business concept, and the clearly defined and equally spread advantages for each member of the value chain.

Discussion on Parameters for Model:

Analysis of Partner Requirement:

The analysis for the complete set of partners required was performed on the value chain necessary to develop and offer a new service to the final customer. It was important to look at the second stage – the consumer finally paying the bill for the TV sets and the consumption of service. Business concepts (rules of the business) and rough financial analysis of the partners capabilities for innovating and competing with players in digital consumer products were performed.

Valuation of Partner:

The elements to check on the partner were on judgement on capability to contribute to and to exploit the commonly generated new customer value – besides feeling competitive pressure from digital TV and PC players, the motivation to move faster. The intention was (risk elimination) not to tie in partners that simply try to gain know-how and then block decisions for pushing their own developments. Overall partners should cover a certain market share in order to represent a relevant share of customers.

Valuation of Unified Enterprise:

The unified activities were analysed according to a judgement on the strength to set up and develop a new standard. There was no business plan for the network set up, but the individual partners made up their business plans according to the success of the joint activity and thus the defence or extension of market share.

Valuation at Critical Milestones:

The critical milestones were can be verified in terms of impatience of individual network members management, and an emergency meeting set up for delivering results and defining procedure.
100 days: the teleweb consortium was formed formally as a consortium working in the frame of EACAM and having one product defined and communicated.

0,5 development cycles: about one year after foundation the whole value chain was assembled through different companies. Targeted market share was not represented, as major part of companies was German or German market oriented. Overall it took one more year to develop a demonstrator product for the IFA 1999.
The milestone 1,5 development cycles was considered most important. It happened to be the IFA 2001 (four years after foundation of teleweb consortium). Targeted market share representation still was not reached. At that point of time either the product was 'on air' or the network would have failed. The rating was done according to availability of service and products all across the value chain and its positive reception by the market. The reception of the market was also rated in contrast to competitive activities. Thereby teleweb had a clear lead, as it was rated as one of the top ten innovations at the IFA, and no competitive approach was mentioned.
Over all teleweb was slower than possible, but successful in maintaining a threatened market. Political deliberations in some points of time made up for delays, but in some cases also were necessary in order to survive as a network – otherwise request for funding would have ended in termination due to allocation of resources towards digital TV. The passion of the people made survival of the idea turn into a success.

e. Network – SMEs and Institutes – Energy Saving

Background and Business Situation:

Mid 2001 a Thai university professor, a German University professor, a Managing Director of a German planning enterprise and a Bavarian States representative created the idea to co-operate on reduction of energy consumption and for protection of natural resources in Thailand. Available and proven products were intended to help the Thai industry for further growth on lower cost by protecting the environment and enhancing the comfort of living. The initial focus was put on existing and to be constructed buildings.
For starting-up the Bavarian Government contributed a fund for marketing activities and student exchanges for the universities to develop know-how on transfer of energy saving products from Germany to Thailand. Through business results the participating universities intended to get financing for further research projects.

In contrast to teleweb this approach is driven by universities and their partner, a small sized company with very limited access within the German market so far. There is no wide infrastructure supporting foreign countries or releasing capacity easily for adaptive developments on foreign markets. Therefore the value chain for servicing the wide application range of reduction of energy consumption had to be analysed carefully for adding partners that provide elements to the value chain for the network finally

servicing the Asian customers with the appropriate value add.

A few months later a partner with products for energy saving and Fraunhofer Institute were joining the group. In order to evaluate the market potential of the idea a seminar on products and service ideas is held in Thailand. The market potential was estimated worth next steps in starting development activities in understanding product requirements for the market. A few weeks later the group named an external network manager for focussing the different activities and for lining up the different value elements and ideas to the one original goal.

The network activities are rated successful once every business partner can do profitable business within a timeframe of about two to three years of activity. This covers the expectation of the Bavarian Government of supporting local small enterprises in access to foreign markets. The universities want to intensify their relationship in research and generation of new fields of expertise.

Information Available:

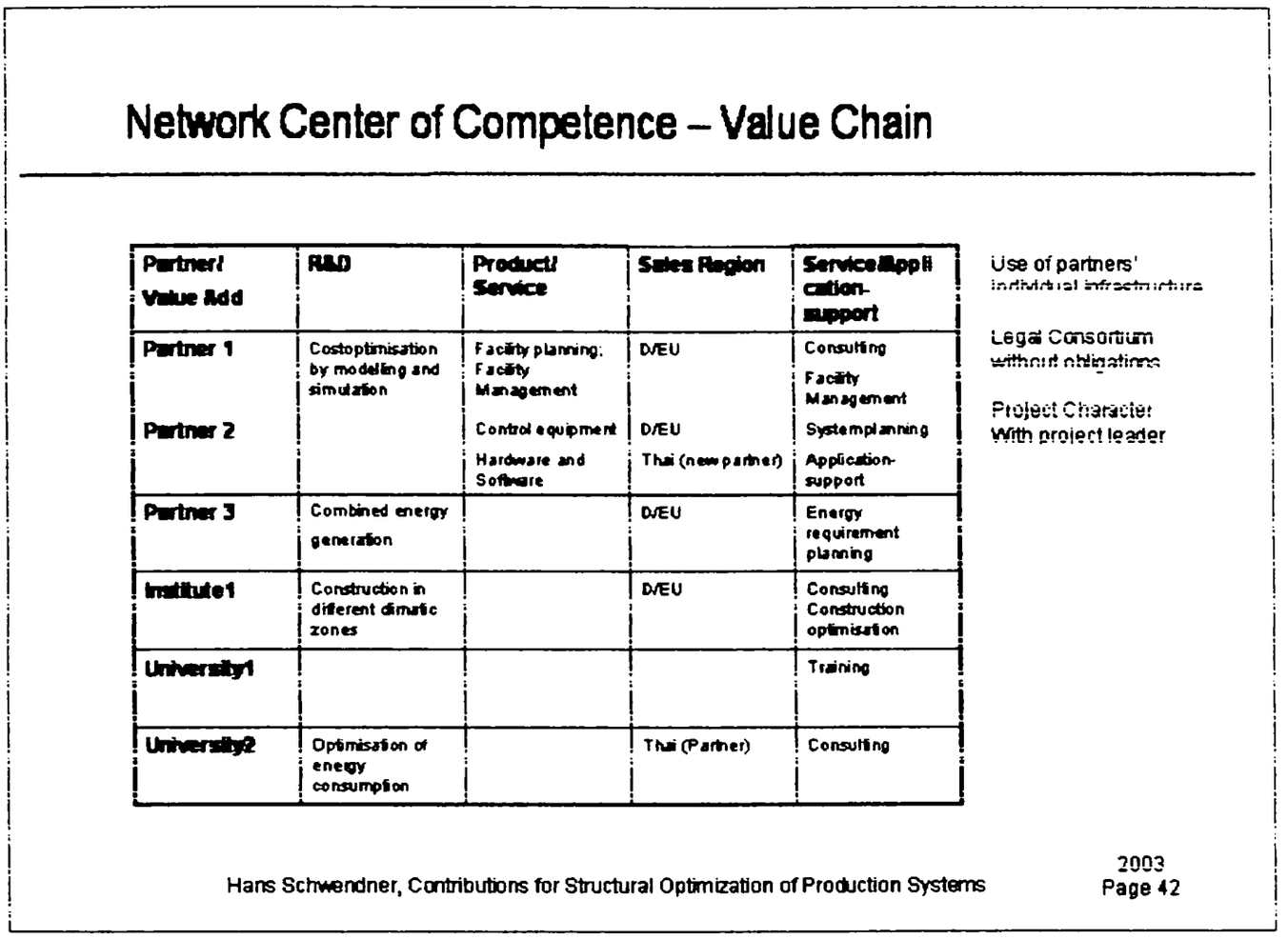
Business 'Energy Saving and Resource Protection':

- value chain (set-up, competencies)

the value chain was in reverse set up according to the partners already unified in the center of competence. Through this analysis weaknesses in the value chain were identified and tasks assigned to the individual members to support certain activities to commonly compensate for the weakness. E.g. the missing sales channel was compensated through representation of all partners when one partner was visiting Thailand. Competencies were arranged according to potential common business interest. Figure 4.e.1 shows the networked elements of the value chain.

- cost structure (history and projection)

Through funding available the cost structure was more a matter of sound use of available money for management of the network.



/Figure 4.e.1.: Network Center of Competence – Value Chain/

- products (status and road-map)

The product and customer value for a network product was defined. It did on one hand serve to attract customers in Thailand for the products of the network partners. On the other hand the network promoted its service of enabling the market entry into Thailand.

- manufacturing (cost and cost projection)
- prices and price projection
- investment requirements
- cost of entry into new market segments
- cost of entry into new customers

All of the above were not analysed deeply. The products offered had a similar price potential as in Germany, but sales cost in Thailand are mainly defined by travel expenses from Germany to Thailand.

- management capabilities available

For the German part of the network there was a project manager, but there was no equivalent person in Thailand. Therefore communication on adequate level for definition and execution of actions for market access was improper.

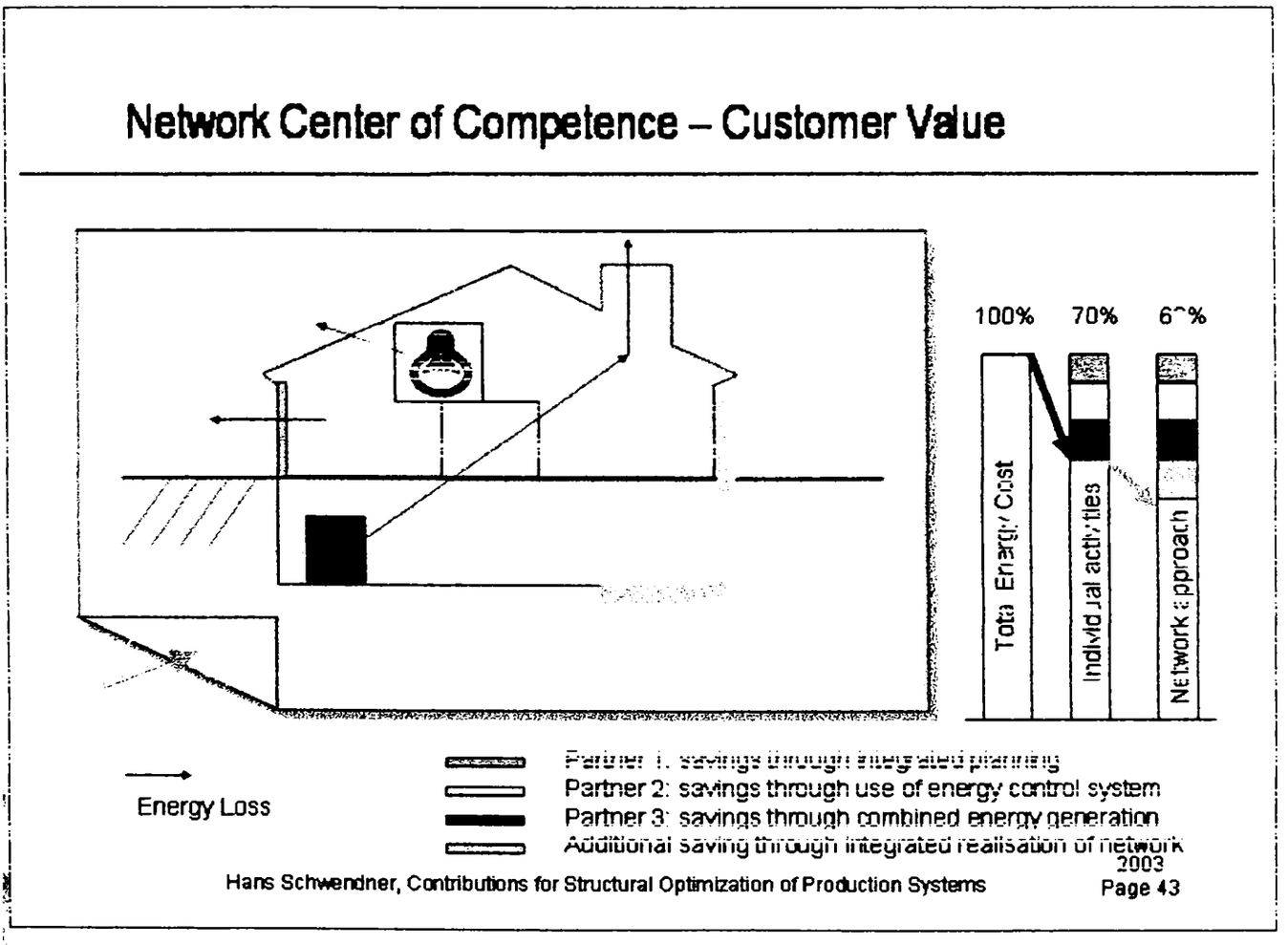
Market:

- Market size and projection
- Market structure (homogeneous, segmented, fragmented...)

The market was estimated 'lucrative' based on several discussions with potential customers, not more.

- Customer value of solution vs. alternate solutions

The value had to be defined in competition to other networks already existent and funded for a decade. The title 'resource protection' and 'natural resources' has been used by a lot of similar networks of institutions and industry.



/Figure 4.d.2.: Network Center of Competence – Customer Value/

The major differentiation finally was identified in the low barrier of entry for a partner in being able to sell the products and low investment with quick returns at the customer. Figure 4.d.2 shows the overall customer value represented though the network. Through integrated planning, energy control, combined power generation etc. in an interleaved one hand approach the gainings for a customer are well above individual values per device. Value is generated through reduced investment, reduced running cost and thus reduced life time cost.

- Value chain of customers
- Organisation structure at customers for product decision

Investigation was done in order to identify required network head in Thailand for selling products.

- Cycle of innovation for new technical solutions (products) with extended customer value
- Production ramp-up cycles
- Market shares of alternate suppliers
- Technological evolution trends on product solution and customer value
- Cost structure of major competitor
- Defendable advantages/disadvantages over major competitors

On the dedicated product and customer value there was no competitor active with similar offering. In combination with slow motion of Thai business there was no need to really care about cycle times, capacities, defence of advantages, etc.

Business Plan and Vision:

There was no business plan available, but a vision of a customer value on 'cost savings' through energy saving. The vision was combined with the exotic flavour of a country nice to visit – Thailand. Funding in a way was supportive to reduce risk when engaging in an adventure with potential longer term financial returns.

Options for Action:

a) exit and focus on other markets

b) network of companies and institutions

Decision and Actions Taken:

The decision was on option b) to establish a network. Small sized companies with a relationship to the existing partners were approached by the founders of the idea until an energy optimisation company and

Fraunhofer Institute joined the group. Finally a network manager from externally was established to manage activities towards a self sustaining enterprise.

Results and Valuation:

The network established is still alive. Self containment is not reached from business results in Thailand, as there is no financial model accepted from the members to contribute a commission of their business to the network for coverage of cost and generating a profit. Thus the network as an enterprise did redefine its service as a node for enterprises to provide access to the Thai market and to supportive development resources from institutes. For this service partners have to pay a fee and further financing is provided through funding from government agencies. Therefore the business mission was changed to address government agencies and new potential partners as customers for extension of the competencies in the value chain, instead customers of the network partners.

As it got obvious that the perception of customer value for products and services is different in Germany and Thailand, the common approach for a unified new product got obsolete. Instead the group focussed activities on one partner of the network to support complementing missing elements in the value chain to access customers in Thailand (sales, service, overhead functions). Thereby the one company was able to generate business and dragged the second company to establishing a trial for outsourcing part of its production to Thailand. An activity that is perceived key for the future survival of the planning company – use of low cost resources in Thailand. Through this selective approach of companies a network of partners in Asia got established for business for both partners.

Over long periods small enterprise partners neglected necessities to establish all elements of value chain and support functions of IT infrastructure for proper communication. This neglecting of requirements led to severe delays.

For overall success it was key to have the commonly accepted vision and very competitive competencies assembled to always new business concepts (initial concept of network enterprise generating business of combined products; then concept for providing marketing support for one partner, finally concept to serve as a hub and support government agencies' interests). Thus new partners could be approached and finally business generated. Vision, competencies, innovative business concept, passion and flexibility were key to long term success.

Discussion on Parameters for Model:

Analysis of Partner Requirement:

The business idea was new and no individual foundation company had neither all competencies along the value chain to satisfy the requirements for servicing a customer in Thailand nor the financial resources to cover for investments in accessing the market. Also a system value chain is required to enable the customers to plan, install and operate energy efficiency product. This drove the intention to set up a network as the most suitable organisation for combining the interest of institutes and enterprises.

Valuation of Partner:

The judgement was done on available products contributing to the intended customer value, competencies complementary to existing partners and willingness to support the network.

Valuation of Unified Enterprise:

As the market was rated 'very large in potential' in contrast to the network partners' current revenue, the valuation did not measure up in a business plan reflecting revenue, but in ease of access and capability to extend the network towards new members and towards customers through the new partner.

Valuation at Critical Milestones:

100 days

Valuation according to definition of one product roadmap and networks' organisational set up to represent this roadmap to the outside world.

0,5 development cycles

Valuation was done in third quarter 2002 according to the business generated for the partners. This was zero. Therefore action was taken to focus all activities to generate business by focussing support to one network partner.

1,5 development cycles:

Will be reached by end 2003; valuation will be capability of network to sustain growth in partners by serving as a platform for entering the Thai market.

f. Parameter Analysis from Case Studies

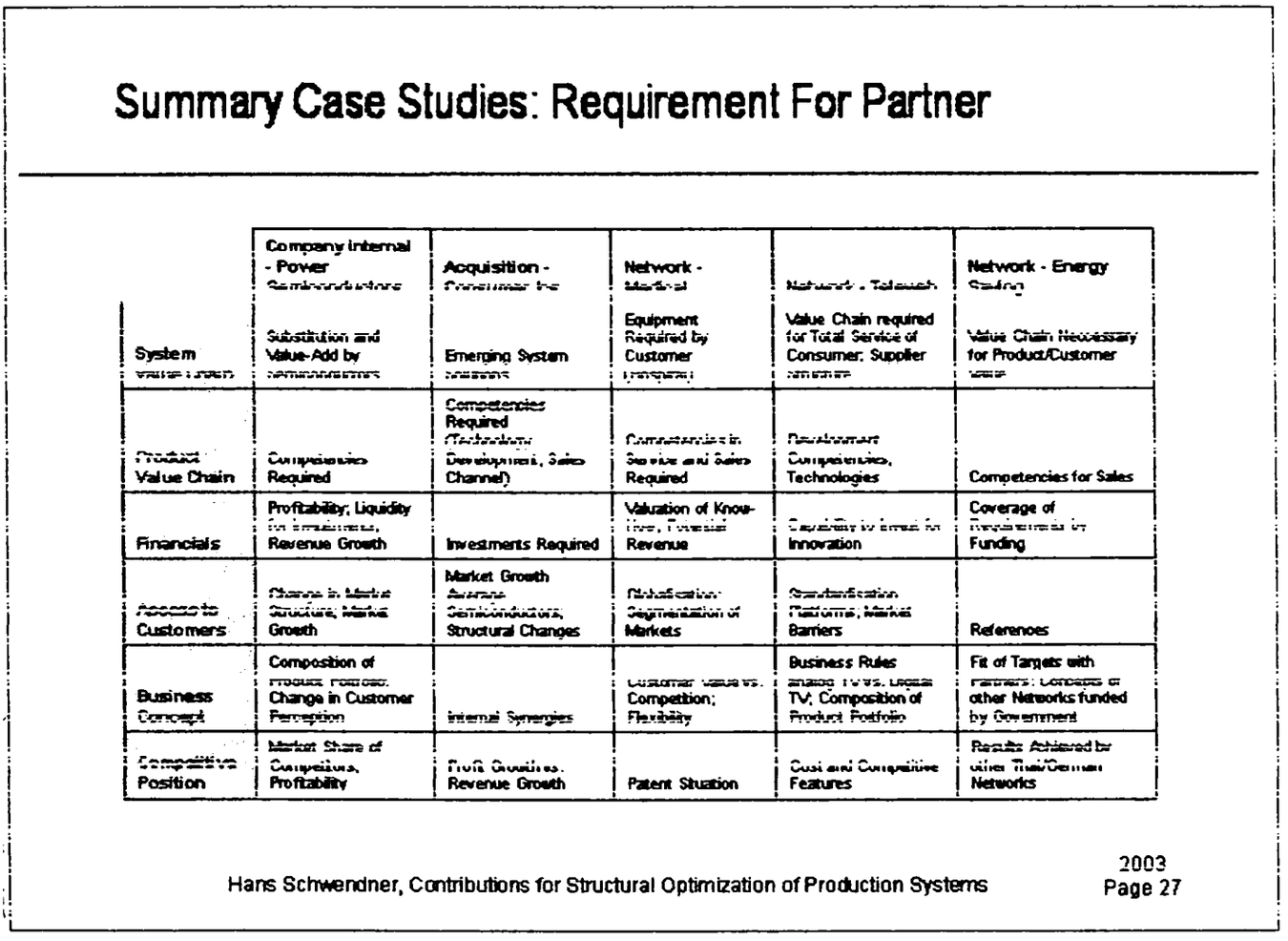
The set of case studies sets up a framework across the different motives for a partnership on the one hand and on the other hand across the complexity of partner search from internal over singular external merger

over supply pyramid to open network.

The following figures summarize the parameter valuations relevant for decision on the individual elements of purpose of the model. The parameters are compiled to a set of attributes that are capable to describe a business situation with its players (customer, competitor, enterprise, etc.).

Requirement for Partnership

Figure 4.f.1. summarizes the parameters for evaluation of need for a partner.



/Figure 4.f.1.: Summary Case Studies: Requirement for Partner/

Overall there are general criterion (attributes) across the different cases:

- customer requirements from a total system perspective (value chain of total solution and required investments)
- customer value generation from a product value chain perspective (competencies required, available and investments required)

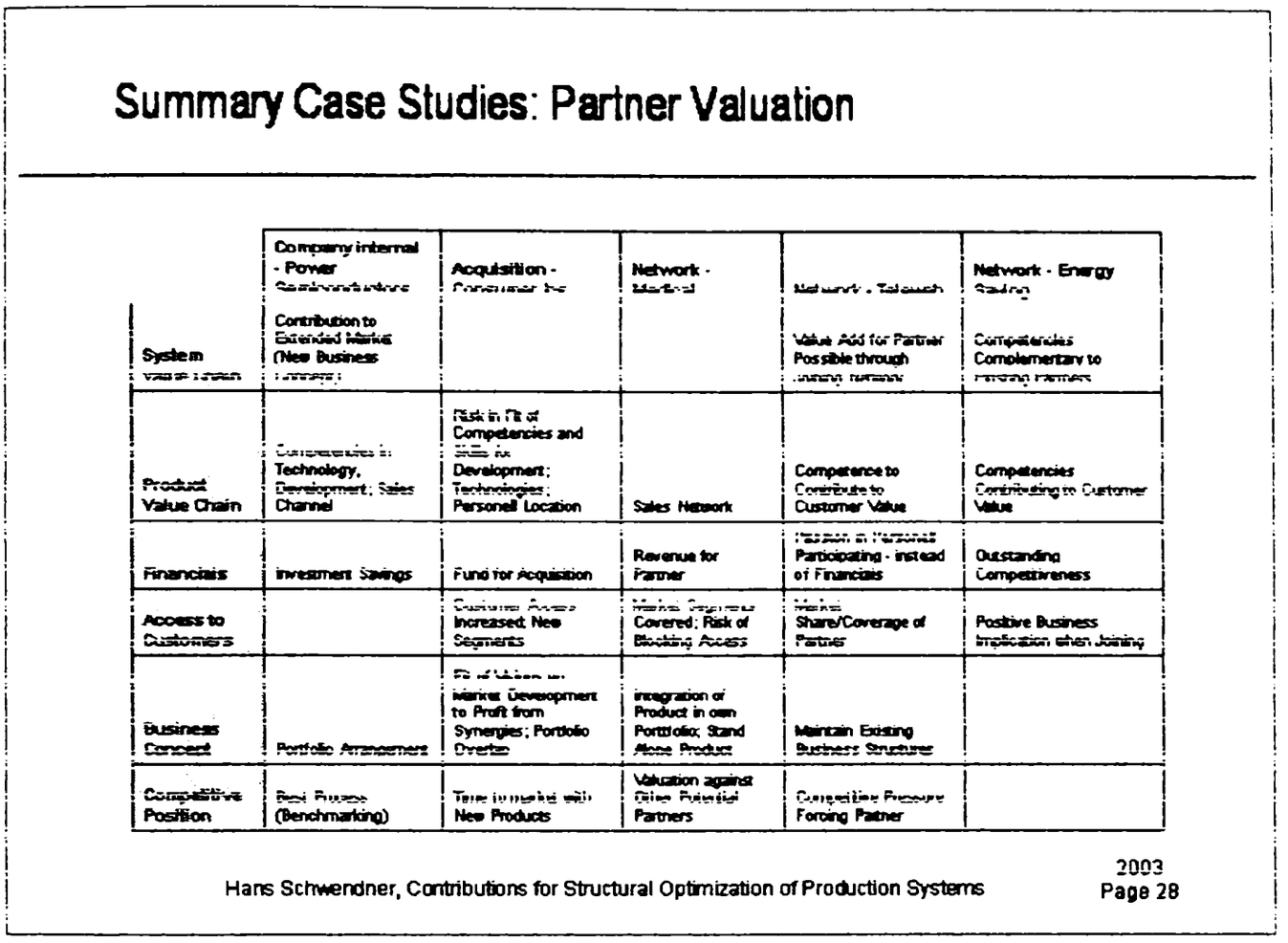
- access to customer and market perspective (global market, fragmented market, market growth vs. own growth, etc.)
- business concept (capability to achieve required competence on ones' own)
- competitive position (efficiency, barrier of entry in terms of invest and time)

The customer value is mapped to required competencies. These are referenced with competition. The analysis is based on an extrapolation of current trends in anticipating a future situation. In case cutomer value can ot be met with own performance and when own performance will always substancially lack to competitors' performance then a partnership is a solution. The valuation especially to address transformation and niche markets is done with reflecting competencies to customer access – in reference to competition. The reasoning by management thereby also is the evaluation of internal realisation vs. external partnering (easiness access to 'external solution' vs. investment and time). Especially the view on the total system requirement steers questions towards a transformation of the existing enterprise and of the business concept by a partnership. The criterion thereby are the parameters on market maturity and distribution of margins among suppliers.

Alternate business concepts from companies with comparable capabilities, but valued different on the stock market may give insight to capability for innovation (see 2.e.).

Partner Valuation

Figure 4.f.2. summarizes the parameters for evaluation on potential partners. While the analysis for need of partner focuses to detect a delta in availability vs. requirement, the evaluation of potential partners is to match available competencies (opportunities) with requirements and to judge assumed cooperation results for increased customer value.

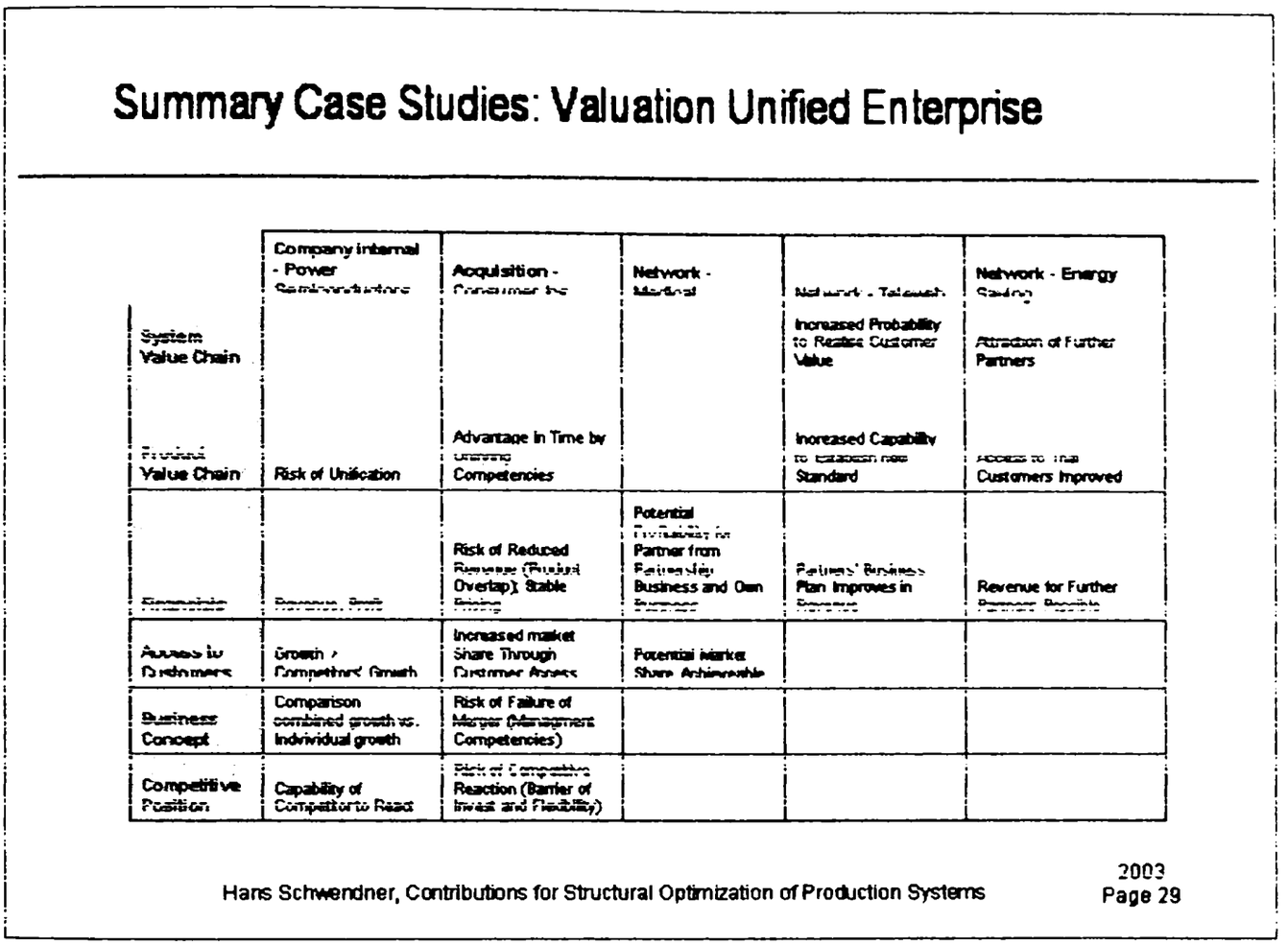


/Figure 4.f.2.: Summary Case Studies: Partner Valuation/

The valuation in general is done on the same descriptive parameters as the analysis for partner requirement. The judgement of risk for failure of alignment of targets, based on descriptive parameters, is a key result. The analysis on the match of competencies for value generation is more the approach evaluating business potentials, new ideas, and learning through experiments – under the assumption of alignment of targets. Risk is evaluated on its manageability.
For this step management may have developed several options for innovation in business concept (expressed in moved/extended market segment and increased customer value). In general options for legal and financial structure are discussed at this step.

Valuation Unified Enterprise

Figure 4.f.3. summarizes the parameters analysed for the valuation of the unified business.



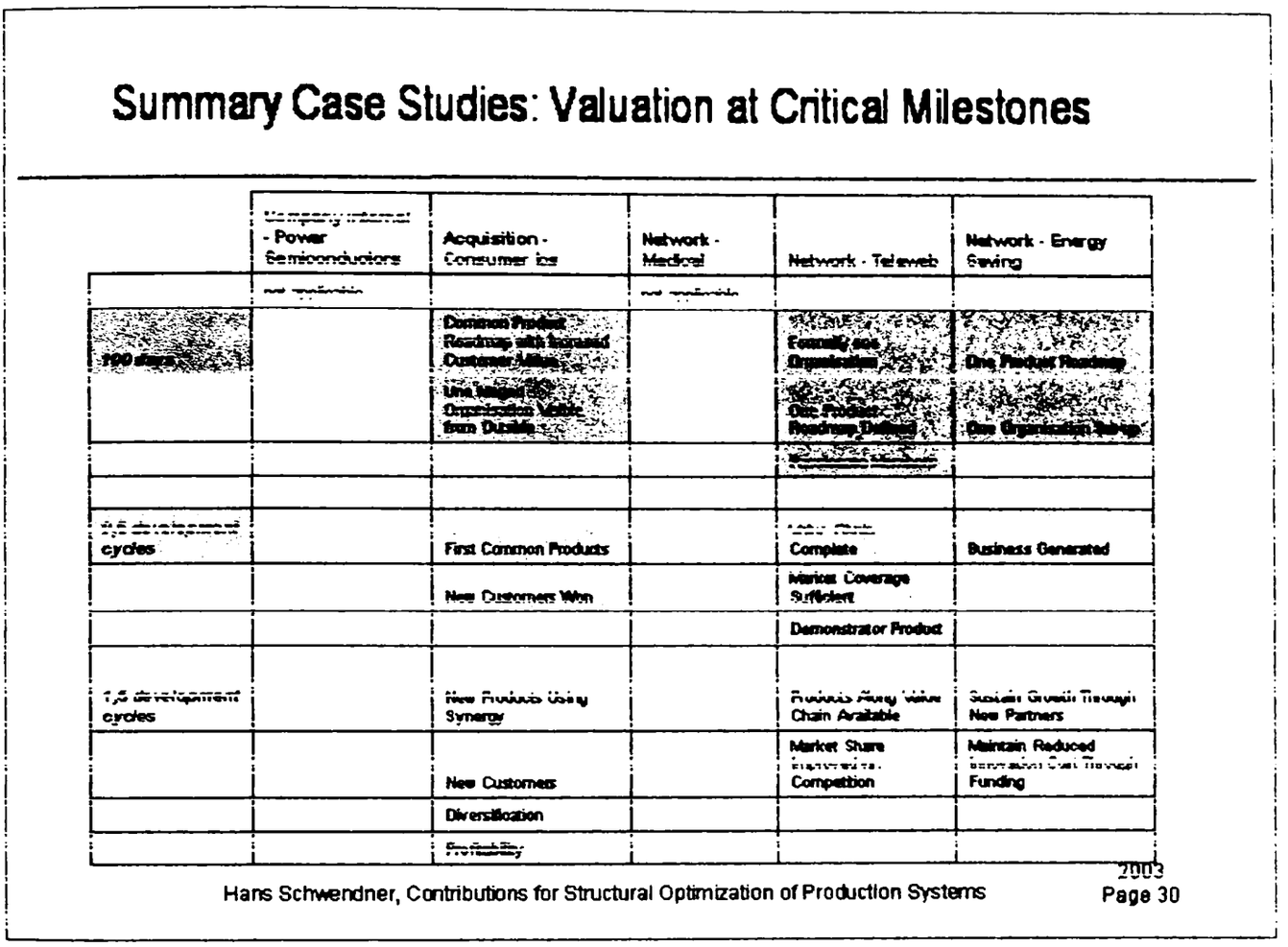
/Figure 4.f.3.: Summary Case Studies: Valuation Unified Enterprise/

The step of valuating the unified enterprise is to carefully optimise investments on maximising customer value while reducing risks in merging organisations or through competitors' reaction. The access to customers should improve and revenue and profit should increase steered by increased customer value. At this step the parameters of evaluation are similar to step one and the unified enterprise is put in reference to its environment (customer and competition).

Valuation at Critical Milestones

At this step managements' – better leaders' - competencies and flexibility to act on unforeseen events is the critical success factor.

Figure 4.f.4. summarizes the evaluation parameters at critical milestones. The schedule of the critical milestones (100days, 0,5 development cycles, and 1,5 development cycles) is verified through the case studies and will be applied in the model. For each of the dedicated steps clearly and repeatable results can be defined.



/Figure 4.f.4.: Summary Case Studies: Valuation at Critical Milestones/

The results are measurable in terms of improvement in customer value generation. Management task to achieve the critical milestones is a matter of 'leadership', a method for management to achieve certain targets by people. The parameters of the previous steps are mapped onto the critical milestones for review on achievement.

g. Observations and Conclusions

The evaluation of cases was performed across the different motives identified for partnership and across the different levels of complexity of partnership from internal merger of business units towards and open network.

Generalised a partnership is recommended in case an enterprise can not generate sufficient customer value in reference to competition at present or in the future.

Parameters can be extracted for valuation and generating a basis for decision at the different steps of evaluation for partnership requirement to

managing the joined enterprise. The parameters are generic for an industry producing products. The parameter values represent the specific industry segment and the specific business situation.

These parameters can be structured to attributes representing enterprises in a business situation:
- customer requirements from a total system perspective (value chain of total solution and required investments)
- customer value generation from a product value chain perspective (competencies required, available and investments required)
- financial capabilities to gain required competences
- access to customer and market perspective (global market, fragmented market, market growth vs. own growth, etc.)
- capability to achieve required competence by business concept
- competitive positioning (efficiency, barrier of entry in terms of invest and time)

Critical milestones for merger are verified. The milestones serve as a guideline for focus of management for increasing effectivity and efficiency.

A hypothetical flow for structural optimisation - from a current enterprise situation to a target situation - was verified for applicability across the different levels of partnership. This flow will be taken as a framework for model development in chapter 6.

5. Parameter Extraction – Leadership and Management

The performance of enterprises is by and large dependent on the performance of management, better by the performance of their leaders - as the case studies reveal that success also is driven by the elements of passion and lucky anticipation driven by leaders. So far there is no model capable to synthesize leadership. Nethertheless it is possible to extract concepts for priority setting and valuation of situations for higher probability of success. Within this chapter concepts and descriptive tools are extracted to methodically and parameter wise optimise the model for structuring production systems– based on leadership.

Different sciences are applied for synthesizing new concepts for executing projects highly efficient in newly structured environments. A simple leadership concept is the result to establish a highly dynamic and responsive enterprise to maintain lead in a competitive environment for satisfying expectations of owners and investors in the long run – by focussing on the customer. Knowledge from sciences beyond management and engineering is combined in a special way in order to develop a comprehensive understanding of basic mechanisms of belief versus knowledge, change of belief, and correlation between root cause and result/target (philosophy). These new findings are to achieve an optimum in structure and personnel performance within an enterprise and its management – to be applied in enhancement of the model. Sciences touched are physiology (understanding reactivity of human beings), psychiatry (for correct interpretation of human behaviour), artificial intelligence (belief and coherence), and psychology and sociology (for understanding effects on sub ordinance and conformity).

a. Selection of Staff and Leaders

Interaction with staff members, defining goals, setting targets, delegation of targets/work load, control – those are the daily tasks of leaders. For reaching effectiveness an efficient leadership process is required. An Understanding will be developed how to interact with employees in order to reach the goals – from a perspective of a leader.
The critical issue thereby is to find the way to get the individual goals aligned with the goals of the enterprise in order to support the original tendency of life which is based on alignment on harmonising all targets on one uniform overall target that is intensive in experience /FETZ/.

The better leaders are able to align and focus their staff and orchestrate their competencies within the process set of the frame of responsibility the better the targets will be reached. The correct way of handling this process does focus the company not by power but by conviction of people and strong performance is the consequence.

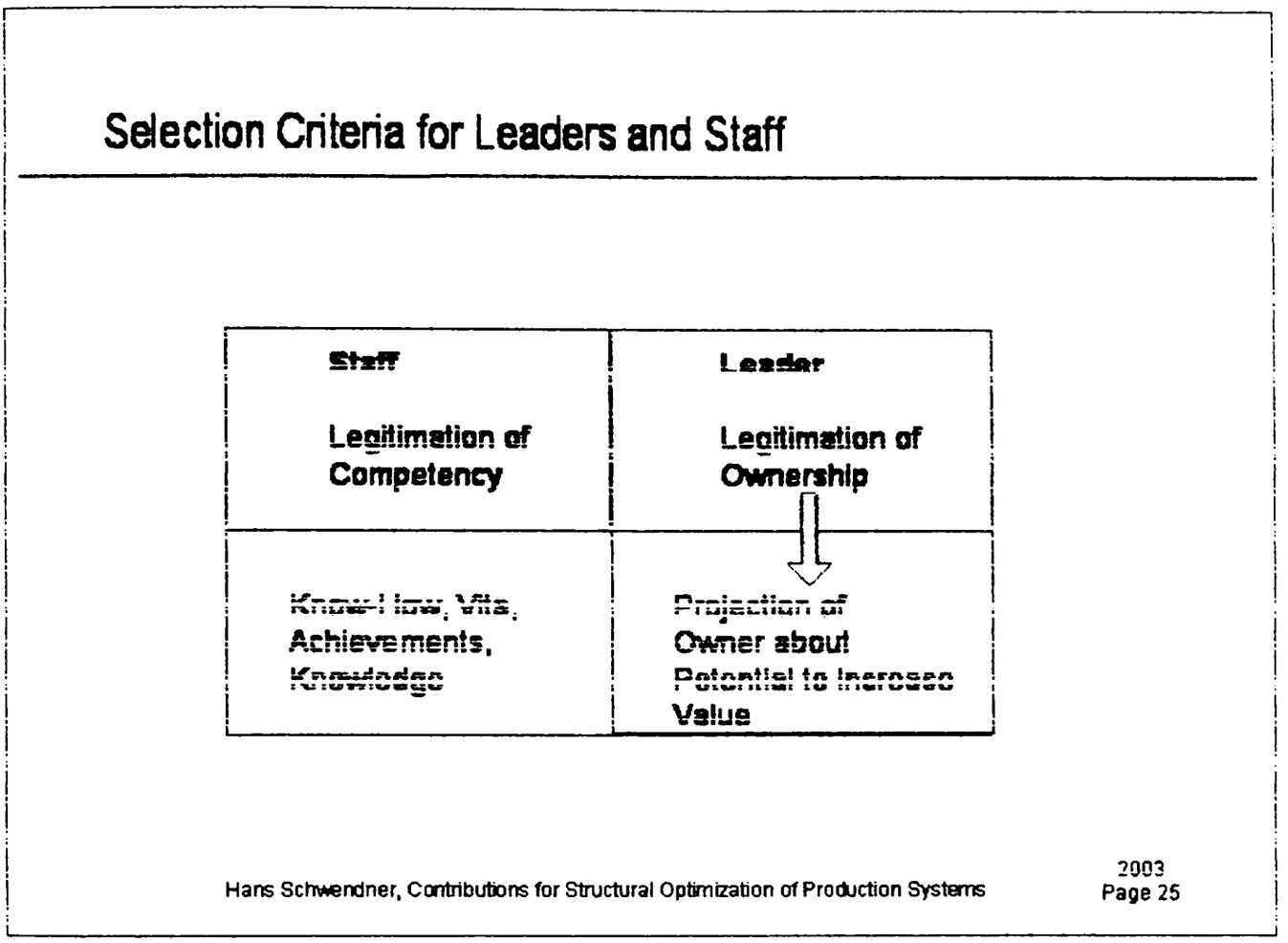
The key element for the leadership process is the overall underlying element of philosophy that there is a purpose in any relationship and not

the relationship is the purpose. Vitality is characterised by the ambition in reaching intensity (quality of life) – a finality/the intended target - and not just on physical-chemical mechanisms.

What are the expectations of the shareholder from the leader of his enterprise? The general expectation is that the leader of the enterprise has to increase the value of the enterprise in their point of view. By that concept leaders are selected. There are two recent examples in German industry that proof this concept. One is the dismissal of the CEO of Telekom – Ron Sommer – as the main shareholder felt the pressure that the value of the company on the stock market was constantly decreasing and there was no clear path on returning to higher value. The second example is Bertelsmann – Thomas Middlehoff – who by all competencies had different value concepts of the company in mind than the owners. He intended to circumvent the clear direction of the owners not to get a publicly traded company.
The competencies for realising the owners' expectations are the capability to orchestrate the resources (staff, money, equipment and management) by applying the appropriate concepts for value generation and designing the appropriate leadership processes. In contrast the competencies requested from an employee are in the field of know-how of operational processes and references on previous achievements and education. This difference in expectation and task does naturally lead to the decreasing operational know-how in increase in hierarchy. From an 'outside view' sometimes the selection of a CEO then looks like selection by relationship criteria rather than competency. In respect to the concept of legitimation of ownership this is the correct approach, because the combination and alignment of people for generating the company value is the task.

Figure 5.a.1. /ZAPKE-SCHAUER/ does reflect the difference in selection criteria between leaders and staff.

The hierarchical expectation of owners, leaders and staff has implications on the set-up of the model, the definition of the model parameters. The concept for generating company value must be represented together with the measurables that are a result of value generation in respect to the expectation of the owners of a company.



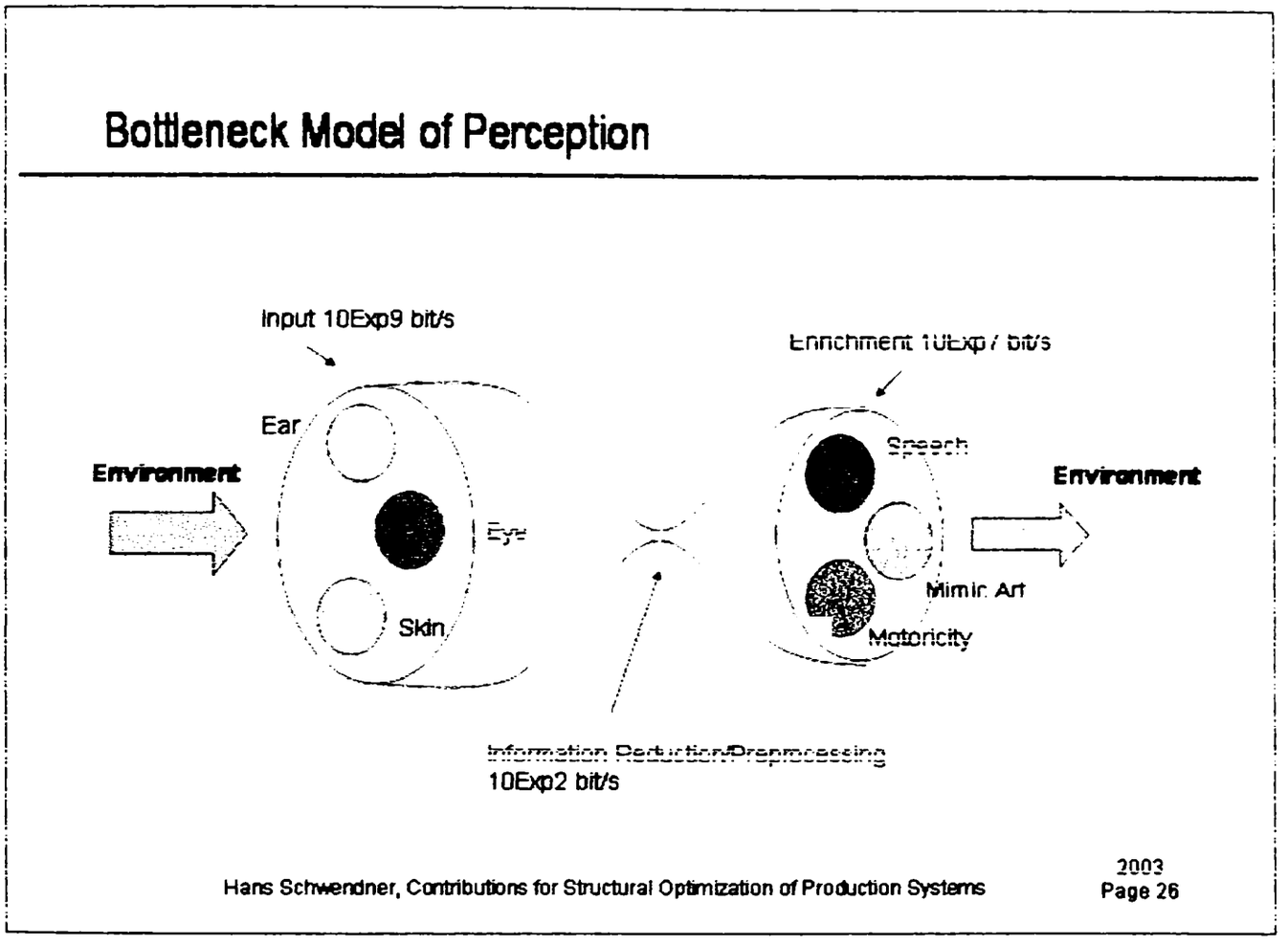
/Figure 5.a.1: Selection Criteria for Leaders and Staff/

Transferred to the model this means that the 'target' must be closely related with value generation (= customer value). The attributes must reflect the measurables and competencies for generation of value. On the opposite it is not necessary to represent processes, legal structuring or any sub-details as these are to be evaluated and realised by staff - and not by management – as a consequence of the targets.

b. Motivation and Mental Concepts

For understanding the interaction required from a leader with his staff the leader has to understand some basic biological and physiological effects. *Figure 5.b.1. illustrates* the bottleneck of perception, which can always be found after a management meeting when all have agreed to do a certain thing, but the very next day everyone seems to follow their own targets – from the perspective of the leader – but not to work on the agreed task. Asking the staff they are convinced they work on the agreed task.
The bottleneck of perception /VESTER/ means that all environmental influences (data) a person receives constantly are already pre-processed to the most extent by different natural and trained concepts and reacted

immediately (any effect on skin that is most of the time even reacted unconsciously). Thereby a reduction of the received information by 7 potencies takes place before it will be transferred into the mind.

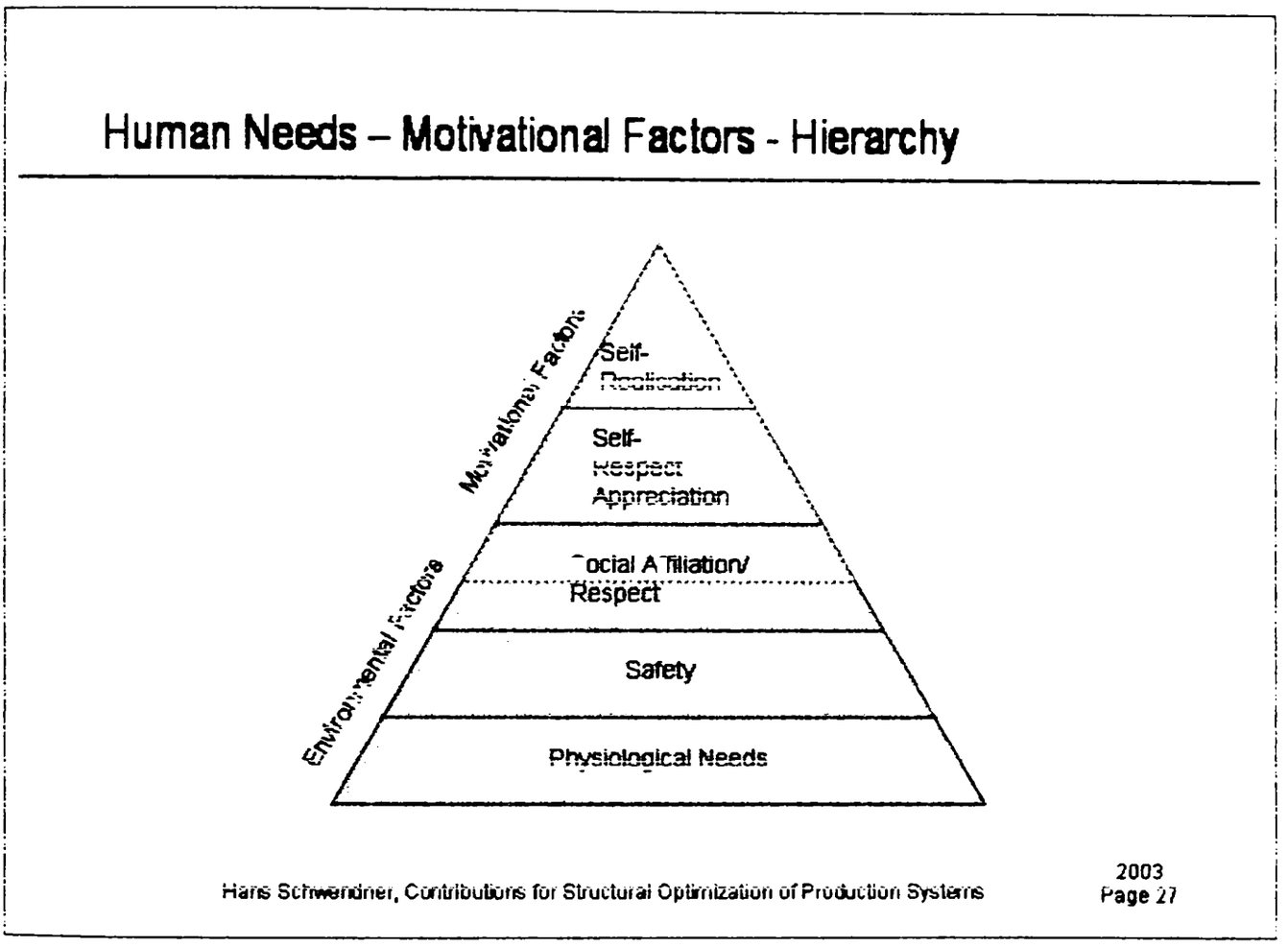


/Figure 5.b.1.: Bottleneck Model of Perception/

Within peoples' minds and for further processing for action this information is enriched again with the concepts built up for processing certain actions. Whether it is to have certain mimics (conscious or unconsciously controlled by physiological processes) or to execute on certain things that people think are to be done.
For any leader this means that he has to find a way to exchange the existing concepts in the peoples' minds with the concepts of the company in order to get alignment in equal interpretation of targets and words. Sometimes it is even forgotten that words also have different meanings on their own, but on the other hand are by nature abstracts for description of objects their character and their relationship, and thus have different interpretation by cultural background.

Another step to efficiency in leadership is the understanding of motivational factors. Since the discussions of Aristotle on men's' ambition for common

sense and admiration of nature – always related with a purpose – management applicable theories have been developed. Several models deal with a more or less fixed hierarchy of human needs whereby people first seek to satisfy their basic needs before advancing to 'higher' requirements.

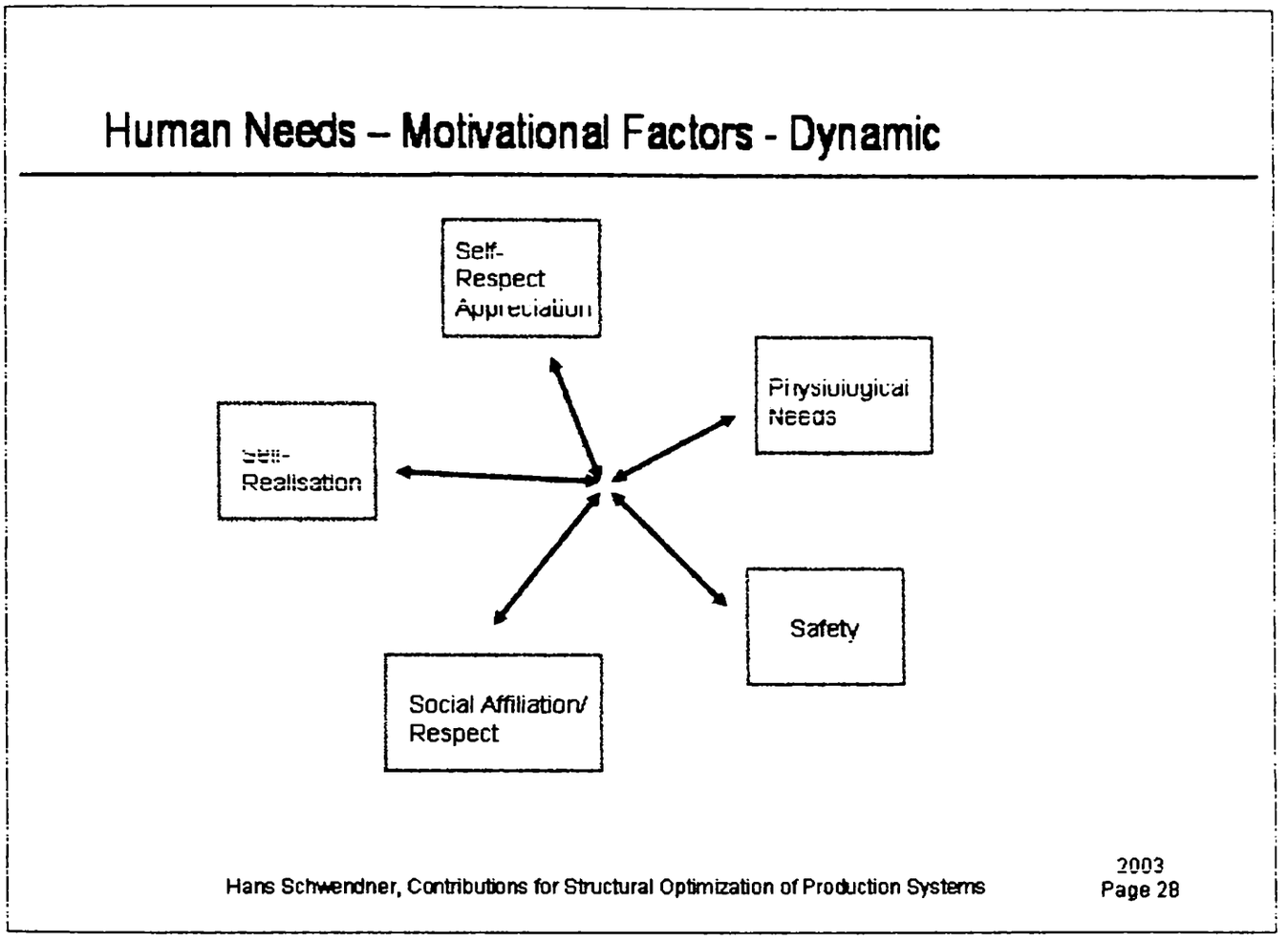


/Figure 5.b.2.: Human Needs – Motivational Factors - Hierarchy/

Hereby the needs not yet satisfied are motivational. Figure 5.b.2. does show this hierarchy. The key elements are taken over from the research of Maslow. Add to the hierarchy there is a gradual difference in motivational effect inherent. The very basic needs – the environmental factors – prevent from dissatisfaction. The more advanced needs for relationship and self advancement are the motivational factors that contribute especially to the individuals' satisfaction.

Apart from the hierarchical pyramid of needs there are dynamic models developed whereby the individual always tries to satisfy a set of needs with importance factors set by current goals to be achieved. That means that the individual tries to balance the satisfaction of needs according to present (i.e. limited view into future) individual circumstances and targets. Figure

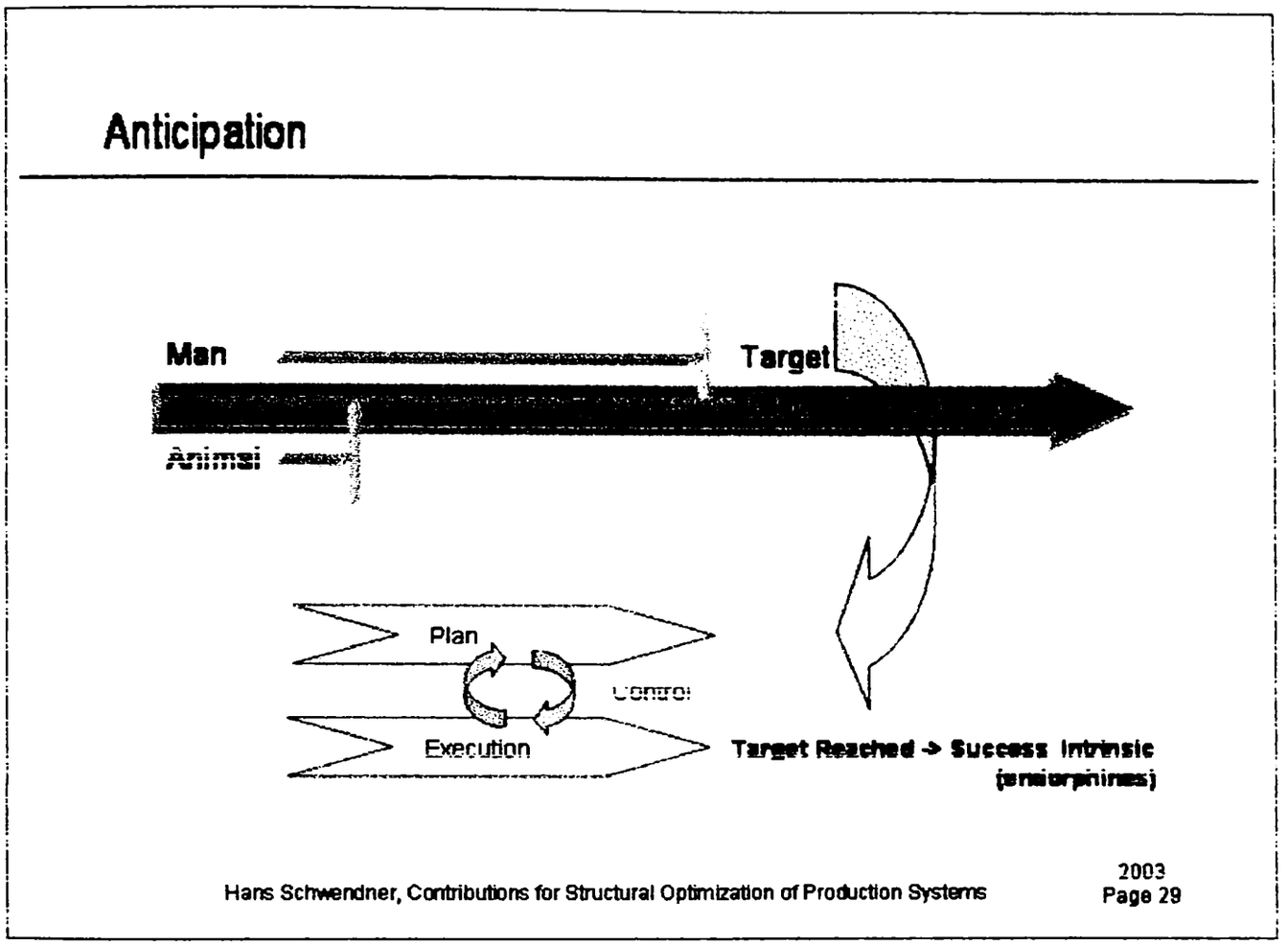
5.b.3. /WARNECKE1/ reflects then a set of needs only that are always present.



/Figure 5.b.3.: Human Needs – Motivational Factors - Dynamics/

Any interaction of a leader with his employees has the best motivational effect, when finding an optimum fit of the task delegated with the individuals' needs.

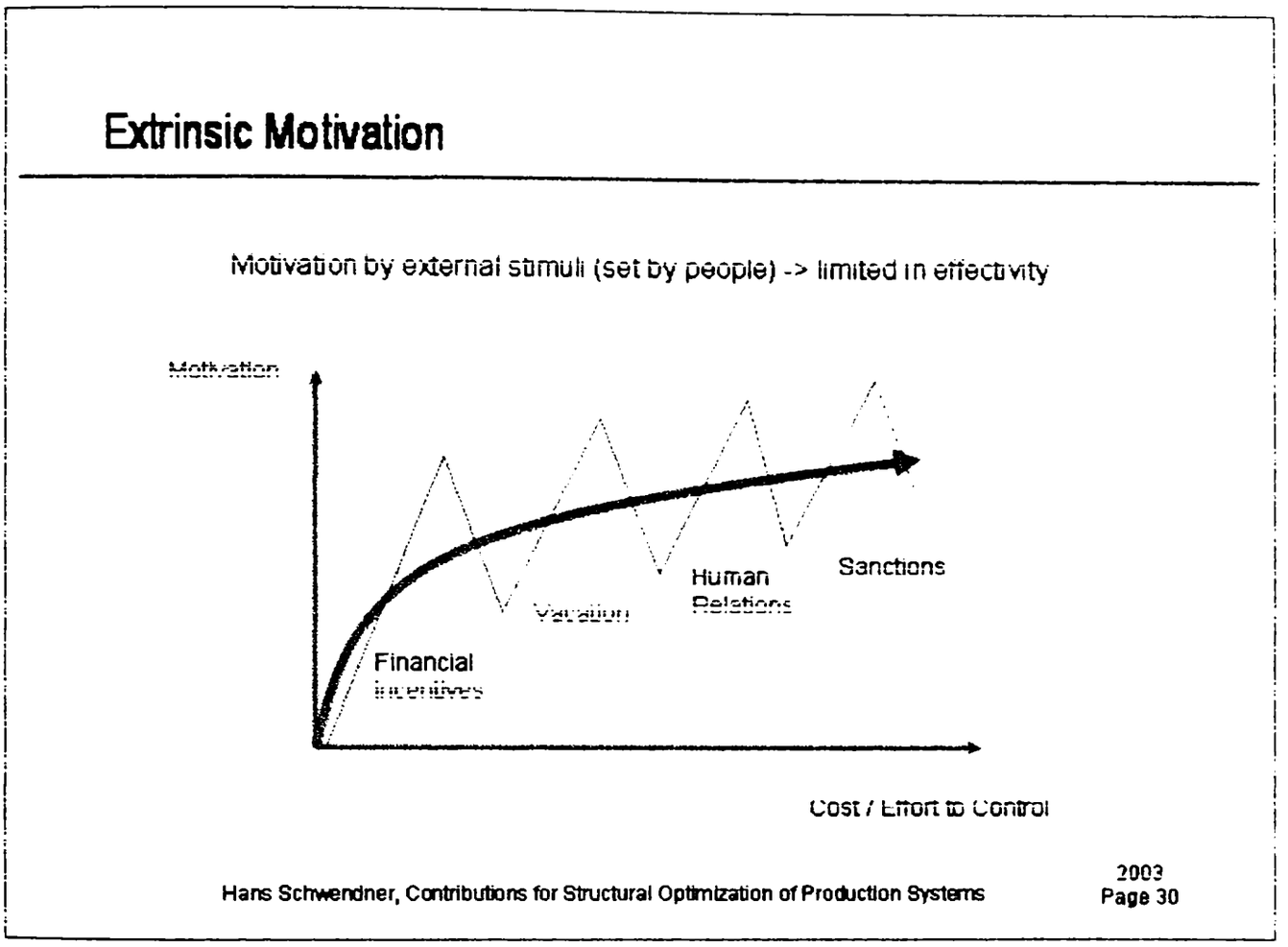
The next motivational aspect is the capability of human beings to anticipate the future. This capability is most developed within all species known with the human being.
Only based on the anticipation of the future people can develop hope and fear as also their degree of satisfaction and dissatisfaction is a matter of ambition to targets and self appreciation /FETZ/.
Figure 5.b.4. shows the consequence of this theory. Based on an anticipated view of the future (=target) the individual has to develop an ambitious plan for execution. Once the target is reached in correlation with the plan (measured through a control process) there is success and thus positive motivation for the individual.



/Figure 5.b.4.: Anticipation/

On the success endorphins are released by the body that generate positive feelings.

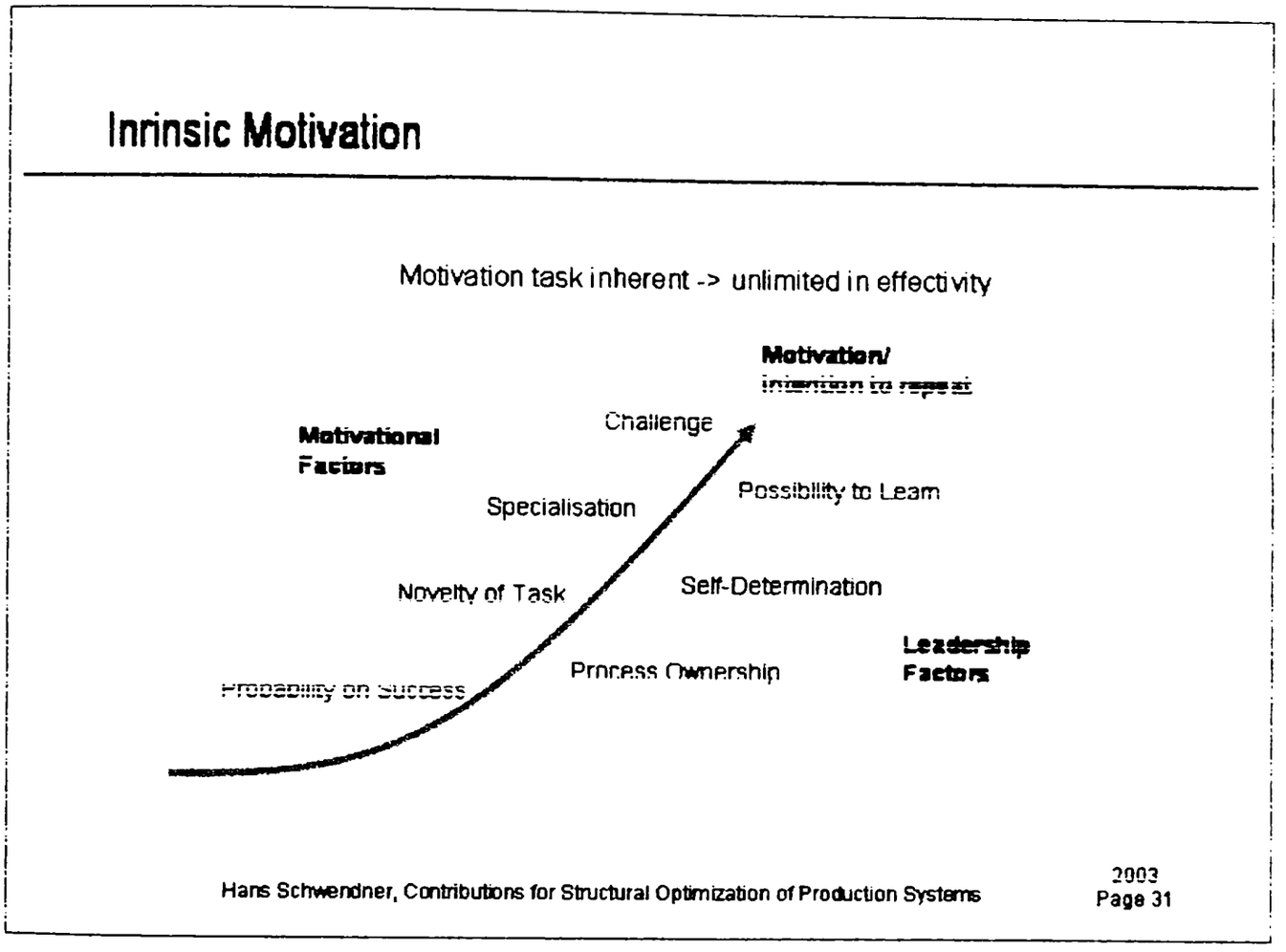
For further generation of a framework of positive feelings by motivation there are two different groups of motivational activities: one group are the factors set by external stimuli (see figure 5.b.5 /ZAPKE-SCHAUER/). Those are limited in effect, as the individual can not repeat those factors on his own. For enterprises those factors are usually combined with cost.



/Figure 5.b.5.: Extrinsic Motivation/

The other factors are the intrinsic factors (see figure 5.b.6.). The basic difference to extrinsic factors is the fact that they drive motivation out of the task itself and therefore are at no additional cost. Through the task the individual gets the chance to determine about the own future and gets the chance to anticipate.

With elements of process ownership, self determination and the possibility to learn any leader has the tool set to drive intrinsic values within his staff. Any task performed through intrinsic usually motivates for repetition.



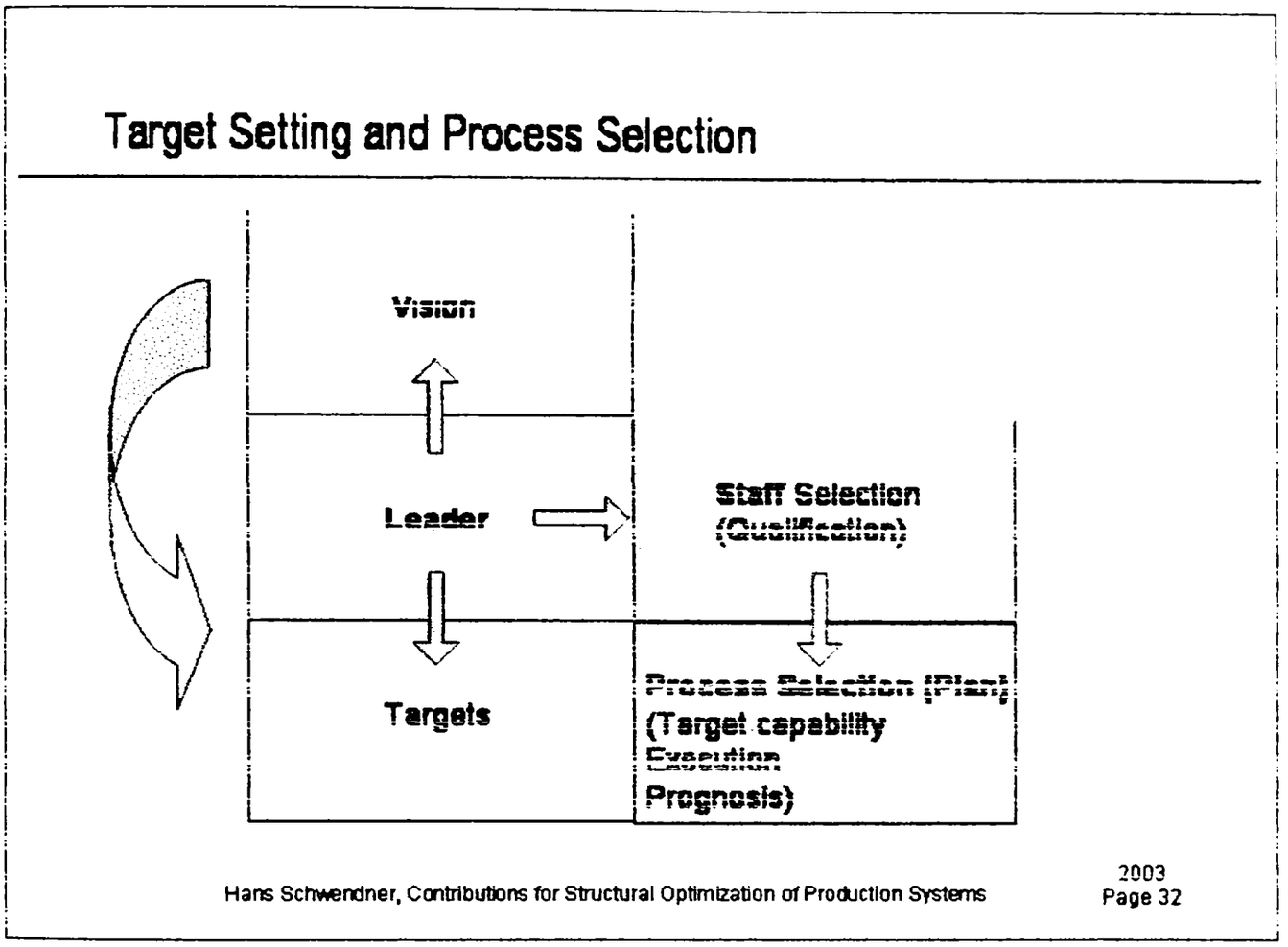
/Figure 5.b.6.: Intrinsic Motivation/

Vision, Targets and Execution

The leader has to look for two elements very carefully:
- how to drive intrinsic values
- align the mental concepts of staff with the concepts of the enterprise

Approaching the leadership process with some of the elements of strategic management would lead to following concept of contents and flow:

The leader generates a vision for his staff that is less a vision about the future of markets etc. – projections about those developments anyway are to a high degree wrong, as there is nobody who can predict the future – but contains statements what positive things are enabled once the targets are reached. It also describes what factors must be available that the targets would appear already today. Through this approach staff gets the opportunity to link positive elements of the future with own targets, as the vision tackles current problems and supports staff' values positively.

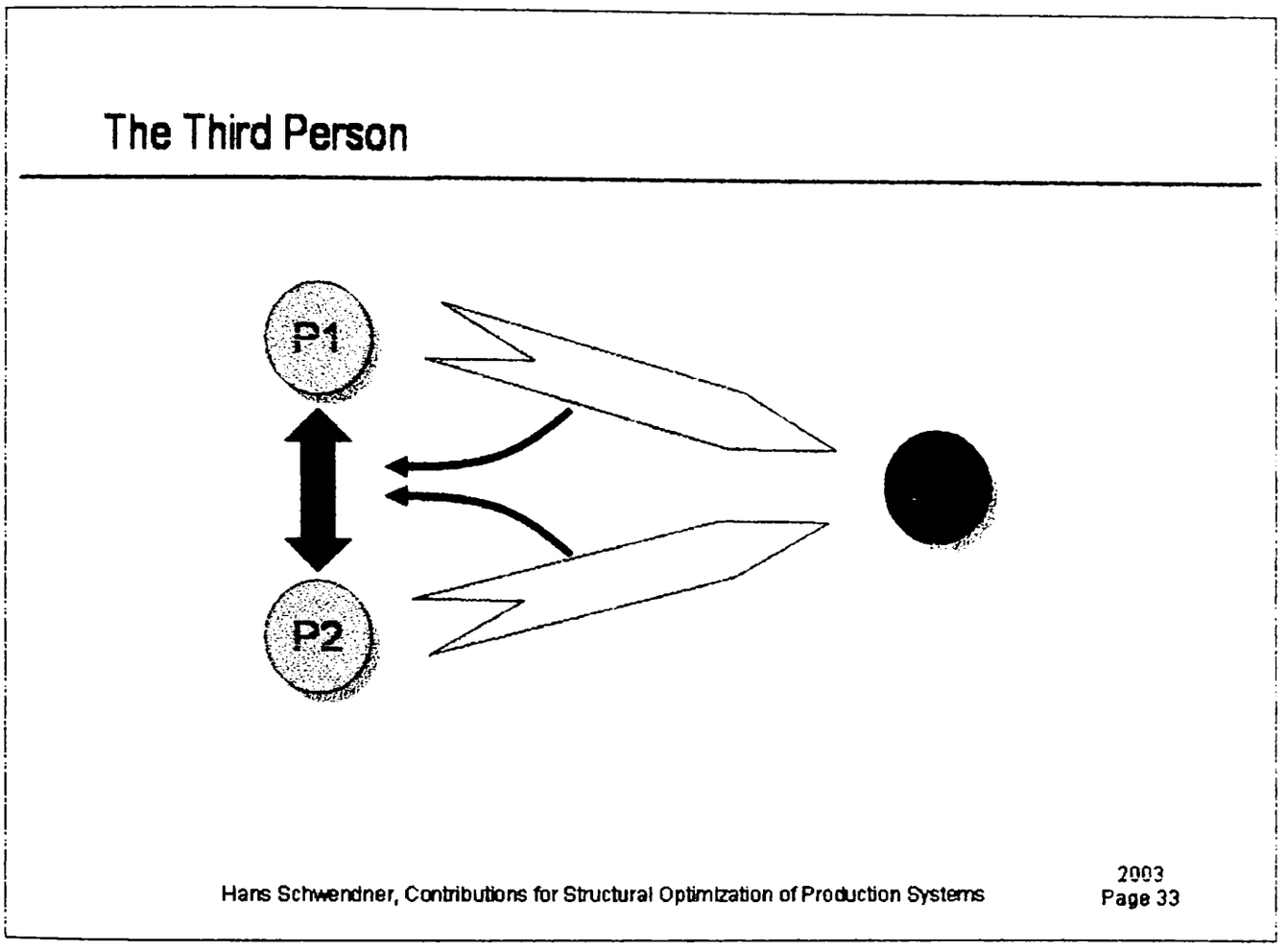


/Figure 5.b.7.: Target Setting and Process Selection/

Out of the vision targets are derived that are directly communicated with all staff members. This direct communication is critical to verify that the employee really has understood the same content and thus has adapted his mental concepts with the concepts of the company.
As seen in figure 5.b.7. staff has to develop a process (plan) in order how to reach the targets best. By definition the leader should have chosen the best competencies within his staff for execution. Through planning in combination with visions' stories about the future staff can anticipate and develop self determination. The targets themselves are to be defined by a certain quality, budget and time to be reached. They also have to fit with the frame of responsibility of the employee.Company targets are translated into individual targets by this process.
The relationships between individual functions and value generation can get transparent as the vision describes the constituting factors. Staff can be approached on the level of common sense.

Vision and targets also must be embedded in a context aligning employees towards the customer. The advantage by doing so is that all can focus to an external third person. The relationship between employees than can be

always referred to this 'outsider' and any obstacle can be discussed on a more neutral and value add basis.



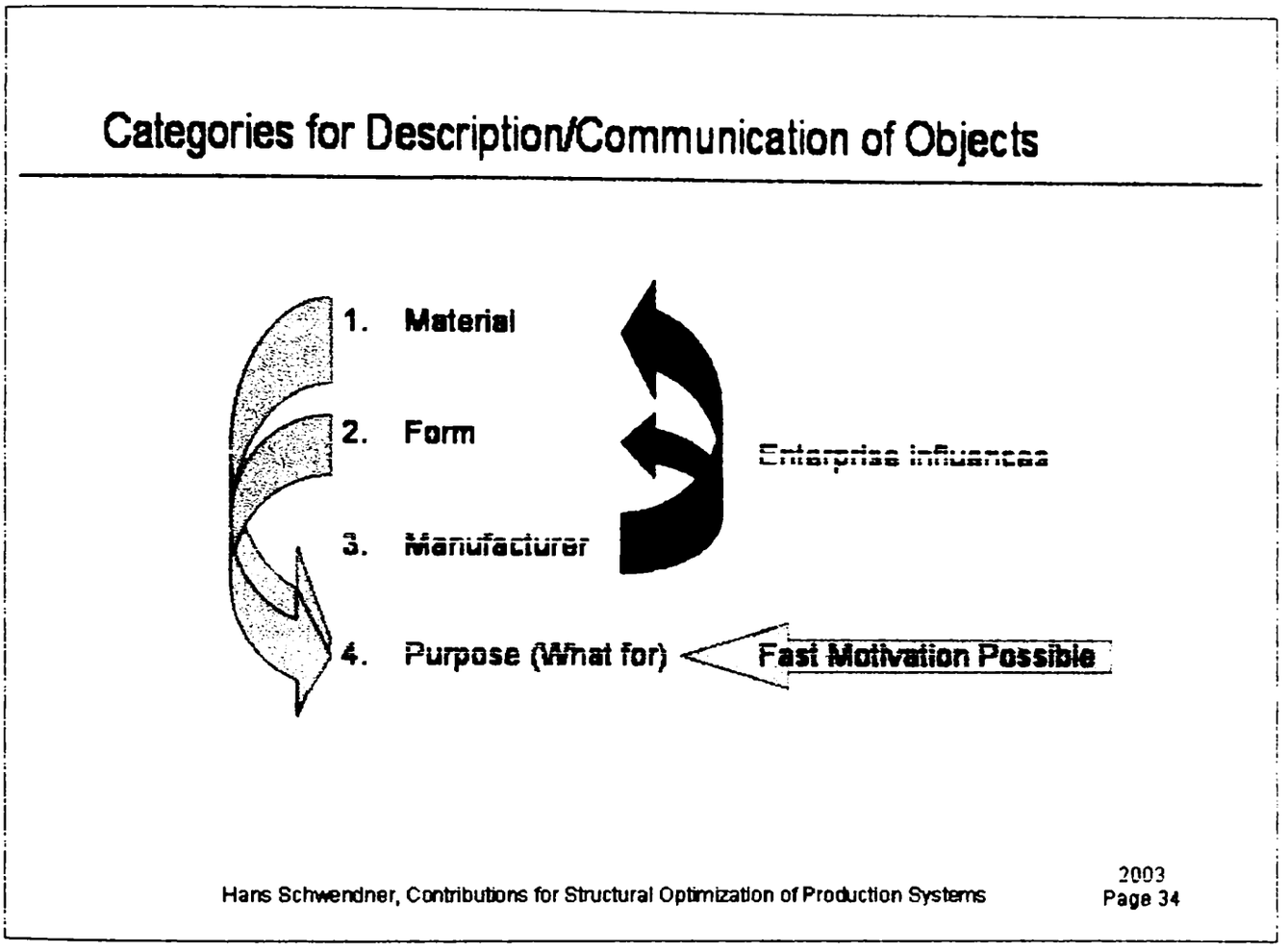
/Figure 5.b.8.: The Third Person/

Above figure 5.b.8. illustrates the third person effect. Viewing towards requirements of a third stabilises the relationship within staff.

This effect can also be generated in target setting. In case the feedback of an employee on process to achieve targets is negative, some bosses tend to apply pressure. This immediately converts the employees' physiology into an alert mode by producing adrenaline and then blocking the openness for information for several hours as the body focuses on reception of potential dangers. The external third party method could be applied by referring a competitor as a benchmark proofing that better results are achievable – when there are results, the processes must exist. The task does get intrinsic immediately.

By applying game theory and psychology (for example 'zero game' and its

effects on human behaviour) the same conclusions can be drawn.



/Figure 5.b.9.: The Four Categories for Description of Objects/

For a network it is relevant to understand also the categories for description of an object. Usually people tend to describe something by the material, form or by its manufacturer (figure 5.b.9). Generally the manufacturer defines the material, processes that into a dedicated shape/form and thereby enables the products application for a dedicated purpose. The categories of material, form and manufacturer get disguised within a network. Therefore the focus within any discussion on vision, targets, etc. must be the purpose or indirection customer the customer value. Through addressing the purpose immediate motivation is possible.

By focusing leadership on purpose of the network also the ethical effect of increasing the employees' capabilities for acting on their own is a result besides the increase of intrinsic.

The building of an own culture within the network can also be expedited by this approach. By focusing on an external customer, openness is a consequence. Discussion on purpose eliminates emotions and focuses on

rationales. Hindering politics are reduced by clear process ownerships and thus procedures for decision can be fixed.

The theory discussed in this subchapter on motivation and mental concepts has implications on processing a structural change. The elements influenced are:

- communication (wording)
- communication (content: values)
- content of milestones (vision, anticipation, intrinsic, motivational factors)

These findings are to be reflected in the model:

- The wording used for description and further on communication must be clearly defined in order to be clearly and commonly understood and interpreted for valuation and action.

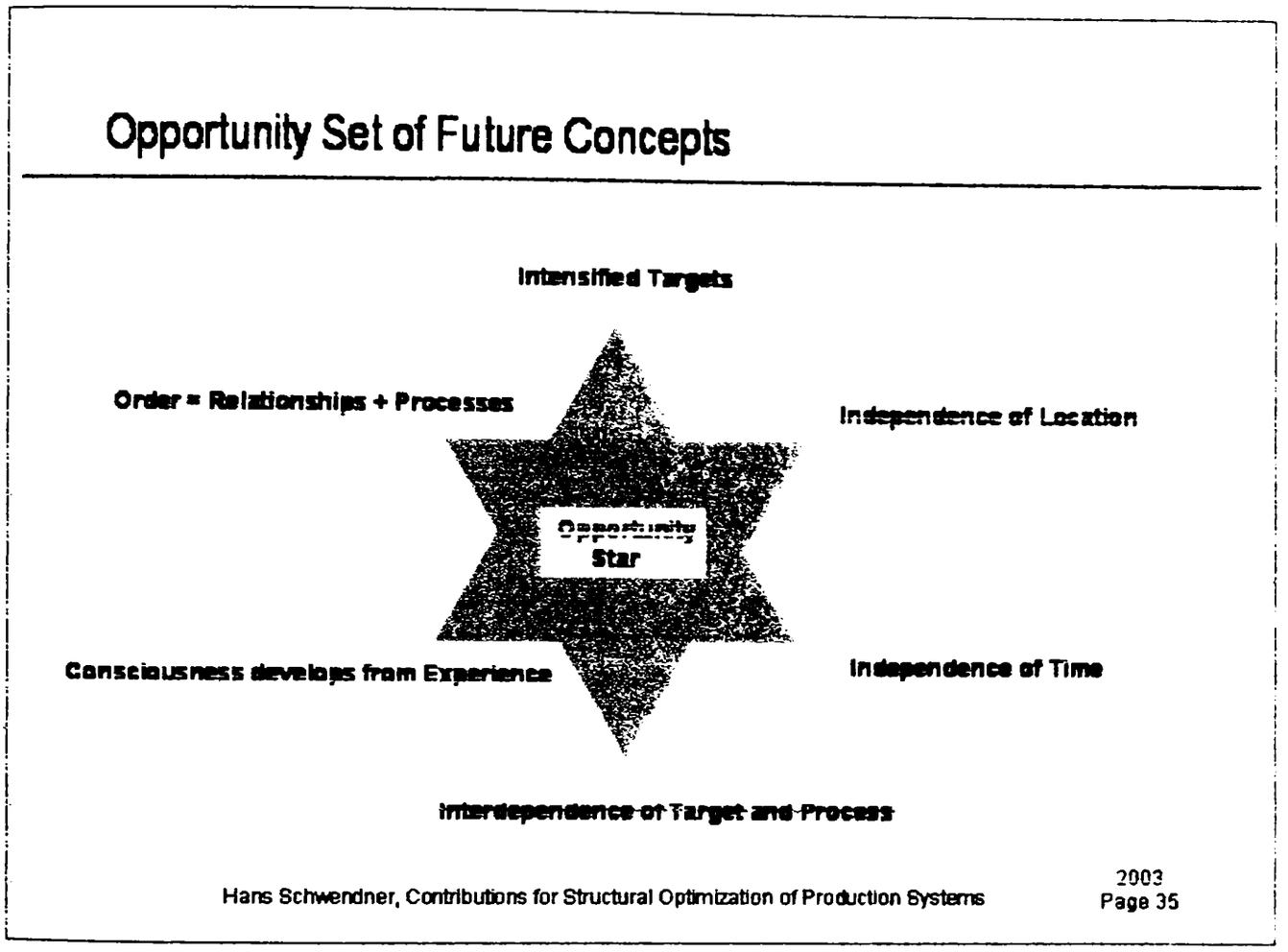
- The model should address issues that can be used for communication with people involved in execution. The contents is to be in a way to reflect an outside of the enterprise (third person = customer; purpose = customer value) in order to drive emotion into a positive channel (= outside to support the customer) instead to an internal fight (= cultural barriers).

- The parameters allowed to change for certain milestones are to be linked with people to execute. There must be the elements in the vision about the milestone results, what intrinsic values are to be touched. The attributes that can be changed within certain periods of time are to be explainable in a way that people can build an anticipation of approaching the result. This means that parameter changes are to be classified in changes that are proven to work within a certain period of time, and changes that require a new approach that is unprecedented.

c. Future Oriented Execution Concepts

This subchapter extracts some principle rules of nature – mainly out of the discipline of philosophy – and thereby a framework of opportunity is defined. The idea in this approach is to build a consciousness of opportunities along a framework that allows quick referencing for options of action and thus gives guidelines for further on optimising model parameters and set-up.

The following figure 5.c.1. summarizes the opportunity set into an 'opportunity star'.



/Figure 5.c.1.: Opportunity Set for Future Concepts/

The beams of the star are to be interpreted as follows:

Opportunities derive of intensified targets:

Whenever there are ideas for targets that complement the existing target this should be examined as an opportunity. The harmonisation of new ideas into an existing set can intensify the vividness of an enterprise.
The key criterion hereby is that the existing set of targets is not changed but the harmonisation of the even wider number of targets now does allow a new and higher quality of self determination and thus generates new intrinsic values for higher levels of performance. The selection of additional targets has to be done carefully in order to reach the harmony and to define new targets that envision a more important future to the enterprise than generated by the previous targets.
Any new media, like the internet with supplying information, thereby are supportive to find new ideas for intensified ideas.

Any opportunity is independent of location:

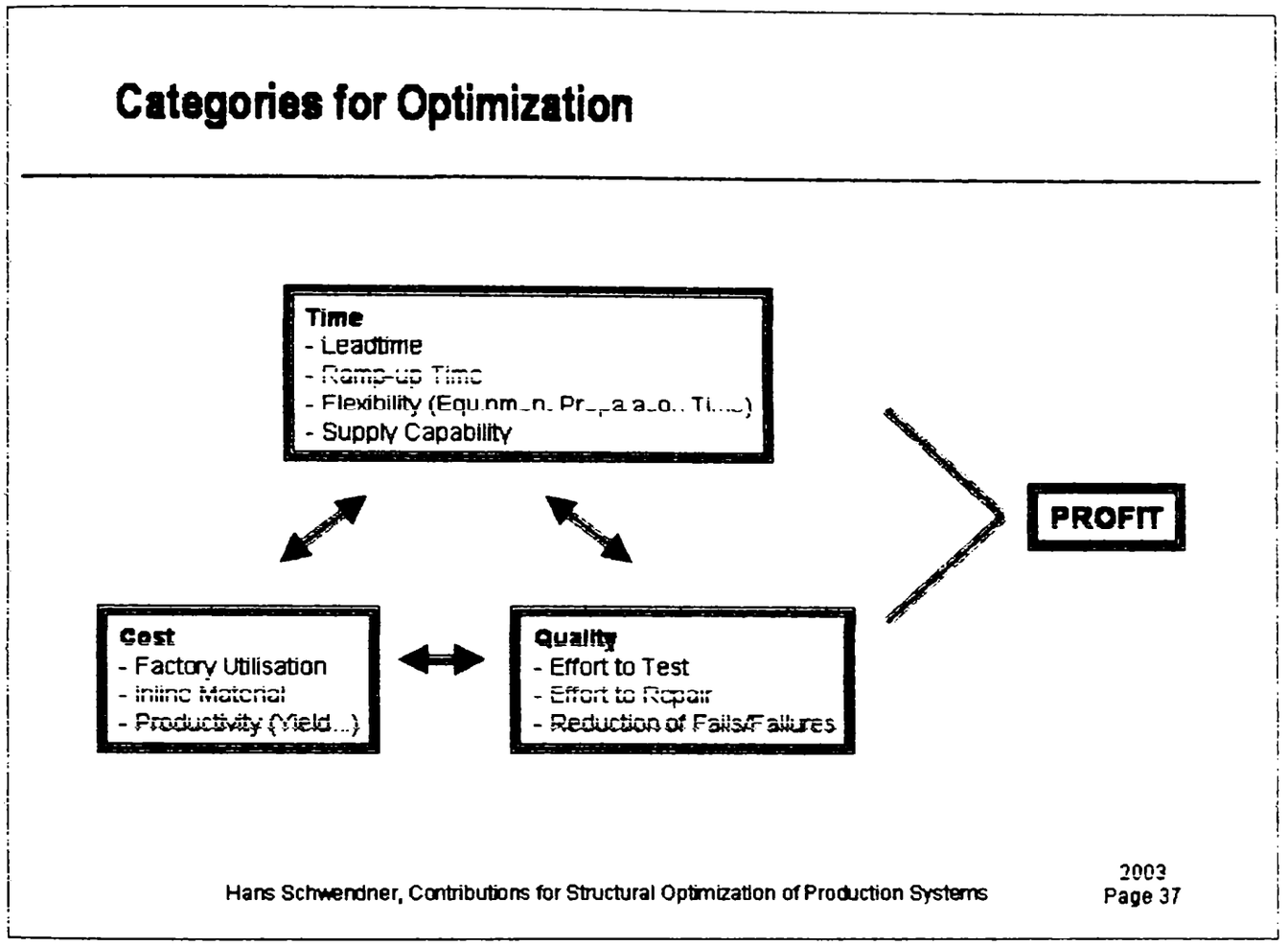
Whether is production, or development or access to a market, from a rational point of view there is no reason that this is dependent on any location. The basic elements for driving people to do something (produce, develop or buy) of target and process are available everywhere. For production and development 'cost' has to be optimised and for market access the 'customer value' has to be optimised. The logistics for handling an enterprise independent of location are the challenge to be taken care of. Logistics mean the transport of material and the consistent supply of information. Especially new information technologies enable thereby new ways of production by making date and information accessible everywhere and at every time.

The effects contrasting this rational point of view are sociological and psychological behaviour effects of human beings. The one aspect is the sub ordination to authorities and the other aspect is conformity /MILGRAM/. On the first aspect it is important to set up transparently for all people involved the lines of authority and the respective environment (contracts, commitment, feeling of responsibility, etc.). On the latter aspect it is important to detect all elements that can generate behaviour of conformity in another direction than the one to be targeted. Increasing local distance increases the effort required to keep lines of authority set up and to keep conformity in the right direction. Within the model those two 'energies' have to be taken into consideration for valuation of separate locations.

Any opportunity is driven by events and not by time:

In general it is not the flow of time that generates opportunities but there are certain events that trigger a new perception about a subject and thus create the idea or environment for an opportunity. Therefore the increase of opportunities for own activities can be promoted by increasing the awareness for events and their influence on the properties of an object or the perception on the situation. Especially networking software tools allows to inform about key events throughout an enterprise within seconds.

The above paragraphs seem to be in obvious contrast to the categories of optimisation as summarised in figure 5.c.2.. The major categories for optimisation addressing the key challenges for delivering product to the customer are: in time, at the appropriate quality, and at reasonable cost.



/Figure 5.c.2.: Categories for Optimisation/

Up to now most effort is put into optimising cost and quality. This is due to the fact that measurement points and measurement data get easily available. It is and was not possible to approach time as a key improvement factor due to missing data points online for immediate correction. Therefore lead-times were and are taken more or less as a given and not improved at the same rate of 30% per year or in multiples of *step functions like the other categories*.

The finding was that optimisation on the category time can be used for driving optimisation in cost and quality. This is due to the fact that reduced time required for processing a product leads to less material used, less resources involved and required and in the end to less equipment required due to reduction of process steps. Additionally quality is improved due to the simplification of processes fewer failures can be made on the one hand and on the other hand the shortening of feedback loops allows more precise process control and shorter reaction time on corrective actions at deviation.

Reduction of time required for productive output requires also a rethinking

of batch or lot sizes in order to shorten feedback loops within manufacturing on the different process steps. In future the ideas of single wafer lots or even individual sections on a wafer as a lot should be considered for improving process continuity over processing time. This is getting more and more important for larger diameter wafers as their individual processing does allow already parameter deviation.

The optimisation on the category of time does require efforts of the semiconductor industry and the equipment industry to provide:

- In situ measurement capabilities at tools
- Standardised data interfaces at tools
- Overall data network for data access and evaluation
- Self controlled equipment

In order to get access to the required data for immediate improvement instead of the current disguising of failure through the subsequent process step.

A key paradigm to approach for optimisation on 'time' is the equipment set-up in batch processes. Here new ideas for improvement in terms of 'lot size one' have to be developed to allow higher degrees of flexibility of production mix in manufacturing. Concurrent engineering of technology development and equipment development and review of description of process parameters for control can be initial ideas for consideration. Benchmarking with completely different industries could help thereby. For instance the automotive industry managed to eliminate the paradigm of set-up time for manufacturing to shift completely from one model lines to individual cars as batch unit.

Reviewing the statement that the category of 'time' is contrary to the 'event drivenness', above discussion can be summarised in a supportive statement like follows. Time can be taken as a measurement for intensity of events, but time is not the trigger of an opportunity. Any events can obviously happen at any time, when certain conditions are available. Therefore the conditions for availability have to be carefully analysed and reengineered for earliest availability in event. This is a matter of the best process then.

Target and execution are conditional to each others:

The process of execution does influence the target and vice versa. Once the process is started, it is clear what target will be the result and once a target should be reached there is a certain process necessary. This means that wherever is a part of an enterprise it must be made sure that the targets are transparent and the other way round any event on the process must be transparent to responsible people on the target setting process. Communication tools and their application enable especially the remaining of the target/process interrelationship independent of location and independent of the time conveyed.

This guideline applied in combination with some of the others (e.g. independence of location) and taking the technological and sociological developments as an opportunity can derive for example the conclusion that there is an increasing number of networks. These networks can get virtual in terms of location and time. In consequence one has to shift the paradigm of logistics (transport and information flow) and communication being a cost factor to getting an enabling factor for new processes and markets. The simple example of videophones does show this paradigm change. Video communication on the very high end can be done via high performance video equipment and high bandwidth communication lines at cost of several thousand € on the one hand. On the other hand video communication can be done via a web cam and communication via the internet data channels at low cost. Maybe certain messages are then taped on video and distributed via the internet. The application of right technology for the appropriate purpose is most relevant.
thereby it is possible to have the interrelationship between target and process alive within virtual networks.

Consciousness does develop of experience:

Within every relationship there is the feeling that its development does take 'time'. The phenomenon behind is – very similar to the different states of 'data' develops to 'information' that can be converted into 'knowledge' – that the consciousness on relationships is built on experience. The abstraction of experience into general concepts is the new level of knowledge and consciousness. This interconnection has to be taken care of, especially when approaching a new opportunity with new partners. There is a management concept that talks about 'early wins' that comes very close in describing this phenomenon. In general one has to understand a relationship as a process then, that requires events for generating a common experience and then it is possible to build up new levels of consciousness – like trust.

Applied for managements tasks like 'definition and generation of a corporate culture' this means, that the development of a new common culture takes time, and is not a given or can be pulled over a new organisation. The approach therefore has to be different in a way that culture is not a given target, but an experience developed out of an insight by staff through questioning for the targets and not the personal value system. The execution to achieve the targets does conclude in a change of the enterprise that also affects the personal value system also by experiencing the culture as decision procedure through change – but not as a prerequisite for action. The speed of achieving a commonly new culture is dependent on the capability of the leader to get in resonanc with his staff and therefore to align them towards 'his' – the company – vision. The more he is in dissonance the longer this takes or maybe even will fail.

There can also be the conclusion derived that enterprises have to focus

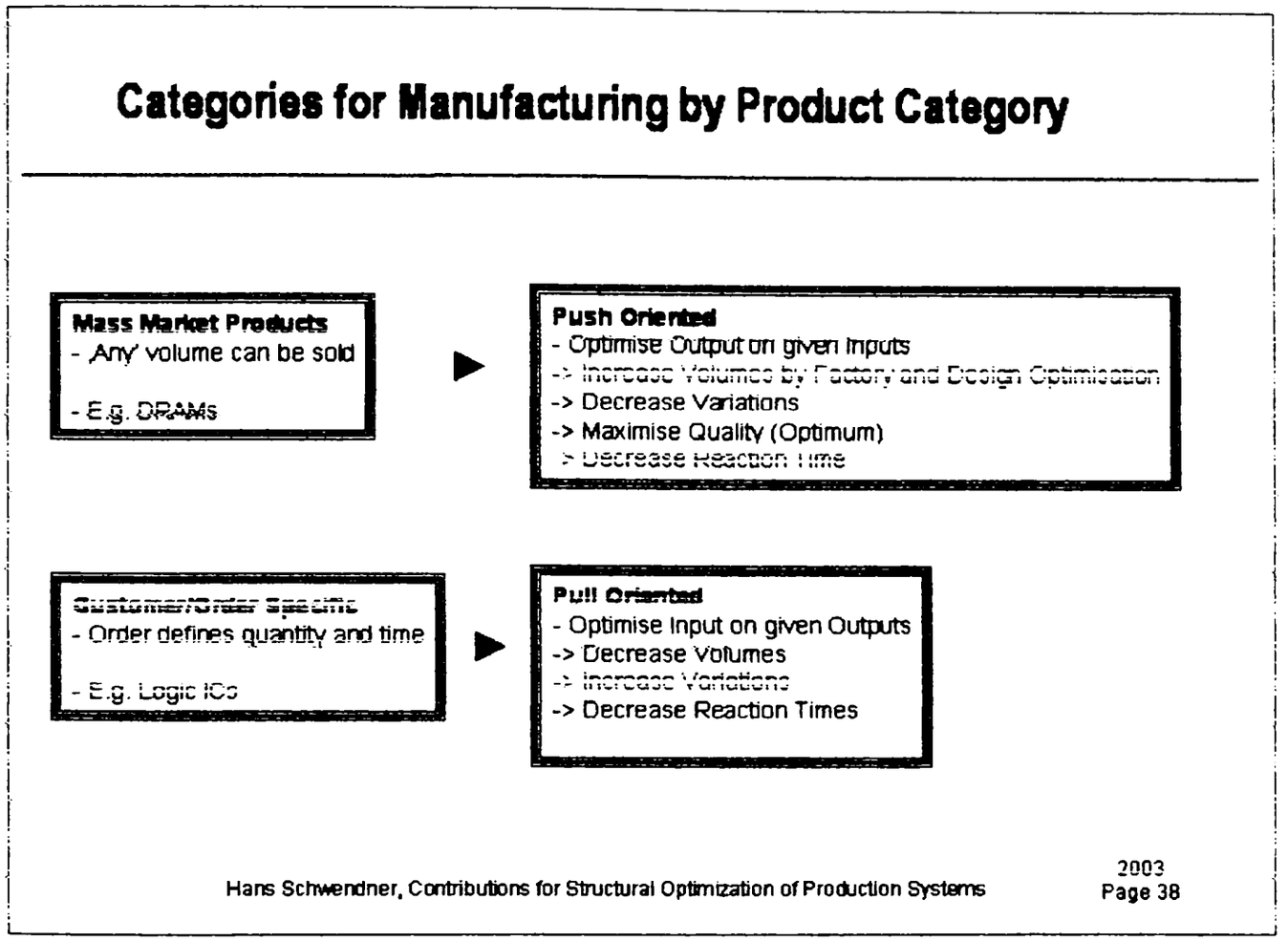
better in order to generate their own 'consciousness' that can not be copied by someone else easily and thereby stay competitive. 'Consciousness' thereby can be defined as a unique way in approaching – or thinking – the set of vision, targets, and processes.

Certainly both and a lot further options for 'generation of a culture' are valid.

Any order consist of relations and processes:

Relations and processes are the describing factors of a system for making it achieve certain targets. This is in addition to descriptive elements like competence. Enterprises have to arrange competencies in a web of required relations and along processes. Though faster they are able to arrange so, the more flexible they are and can dynamically act upon requirement. Currently most enterprises do apply an organisation chart for describing rather competencies than relationships. This element is especially important for physical structuring of an enterprise (local arrangement of know-how and equipment).

For example analysing semiconductor products by different parameters, in conventional competence thinking, on demand structure, volume, similarities, differences, etc. it can be found that two basic categories do exist.
One is the mass market products that are in high volume required on the market and virtually can be sold any time in any volume. The other category are order specific products that have a clearly defined set of parameters in terms of product specification, delivery time (=demand) and quantity. This set is defined by the customers' request and deviation does effect the customer negatively (financially in early/over delivery due to bound capital, or in bad serving of their customers due to late/under delivery).
These two sets of products could lead to the assumption to structuring a manufacturing site distinctively for either product category. Considering the management of events, measured by time, this is not necessarily being done by different management principles. Figure 5.c.3. does summarise the categories and their respective approaches.
Mass market products can be manufactured in a 'push oriented' concept that overall optimises the output in terms of maximum amount of physical products versus a given input in terms of resources and quality. The management of 'Events (Independence of Time)' can be applied in order to increase output by increasing manufacturing speed and speed of learning by short feedback loops on any deviation and their respective potential elimination.



/Figure 5.c.3.: Categories for Manufacturing by Product Category/

Order specific products can be manufactured in a 'pull oriented' concept that does respectively take the required output as basis for optimisation for required inputs. The management of 'Events' can be applied in order to decrease input resources by reduced lead times (i.e. less capital bound) and shortened feedback loops on any deviation and therefore more capability for reaction and less threshold required in terms of in line buffer inventory.

The approach of management of 'Events' does allow a combined management of those product categories at the same time, as the principal management goals are the same and are measured against the same criterion: feed back times on output versus input.

Still there is the question of internal distinct structures for manufacturing. So far companies /INFINEON/ separate most of their production locations according to the category of product. This is a matter of processes applied for manufacturing (while using the same tools for either product category) and the – as discussed above – obsolete experience of different management required. The management of 'events' superposed does allow

one management concept.

The effects to be taken into account in structuring are the time for change in combining different process flows into one local organisation. People behave according to lines of authority and conformity /MILGRAM/. Situations may appear whereby authority is given to knowledgeable technicians and not to management, and by mixing technical statements with management goals, a management structure breaks into pieces. The effect is a loss of time in execution due to resistance in decision and execution, if not executing the opposite of requirement.

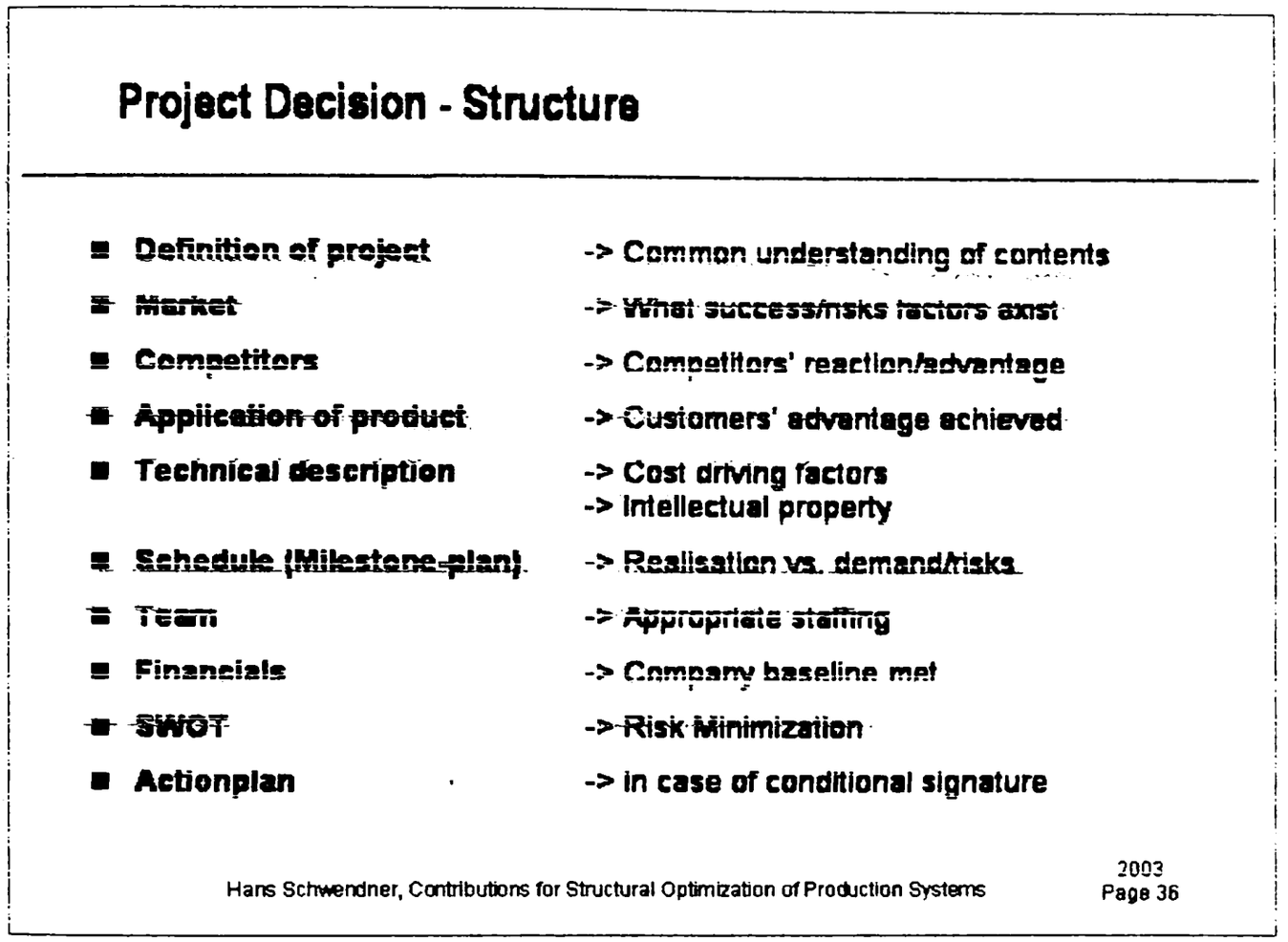
Therefore especially the attribute 'flexibility' has to take account of processes and relationships in a technical point of view and in a psychological one.

Preparation of Management Decision

The model to be developed should be accepted and applicable in management level as a tool for deriving decisions. Therefore it is important also to take a look at the preparations and topics for decision in management circles of advanced enterprises. Representing the required steps and elements a preparation for a project decision is taken as an example. There the release of resources for development and market introduction and the intended positioning of a new product are decided. For proper and transparent decision the appropriate valuations have to be presented by maximising the opportunity, keeping risks manageable and establishing a reference (plan) for measurement of execution. It is important to understand that the purpose of decision is an investment whereby a return is expected out of business in contrast to a speculative activity whereby a return is expected out of a chart analysis. Besides that the management should be occupied for the minimum of time only.

A structure developed for future oriented management circles, supporting those requirements, is shown in figure 5.c.4:.

The structure covers the three key elements for an investment decision:
- understanding the business
- management capability (team)
- financial predictability and return



/Figure 5.c.4.: Project Decision – Structure/

The first part is a 'definition of the Project' in order to describe technically contents and functionality in order to get a common understanding among the participants.
The second part does explain the market and the opportunities and risks. Generally absolute market sizes in value and in units are described with looking back several years and an outlook over product life. Additionally *major potential customers and driving factors for the market* with key events (standards approved, consortia founded, laws passed...) are evaluated. The outcome should be a set-up to approach the most important customers (from a company point of view), what potential market influencing factors have to be observed and whether risks of market fluctuations are manageable. The risks should be covered by a safety margin (= potential exit line) that allows an exit without putting the enterprise at risk.
The third part does evaluate on current and potential competitors in order to figure out lasting differentiating factors and to evaluate their potential reaction and potential new entrants with new solutions. Whenever possible benchmark cost information on comparable solutions should be integrated in this section.

The fourth part does technically and financially value the product in its application. By evaluating the functionality from a customers' point of view (how much would the customers' customer pay for the feature; also in reference what does the feature cost at a competitor) the argumentation must be clear: why should a customer buy this product. Evaluating potential cost advantages throughout the value chain (effort at incoming inspection, material, handling effort...) do complement this synthesis.
The fifth part does technically describe the method of development, acquisition of missing IP and methodology of initial manufacturing. Thereby the critical cost driving factors get transparent and the potential risks can be evaluated from the amount of 'unknown IP'. Whenever necessary, critical patent situations are to be mentioned.
The sixth part is the development plan with schedule, timeline, resources etc. Nether the less the most critical issue is the commitment of the qualified project leader to the plan and the team supporting this. The signature of all team members should document their commitment. Management should concentrate on challenging the aggressiveness of the plan (good chance to manage in time and cost, but not too relaxed) and the completeness in efforts.
The seventh part does introduce the team members.
The eighth part is the financial plan and does give the management the key parameters from project start over product life:

i. Invest
ii. Revenue (average sales price per piece)
iii. Manufacturing cost structured by main cost drivers (Margin)
iv. Key Cost parameters (yield, size, package, main supply parts, licenses...)
v. Discounted cash flow
vi. Ranking within other development projects

All those values are by periods reasonable to product life, for example quarterly in data processing peripherals or annually in TV consumer markets. The forecast period also extends for a timeframe long enough to gain a return on investment prediction with a high probability for success. Hereby stochastic has to be applied in a way that though higher the risk of predictability though higher the safety margins for covering potential risks have to be. Especially in high tech industry the predictability of future business development is very low, therefore special safety margins have to be applied.
The ninth part does evaluate the strengths, weaknesses, opportunities and threats in order to stimulate a top level view that all influencing factors are thought about.
Dependent on decision action items for important items found during the decision meeting with respective owners and schedules become integral part of the decision (sometimes this might even be a conditional signature).

According to the previous analysis there are steps along the following categories:
- management level
- execution/staff level
- overall business subjects

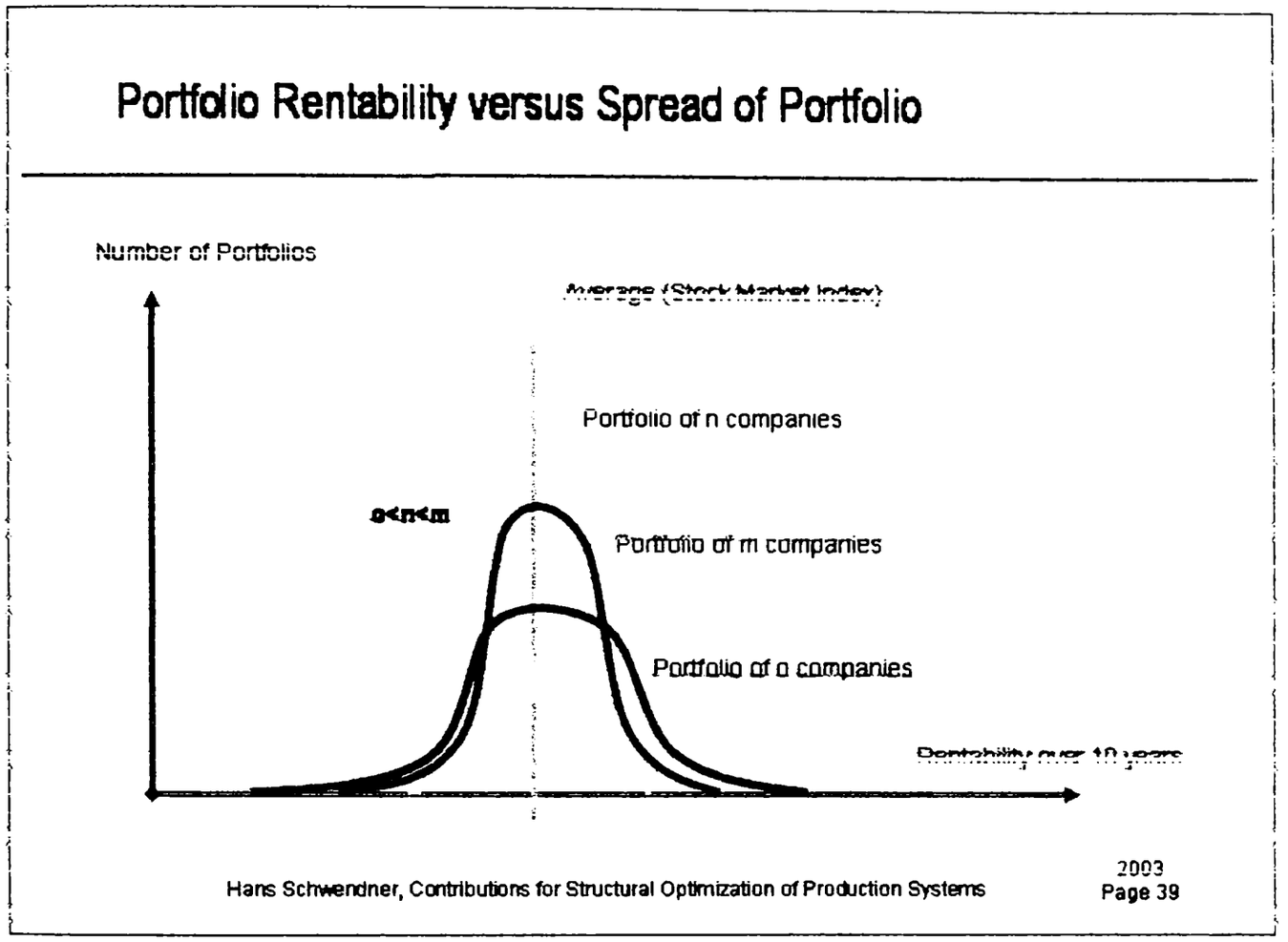
From the first two categories elements can be transferred into optimising the model further in its set-up and selection of attributes/parameters. The 'overall business description' in contrast is an issue of the aspect of common understanding and the aspect of area of investigation for options for action.
The model therefore must allow also these two aspects in terms of generating solutions that steer a discussion on 'unsought opportunities' on the one hand and on the other hand once an area of possibilities is selected it should give options for decision and simulation on future position of enterprise.

d. The Portfolio Managed

In investor community and management there is the continuous discussion on whether to focus activities or to spread activities. In the end this is an issue of safety and performance to be achieved – with the subject of contents to be managed besides 'general management performance' and its accompanying areas of investigation.

Figure 5.d.1. shows an analysis performed on a long term development of portfolios versus the performance of the stock market index /HAGSTROM/. Within the US stock market ten-year traceable companies were selected and different portfolios were built. The difference was the number of companies within the portfolio.

The conclusion is that the probability for achieving performance above average does increase with decrease of number of companies within the portfolio. In the same time the probability for being worse than average does increase with decreasing amount of companies in the portfolio. The analysis did not take transaction cost into account. This would have even decreased rentability of large amount of company portfolios.



/Figure 5.d.1.: Portfolio Rentability versus Spread of Portfolio /HAGSTROM//

For the model and valuation of potential structuring partners the complexity of task has to be weight versus management capability. Resulting performance has to decrease with increasing complexity. In the same time safety margins against negative effects have to be increased.

The above findings can be summarised in following rules:

$$\text{Potential(Success)}_{focus} > \text{Potential(Success)}_{spread} \quad \textbf{(5.1)}$$

$$\text{Effort(Risk Management)}_{focus} > \text{Effort(Risk Management)}_{spread} \quad \textbf{(5.2)}$$

e. Coherence in Models

Every building of a model is an abstraction of reality for a certain purpose. In business modelling of enterprises is not solely a matter of hard defined parameters and a coincident interpretation among a multitude of people, but in a lot of cases a rather subjective interpretation on perceptions.

Nethertheless structuring of enterprises requires building of knowledge

about the business situation and its participants to conclude the required decisions and derive actions. Different opinions have to be valuated for reasonability and anticipation of their future consequences. The model should support this task.

For further development of the model it is supportive to look at factors that drive the acceptance of soft opinion based factors. This is in order to later on simplify the model for parameters and procedures in its development and/or interpretation.
Therefore this subchapter is about belief, justification and valuation.

Generally in a business environment on the level of (also opinion) leaders and decision makers are reasonable people that usually apply two pattern for building their knowledge, opinions and beliefs. For building their knowledge each step and sub element is derived from a proven path and source. Thus knowledge should at minimum contain true cases and true theories. In case there is an element not proven within this chain these are beliefs or opinions. Still beliefs can either be revised on new reasons building up a new path of arguments and valuation or they are revised as the overall system of beliefs gets out of consistency. In most cases people are confronted with a web of beliefs that are not based on solid reasons, but can survive on the consistency in between the singular beliefs. This kind of a system can also be called dogmatic.

Over all there are more soft facts getting important in beliefs. There is the uncertainty on reasons leading to the belief, and the imprecision on predictability on the average behaviour on certain beliefs, and the consequences of such behaviour.

It is helpful in a system of beliefs (i.e. a model of soft facts) to distinguish between the relationships of explanations and the acceptance of beliefs. The relationship of explanations is also an interpretation of the relationship between beliefs. The acceptance or justification of beliefs is based on a comparison of competing structures for explanation.

Coherence is a measurable for the relationship of explanations within reasoning and in between beliefs. Applying coherence and translating it into rules for building a model means:

- at minimum for acceptance of beliefs there must be a relationship between opinion systems

- any valuation should maximise a path of reasoning whereby the explanation is true and the conclusion is true either

- any valuation should minimise cases where the explanation is true but the conclusion is wrong

- any wrong explanation must be eliminated from the opinion system

- analyse on contradictions; if the explanations and conclusions are not contradictory they need not to be checked

In general this differentiation of explanation, conclusion and their interference amongst each others may help to eliminate a lot of parameters in evaluation that are solely opinion but not fact based. Priority then can be given on facts that contribute to knowledge and discussion on facts to derive a new level of true knowledge, not just a probabilistic belief.

For a probabilistic valuation of conclusions there are three kinds of drawing a conclusion from a mayor and a minor premise:

- deductive, hereby a conclusion 'A' is derived as a subset of two premises. The conclusion does not add new information and is always true.

$$P_d(A) = 1 \qquad \textbf{(5.3)}$$

- inductive, hereby a conclusion 'A' is derived as a superset to the minor premise. The conclusion does add new information that has to be verified as it is true with a probability <1 only.

$$P_i(A) < 1 \qquad \textbf{(5.4)}$$

- abductive, hereby a conclusion 'A' is derived as a superset to the mayor premise. The conclusion adds also information, but has an even lesser probability (<<1) than the inductively derived conclusion, and thus also need verification.

$$P_a(A) << 1 \qquad \textbf{(5.5)}$$

This theoretical approach on knowledge and belief can additionally support the process of prioritising the steps upon valuation the effort for transformation of one opinion system into another, for example within a merger.

f. Observations and Conclusions

In this chapter different sciences were applied to find aspects to be taken into account for model set-up and fine tuning attributes definition and parameter selection.

The concept and subsequent processes must be set up in a way that management can focus on generating customer value in respect to enterprise requirements. Soft facts like culture and dynamics are a consequence, not the task.

Set-up of Model:

- the purpose of the business is to generate customer value
- relevant systems for the model are customer, competitor and enterprise
- the attributes must represent 'value generation' and 'value analysis'
- the customer is the reference for value
- the competitor is the reference for motivation searching for improvement in processes and business concepts
- there is no need to represent processes – targets are sufficient
- the abstraction level must be according to management
- the 'consciousness' must be derived from and for management
- the general terms used have to be defined for common understanding
- model must be capable visualise results

Parameter Selection:

- parameters selected are to represent customer value generation
- parameters selected are to represent intrinsic factors
- use descriptive language in the model allowing staff to anticipate
- parameter generation is a matter of individual knowledge reliability
- parameters do not need to represent location or communication

Valuation and Work Flow:

- potential structures and partners are to be valued on the potential for 'harmony' and the increase of 'intensity'
- potential partners require capability to perform above average
- probability on positive performance does increase with focus
- people are key for execution and are to be valuated in terms of risk and opportunity
- people do change over time (motives for doing do change according to personal situation rather than social environment)
- events must be the key for change with aggressive timelines on an increase of intensity
- valuation is on opportunity and on safety by probabilities
- valuation is to take the reliablity of 'knowledge' versus 'belief' into account
- the work flow must represent the separation of leadership and execution

6. Modelling for Structural Description of Enterprises

Within this chapter a work flow is developed to identify dedicated points for management action as a basis for structured and effective procedure through evaluation up to merger. For each of the milestones /TURBAN/ a comprehensive model is formulated. The mathmematical model is to objectivise the generation of results for evaluation of partners for cooperation and thereby to increase management efficiency for decision and during merger. The findings generated of the analysis of case studies and of leadership theory are transformed for representation in the model.
The model used is frames and the relations of homogeneous transformation. Applicability - according to its purpose - in a business environment rather than a technical environment will lead to a transfer from a formal mathematical technical description to a verbal monetary descriptive language with a verification toolset. The model evolutes from a technical effectiveness maximisation to an economic input output optimisation. Dedicated executable and quantifyable results for decision and execution of the merger are the output.

Continuously abbreviations are used whereby capital letters are applied to represent frames, vectors, matrices; small letters are applied to represent individual parameters or values, or to serve as an index (explanation of abbreviations and notations see Chapter 9.d.).

a. Purpose of the Model

The purpose of the model is to support the process of structuring an enterprise towards optimised production. First it is evaluated whether the enterprise has a deficit in competencies to provide sufficient value to the customer in comparison to competition. If these deficits are detected, structuring means the generation of customer value through combination of activities with external partners. This combination can be realised by a merger or a more loose conglomerate type of relationship like a network. The application of the model is to support management as a tool for generation of objective decision and supporting the decision process during the phases of analysis for partner requirement, selection of partner (valuation of partner) and through critical milestones of integration.

The model is based on the concept that an enterprise has the key purpose of generating customer value and to increase competiveness, as the customer and competitive cost structure are the sole long term base for money. Temporarily important influencing factors in comparison - for instance investors when a company requires new capital from the stock market or at company foundation when the sole source of money is the original fund from investors – are not synthesized in the model.

The model is targeted to fit the requirements of the high tech

manufacturing industry. The dedicated characteristics to take into account are the high volatility of the market with its cyclicality of growth, matureness and decline in relative short time – about 3 to 5 years – and the relative high investments into R&D with comparatively long lead times in relation to product life cycle. Thereby the model is to cover the elements of risk taking in a growth phase, the element of focus for maturity, and the element of shift of management concepts for declining markets for keeping the enterprise highly flexible throughout the external dynamics. These factors will be represented in parameters for the business situation.
Overall the model is generic and applicable for manufacturing industry.

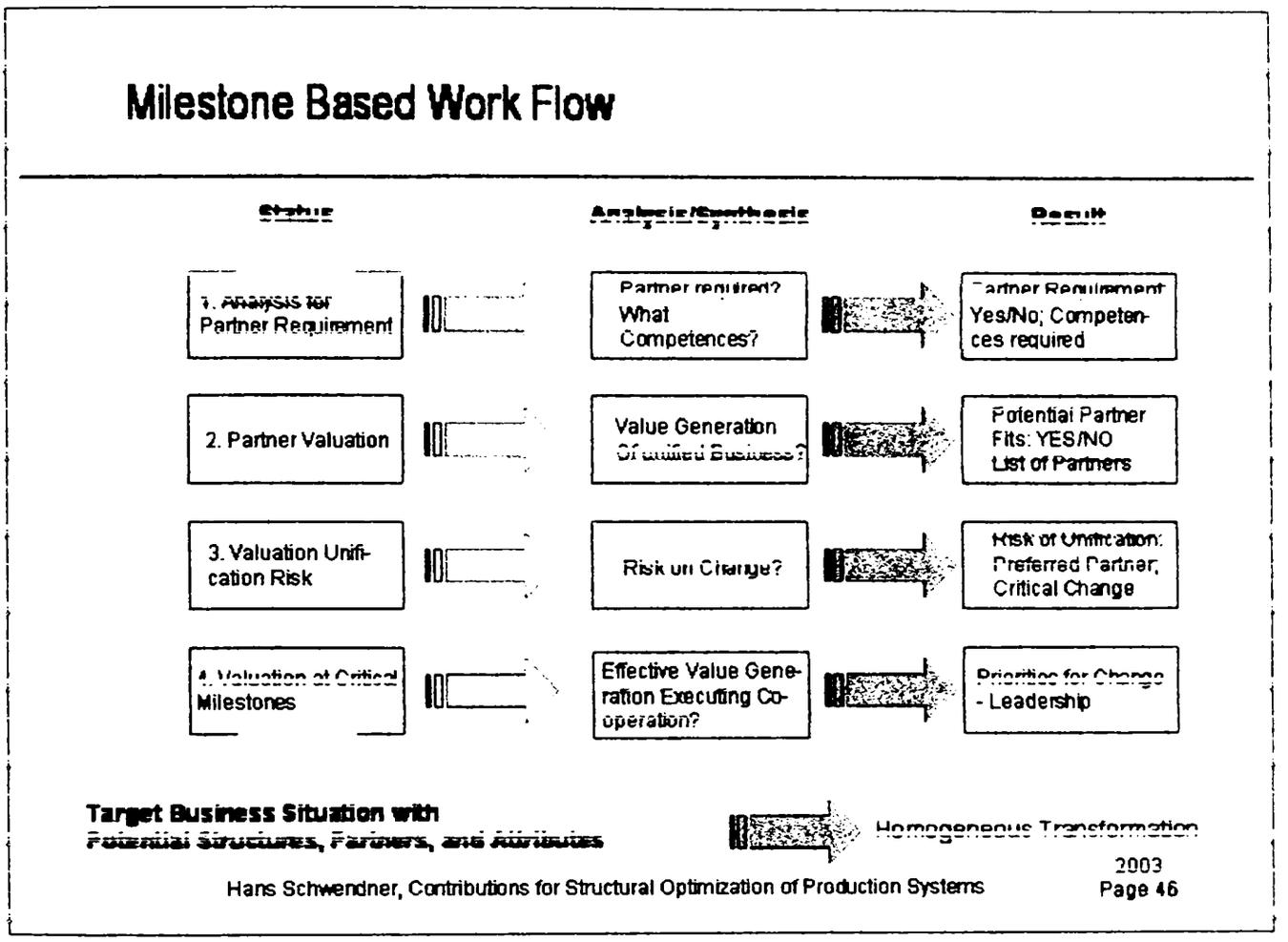
In some cases new approaches in realisation lead to market leadership. Therefore for exploring the 'unknown' the model must stimulate management to bring up questions for evaluation of potential unprecedented solutions.

b. Milestone Based Work Flow

Prior to developing a model, the complex flow starting with the status of the enterprise with the first step 'analysis for partner requirement' or synthesis for best fitting partner until the targeted business situation is achieved - joining activities with one or more selected partners to common success in 'customer value generation' - has to be structured into clearly defined steps with dedicated results. For parameter extraction from business cases a hypothetical flow was already assumed and could be verified for applicability. Following figure 6.b.1. illustrates the flow, the key questions to be answered for management , and indicates the results to be achieved at each individual milestone.

The left hand column shows the flow with the dedicated milestones. The column 'analysis/synthesis' is a descriptive model of the abstracted task to be processed at the dedicated milestone, leading to the individual result or output of the milestone.

The first milestone is the 'analysis of partner requirement'. An existing enterprise is analysed whether an enterprise is capable to achieve desired results out of its business situation. In case this is not possible structuring with an external partner is recommended. The analysis is done in reference to the customer and competition with applying assumptions on future development of the market and its participants. The evaluation also contains the synthesis for revealing what kind of partner, or more precise, what kind of competences and contributions are required.



/Figure 6.b.1.: Milestone Based Work Flow/

The questions to be processed are:
- can competition serve the customer better?
- can it serve better than own enterprise ever can do?

Through the answers of these questions the results of this milestone are at one hand a direction for the decision whether to search for a partnership or not and on the other hand the information on the scope of competence and contribution required from a partner. Especially the answer to the second question is to reveal whether the improvement in customer value generation could be done through the change of management concepts or own investments.

The second milestone is the 'Partner Valuation'. According to the output of milestone 1, scope of competences and contributions required, a set of potential partners are selected to fit these criterions. Each of the potential partners is evaluated for the unified capabilities to generate customer value competitively within its new market environment.
It will be evaluated whether the combined enterprise will achieve competitive performance in customer value generation. This is done

applying the same valuation tool as in milestone one.
The respective result is the judgement on 'customer value generation' of the combined enterprise and thus a contribution to narrow the set of potential options with verification of contributions of enterprises leading to improved performance.

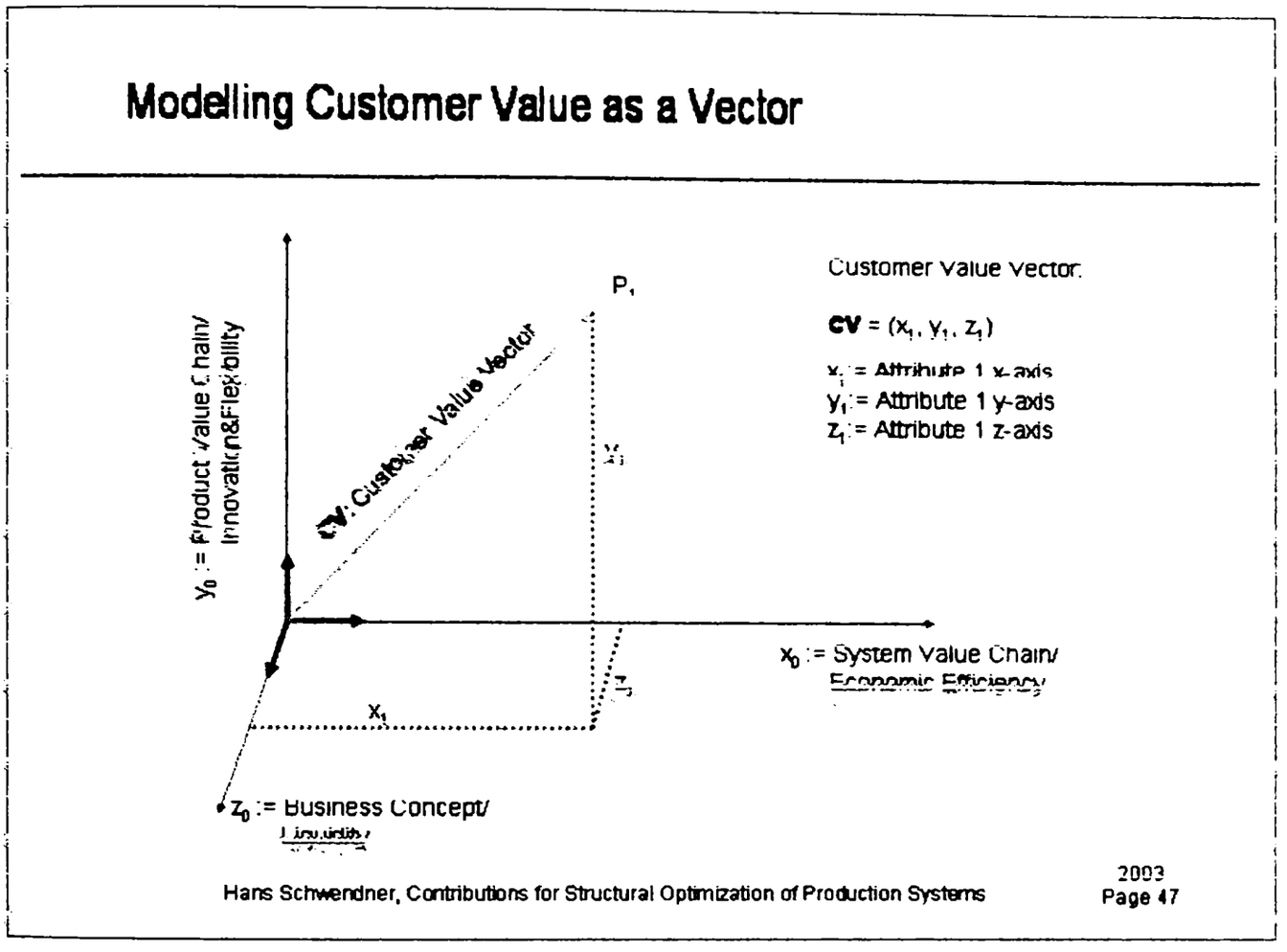
For the third milestone 'valuation of unified enterprise' each of the remaining potential partners is to be analysed on the risk in improvement in customer value generation and improvement in competiveness due to change required in structure for transaction or transformation of the partnering enterprises – the potential to execute for achieving targeted results. Secondly risk is involved in the reliability of the information the decision will be based on. According to the attributes (parameters) involved in fit and change the level of legal and financial cooperation is synthesised. Based on this analysis the decision for selction of a potential partner is done based on the least risk. Either there is a partner available then – or none.
Applying the results of chapter 5 this milestone will draw the border between targets and execution. Therefore this milestone results in analysis of execution of merger. Subsequent milestone will focus on targets in order to generate intrinsic ownership.

The fourth milestone 'valuation at critical milestones' is applied for the three sub milestones in management execution of aligning the enterprises towards one. These are sub milestones at 100d, 0.5 development cycles, and 1.5 development cycles. The critical elements within these steps are the changes to be performed to structurally enable new and improved generation of value.
Based on the inputs of the previous milestones (competences required, critical changes, and target value generated) as a result management receives prioritised parameters for action in integration.

c. Modelling of Enterprise Environment

For modelling the representation of companies as a frame is applied. This is due to the fact, that the output of this milestone requires more a comparison between systems than an analysis of links between companies (see 2.f.).

Customer value is in this model a vector representing an individual company. Figure 6.c.1. does show the one frame composed of the three attributes (axis) x_0, y_0 and z_0.



/Figure 6.c.1.: Modelling Customer Value as a Vector/

The model parameters are selected to represent self sustaining enterprises with a working customer relationship, i.e. revenues, and not a type of start-up situation with pure requirement for funding.

Out of Chapter 4 and 5 the relevant environment to be analysed for structural optimisation has to represent the customer, the enterprise itself, the most important competition (monopolys in this case are not reasonable samples for evaluation) and the potential partners. Thereby each of these companies is represented by a frame and a customer value vector.
Each frame is composed by axis that allow to calculate a 'customer value', the position vector for each of the companies, representing its final position to the sole reference, the customer.

The model of frames and vectors (customer value vectors) is applied for comparison of companies with each others. (milestone 1, 2, and 4). In milestone 3 the model is derived to calculate the risk involved in a merger by evaluation of the changes by rotation (change of view)..

Representation of Companies as Frames:

i) Frame Axis:

Each of the frames is to represent capability for customer value generation with attributes that can be generated generically. Those attributes are derived out of chapters 4 and 5 in content and tune. Each of these attributes does represent one of the frame axis.

x-axis: system value chain - economic efficiency
is the attribute of a company for its overall role the total system solution and its efficiency/competitiveness in provision of product therein

y-axis: product value chain - innovation&flexibility
this axis is the attribute of a company for its competencies along the value chain to act upon existing or anticipated demand; the value chain of a product is represented

z-axis: business concept - liquidity
the axis is the attribute of a company for its business concept and represents its capability to set up new arrangements of competencies for defining the rules in the market

Above axis define the dimension of the frames to three.

ii) Number of Frames

Customer (:= CU), enterprise (:= E), competition (:= CO), potential partners (:= PO), and unified enterprise(:= UE) are described in the same way. In order to evaluate on the own competence vs. customer expectation or competence of competition the model allows an analysis of competencies in correlation with enterprises' goals, and thus their view. The number of companies selected for representation does define the number of frames. At minimum there are four frames: customer, enterprise, competition, and potential partner.

The estimation on importance of the players does give a measurable for the number of players to be displayed and observed for the analysis. The criterion for selection the most important enterprises is market share oriented (e.g. all existing competitors up to a combined share of 70-80% of the market share). Also competitors are to be represented as frame when having an important increase in market share.
For valuation of networks all reasonable candidates and the most important players in their respective market are to be integrated into the model with an own frame.

The primary purpose of an enterprise is to generate customer value, and therefore the reference system does represent the customer. All other

frames are represented in relative position and angle to the customer's frame. Even as there are usually many customers, they can be interpreted as one frame, as the enterprise does actively select (task of sales) the type of customers it does fit best with (Darwinism). Instead of one singular customer the respective market segment then is represented by a frame. One frame represents the market segment when homogeneous, otherwise several frames represent segments in order to cover about > 70% of the market. But in return for each of the different market segments the complete milestone processing has to be done, as each customer value requires different competencies at enterprise. For a network also the reference frame is no longer the individual customer segment of the one enterprise, but the segment of the total system solution.

iii) Parameters for Scaling of the Axis and for Orientation of Frames

Despite the fact that the analysis can go to very deep details, the decision is done on very abstract criterion. Therefore the individual contributing parameters may be analysed very deeply, but still may lead to one highly condensed attribute only. The scaling of the axis follows general measurables used for the special industry segment.
The scaling is 'normalised' through generation of a list of parameters identifying the individual attribute/axis. Based on this list a scaling can be defined.

The frames do represent the individual view of the enterprises themselves. Therefore the orientation of attributes should reflect this individual valuation. Some of the competencies may not be defined exactly the same way as they are for the other market participants. This may change the angle. Still it is possible to generate the same company vector like the reference would do, but in the own reference with different coordinates.

The parameter lists for generation of the parameters for axis and rotation are generic for enterprises and for producing industry. The values are industry segment and case specific. The parameters are synthesised from the case studies in chapter 4, generalised economic terms of the five forces model of /PORTER/, evaluations for competence (production capacity) /POPA/ and others. According to the findings of chapter 5. the wording and selection of parameters is fine tuned, for example wording is chosen target oriented, there are no parameters on culture or location, as these are either a result or can be overcome by technical means, etc..

The values for the parameters represent the input data to be structured and processed for information, that can be valuated.:

x-axis: system value chain - economic efficiency
is the attribute of a company for its overall role the total system solution and its efficiency/competitiveness in provision of service or product therein

Parameter (Range of valuation 0-5)	v	a
system price is purchasing criterion		a
system patents prohibit access		
system synergies lead to cost advantages		
system synergies lead to performance advantages	v	
customers capability for backwards integration	v	a
system integration technological trend	v	
barriers in integrability in total system		
system components supply critical		a
system partners not accessible		a
Total		
Normalised		

/Figure 6.c.2.: parameters x-axis - system value chain - economic efficiency/

y-axis: product value chain - innovation&flexibility
this axis is the attribute of a company for its competencies along the value chain to act upon existing or anticipated demand; the value chain of a product or service is represented

Parameter (Range of valuation 0-5)	v	a
product performance is purchasing criterion	v	
dominance of customer		a
capability to innovate	v	
know-how transfer between customer supplier	v	
change of technology	v	
product differentiation	v	
access to distribution		a
product as system	v	
change in segments		a
reaction time in adaptation (time to market)		
forward integration more important		
alternate products gain share		
laws, regulations prohibit access		a
globalisation increases		a
Total		
Normalised		

/Figure 6.c.3.: Paramters y-axis - product value chain - innovation&flexibility/

z-axis: business concept - liquidity
the axis is the attribute of a company for its business concept and represents its capability to set up new arrangements of competencies for defining the rules in the market

change of players (customers and suppliers)	v	
margin unequally distributed		
liquidity available for investments		
brand awareness	v	a
change in value perception	v	a

mature to declining market	a
profit growth vs. revenue growth	
high cyclicity (new products relative to time to market)	a
relative market capitalisation	a
Total	
Normalised	

/Figure 6.c.4.: Parameters z-axis - business concept – liquidity/

iv) *Determination of Scaling of Axis*

Above lists (figures 6.c.5-7) represent the parameters the individual axis value is generated from. The range of value for each parameter is 0-5 with '0' meaning 'no contribution' to '5' meaning 'necessary/fully available' ('necessary' from a customer perspective; 'fully available' from an enterprise perspective –serving the customer). The value thus is determined by the question of importance to the 'need' of the customer and question of the 'contribution' of the suppliers.

v) Calculation of Scaling of Orientation

For scaling of the angles between the unit vectors for orientation (input for formula **2.4**) rules from knowledge generation are applied. There are parameters that depend on a company individual market definition or individual value perception that will be called view (v:= view).

There are three cases for valuating the view to be looked upon:
- the individual view is identical to the outsiders' view
- the individual view is not related to the outsiders' view (different valuation with no value add; parameters do not contribute to an individual view, i.e. no value foreseen for this parameter)
- the individual view is contrary to the outsiders view

According to this differentiation parameters indicated with a 'v' (v:= view) are related with and contribute to the individual view for the orientation of the axis (yellow marking). These view parameters then are filled with the values 'identical' (i:= identical) or 'contradictory' (c:= contradictory) to the customers view.

The resulting scaling then can be determined within two angle values:
- zero degrees, parallel in same direction <-> identical view
- 180 degrees; anti parallel <-> contradictory view (company vector still has same orientation as a result)

The angle of 90 degrees (perpendicular unit vectors/axis) has the special meaning of 'no value add' as the cosine of 90 degrees equals zero.

vi) Calculation of Customer Value Vector

The number of parameters hit and their valuation does result in the individual attribute value for the company. The individual attribute values for one company identify the '**CV**:= customer value vector' for this company.
The values of attributes x_i, y_i, and z_i are calculated as the arithmetic mean of the respective parameters $p_{x,y,z}$.

$$\mathbf{CV} = [x_i, y_i, z_i] = [\text{MEAN}(p_x), \text{MEAN}(p_y), \text{MEAN}(p_z)) \quad \textbf{(6.0)}$$

The value (length) of **CV** is:

$$|\mathbf{CV}| = (x_i^2 + y_i^2 + z_i^2)^{1/2} \quad \textbf{(6.1)}$$

vii) Calculation of Anticipated Accessibility Capabilities

Parameters indicated with an 'a' (a:= accessibility) contribute to the scaling factor of this attribute. The parameters are selected representing a dedicated customer-supplier relationship (green marking). The valuation is regarding the capability to change the own contribution to customers' need. *The range is also from 0-5 with '0' meaning 'not possible at all' to '5'* meaning 'possible seamlessly'.
The scaling factor is normalised by calculation of the arithmetic mean value and its division by 2.5.

$a_{x,y,z} = \text{MEAN}(a_i)/2.5$; (accessibility for x,y,z-axis; a_i individual parameter accessibility; i index for all elements of the parameter set) **(6.2)**

Thereby values below 1 mean a decrease in customer value by own capabilities and values above 1 mean an increase in customer value. The 'accessibility scaling' of the companies' CV is calculated according to the scaling formulas **(2.6)** and **(2.7)**. With *A* meaning the scaling matrix with the 'accessibility factors'.

$$\begin{vmatrix} a & 0 & 0 & 0 \\ 0 & b & 0 & 0 \\ 0 & 0 & c & 0 \\ 0 & 0 & 0 & 1 \end{vmatrix} = A$$

(hereby $a = a_x$, $b = a_y$, $c = a_z$)

$CV = [x, y, z, 1]^T$, $CV_a = [ax, by, cz, 1]^T$

$CV_a = A\ CV$

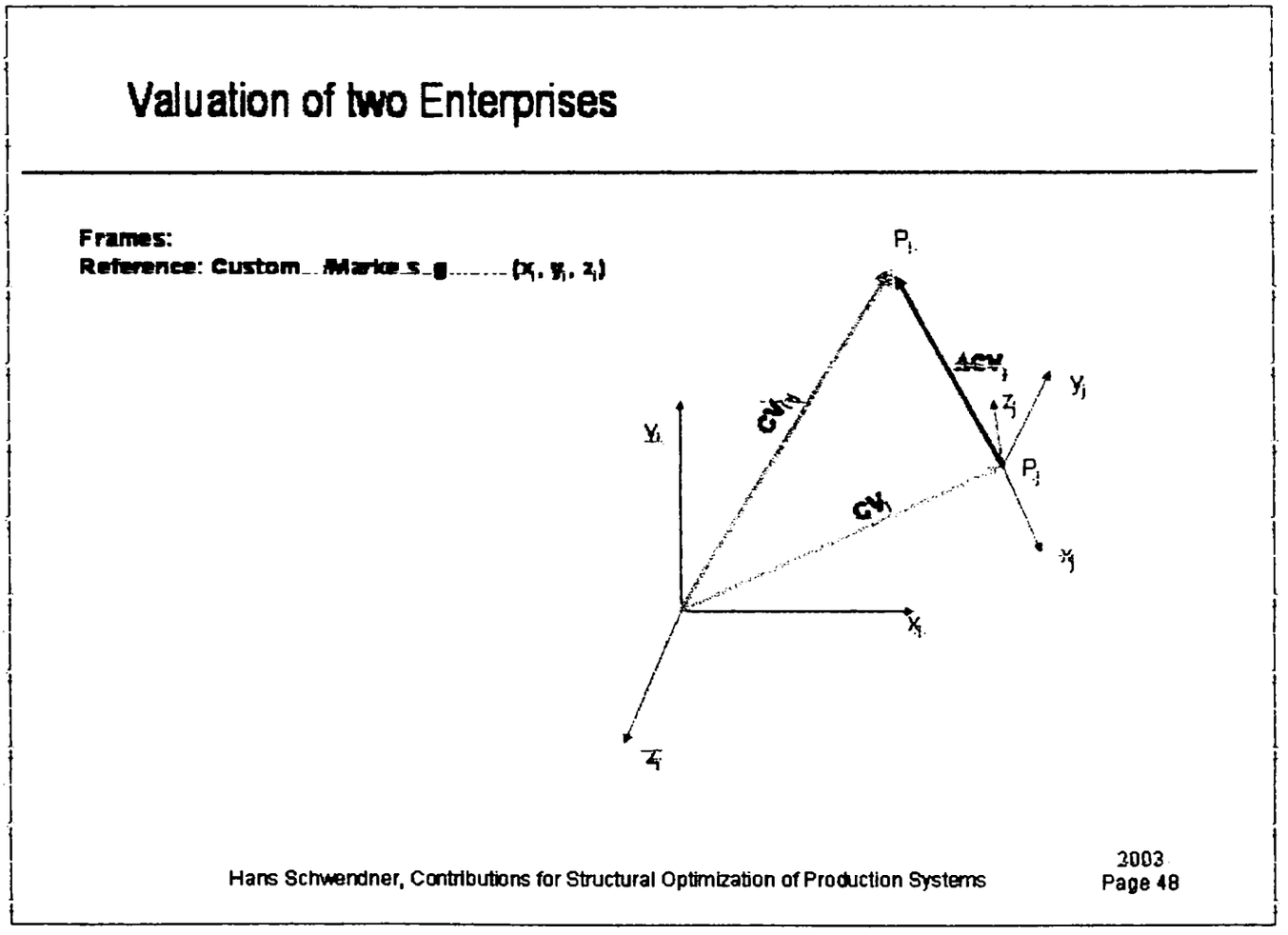
$[ax, by, cz, 1]^T = A\ [x, y, z, 1]^T$

(a:= accessibility; used as an index when at a lower position)

d. Analysis/Synthesis for Structural Optimisation

l) Milestone 1 'Analysis for Partner Requirement'

At this milestone an existing enterprise is analysed whether a partner is required to achieve desired results (customer value generation and competitiveness) out of its current business situation respectively own competence. The mathematical model required is to reflect the enterprise in reference to the customer and in reference to competition with applying assumptions on future development of the market and its participants (accessibility).
For evaluation whether a partner is required **ΔCV** is calculated put in reference with customer and competition and then evaluated for required contributions of a potential partner. Following figure represents the frames and vectors for the comparison.



/Figure 6.d.1.: Valuation of two Enterprises/

The evaluation also contains the synthesis for revealing what kind of partner, or more precise, what kind of competences and contributions are required.

The questions to be processed are:
- can competition serve the customer better?
- *can it serve better than own enterprise ever can do?*

Through the answers of these questions the results of this milestone are at one hand a decision whether to search for a partnership or not and on the other hand the information on the scope of competence and contribution required from a partner. Especially the answer to the second question is to reveal whether the improvement in customer value generation could be done through the change of management concepts or own investments.

The mathematical model developed for this milestone will be able to serve for computation and valuation in milestone 2 'Partner Valuation', as the questions to be processed are the same as for this milestone.

Following the flow for the application of the model is described:

Valuation (generation of parameter values)	- i)	<-|
Input Data	- ii)	|
Mathematical Model	- iii)	|
Output Data	- iv)	|
Valuation	- v)	|
Decision	- vi)	|
Verification	- vii)	-------|

i) Valuation (Generation of Parameter Values)

The first valuation done is to evaluate on the kind and number of frames required.

ii) Input Data

The data for the input are the numeric (value and accessibility) and view values for the parameters for each of the frames.

iii) Mathematical Model

- The customer value for each of the companies is calculated **(6.0)**
- The accessibility scaling is calculated **(6.2, 2.6)**
- The scaled **CV**'s with accessibility are calculated **(2.7)**

The comparison between two companies is done by calculation of their

value (length):
$|\Delta \mathbf{CV}_{ij}| = |\mathbf{CV}_i| - |\mathbf{CV}_j|$ **(6.3)**

For further valuation (comparison) of the companies the **CV**'s values are calculated.
For search of characteristics of a potential partner
$\Delta \mathbf{CV}_{cu\,e} = \mathbf{CV}_{cu} - \mathbf{CV}_e$ is calculated

iv) Output Data

The output is:
- $\mathbf{CV}_{cu}$: Customer Value Vector for the Customer
- $\mathbf{CV}_{co}$: Customer Value Vector for the Competitor
- $\mathbf{CV}_e$: Customer Value Vector for the Enterprise
- $\mathbf{CV}_{po}$: Customer Value Vector for the Potential Partner *)

- $\mathbf{CV}_{aco}$: Customer Value Vector – accessibility - for the Competitor
- $\mathbf{CV}_{ae}$: Customer Value Vector – accessibility - for the Enterprise
- $\mathbf{CV}_{apo}$: Customer Value Vector – accessibility - for the Potential Partner *)

*) Parameters and **CV**'s of potential partner are valuated at this stage only in case the decision is done already to search for a partner. Otherwise these data are calculated in milestone 2.

For each **CV** the value $|\mathbf{CV}|$ is an output data.

- $\Delta \mathbf{CV}_{cu\,e} = [\Delta x, \Delta y, \Delta z]$

v) Valuation

The output data are valuated by rules for generating the decision whether a deficit in customer value contribution can be solved through change in business concept or whether partnering to any extent is recommended.

The rules derived of a descriptive word model of the enterprise environment for evaluation on partnership recommendation are as follows:

(I) can competition serve the customer better
(II) can competition serve better than own enterprise ever can do
(I) := true $\wedge$ (II):= true => recommendation for partnering **(6.4)**

(6.4) (I) and (II) are transformed into formulas **(6.5)** and **(6.6)** whereby the competence to serve the customer (generate customer value) is reflected in the different delta values of the **CV**'s:

(I): $|\Delta \mathbf{CV}_{cu\,co}| < |\Delta \mathbf{CV}_{cu\,e}|$ **(6.5)**
(II): $|\Delta \mathbf{CV}_{cu\,co}| < |\Delta \mathbf{CV}_{cu\,ae}|$ **(6.6)**

Valuation for attributes required by partner:

$\Delta \mathbf{CV}_{cu\,e} = [\Delta x, \Delta y, \Delta z]$

Further options to identify the characteristics of the required partner can be generated by applying a frame transformation. The required partner may have a different frame.

Thereby $\Delta \mathbf{CV}_{cu\,e}$ is expressed in the frame of the required partner "rp".

The transformation matrix E_{rp} for the potential partner then is determined by the cosine values of the potential partner's frame and the transformed enterprise vector:

$$\begin{vmatrix} Cx1x0 & Cy1x0 & Cz1x0 & 0 \\ Cx1y0 & Cy1y0 & Cz1y0 & 0 \\ Cx1z0 & Cy1z0 & Cz1z0 & 0 \\ 0 & 0 & 0 & 1 \end{vmatrix} = Erp$$

(Cx1x0 in E is equivalent to x_1x_0 and does represent the cosines of the angles between the unit vectors. *E* represents the transformation matrix from a frame '1' into '0' as all coordinate vectors and translation do describe frame '1' but are represented in frame '0'. '0' hereby is the customers' frame and '1' is the enterprise' frame.)

So far $\Delta \mathbf{CV}_{cu\,e}$ *is expressed in the frame of the customer.*

To express $\Delta \mathbf{CV}_{cu\,e}$ in the frame of the "required partner", following equation applies:

$${}^{rp}\Delta \mathbf{CV}_{cu\,e} = Erp^{-1} * \Delta \mathbf{CV}_{cu\,e} \qquad \textbf{(6.7)}$$

${}^{rp}\Delta \mathbf{CV}_{cu\,e} = [\Delta x_{rp}, \Delta y_{rp}, \Delta z_{rp}]$

$\Delta x_{rp}, \Delta y_{rp}, \Delta z_{rp}$ do represent the characteristics of the required partner.

A valuation is performed on the criterion that $\Delta \mathbf{CV}_{cr}$ (cutomer value critical) synthesized must be closest to $\Delta \mathbf{CV}_{cu\,e}$:

$\Delta \mathbf{CV}_{cu\,e} = \{MIN\ (|\Delta \mathbf{CV}| - |\Delta \mathbf{CV}_i|)\}$; i indicates number of all Δ's derived **(6.8)**

i) Decision

For recommendation of a partnership **(6.4)** must be true; in this case the model does deliver the output (:= the decision) 'recommendation to search

for a partnership = YES'. In case **(6.4)** is false the model delivers the output 'recommendation to search for a partnership = NO'

The search for partnership follows the direction of the minimum delta **(6.8)**.

vii) Verification

Verification at this stage is done by generating an input for management discussion. In management in general the output of a model is to be dicussed and to be verified. Therefore management will get an input for discussion, valuated information that does guide the discussion towards the critical parameters. This input on the one hand are 'competences required' and on the other hand are deviations between customer, competitor and enterprise parameters in combination with guided questions.

Synthesis for Competences Required

This step is on the question 'what competencies are required by a potential partner?'. The result for this synthesis is generated by extracting the set of competencies Q with all parameters 'p' with relevant deviation between customer value and enterprise.
The set of parameters on competency Q(p) required is defined by calculating and referencing the mean value of deviation:

$$Q(p) = \{p|\ (V(p_{cu}) - V(p_e)) > MEAN(|V(p_{cu}) - V(p_e)|_{x,y,z})\} \qquad \textbf{(6.9)}$$

Hereby following meaning applies:
$V(p_{cu})$: numeric value of the parameter of customer value
$V(p_e)$: numeric value of the parameter of enterprise

This means that the closer the enterprise gets in generating customer value on this attribute, the finer the selection does get (the difference between customer and enterprise diminishes).

The compiled competencies are processed on own capability for solution (change of business concept, etc.) this is done by reducing the set of competencies by the ones that have an accessibility of >=4 (Q": potential own solution).

$$Q''(p) = \{p|\ V(p_{ea}) >= 4\}$$
$$Q'(p) = Q(p) - Q''(p) \qquad \textbf{(6.10)}$$

Q'(p) finally represents the set of competences a potential partner should cover.

Relevant Parameter Deviations – Guided Questions

The verification and discovery of new opportunities are to be guided by an

additional set of parameters that are derived by:

- (highest) deviation in accessibility with competitor
- deviation in view
- (highest) deviation between vector attributes of competitor and enterprise

The set of parameters for discovery 'DIS(p):= set of parameters for discovery' can be calculated according to following formulas:

$$DIS'(p) = \{p| \; |V(p_{co\,a}) - V(p_{e\,a})| > MEAN(|V(p_{co\,a}) - V(p_{e\,a})|_{x,y,z})\}$$
$$DIS''(p) = \{p| \; View(p_{co}) <> View(p_e)\}$$
$$DIS'''(p) = \{p| \; |V(p_{co}) - V(p_e)| > MEAN(|V(p_{co}) - V(p_e)|_{x,y,z})\}$$
$$DIS(p) = DIS'(p) + DIS''(p) + DIS'''(p) \qquad \textbf{(6.11)}$$

Hereby following meaning applies:
$View(p_{co})$: value of view of parameter of competitor
$V(p_{co\,a})$: numeric value of the parameter for accessability of competitor
$V(p_{e\,a})$: numeric value of the parameter for accessability of enterprise

The total set of parameters evaluated 'EV(p)' then is the sum of the competences required and the parameter set for discovery:

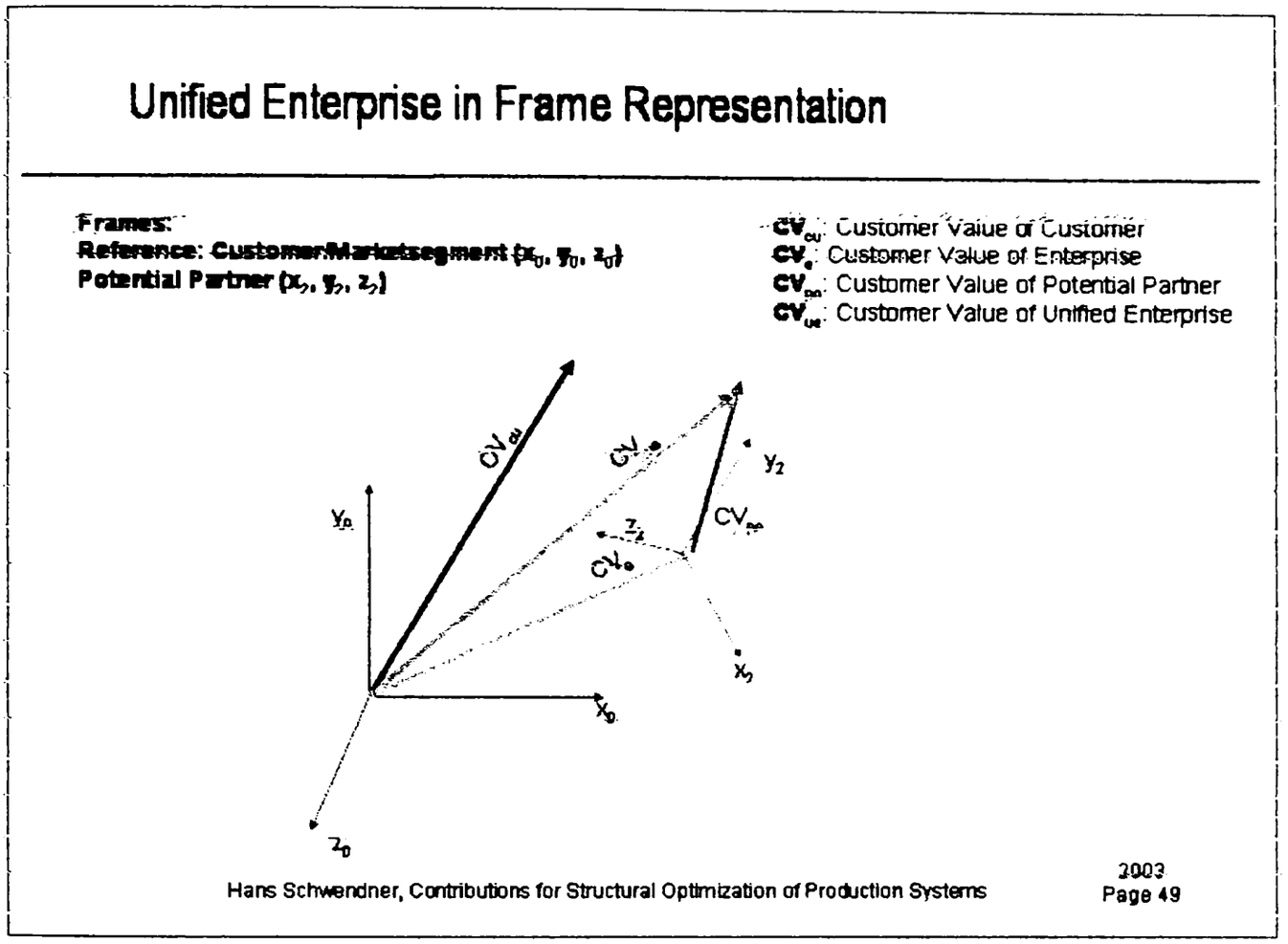
$$EV(p) = DIS(p) + Q'(p) \qquad \textbf{(6.12)}$$

Guidance for questions regarding change in business concept and leadership are derived of the opportunity star (chapter 5.d.):

- is independence of location taken into account
- can targets be harmonised (especially through management harmony)
- are processes considered or targets
- does intensity increase within the area of activity

II) Modelling Milestone 2 'Partner Valuation'

The second milestone is the 'Partner Valuation'. According to the output of milestone 1, 'scope of competences and contributions required', a set of potential partners is selected to fit these criterions. Hereby partnering is the option to increased customer value generation. Within this milestone a set of unified enterprises is generated that consists of the calculated CV's of the potential partners with the enterprise. Accordingly all unified enterprises then are analysed for their capability for customer value generation and competitiveness within their new market environment. The analysis is performed using the model of frames.
The unified enterprise thereby is calculated by adding the transformed vectors of the enterprise with each individual potential partner. Following figure shows the addition of customer value vectors for an unified enterprise.



/Figure 6.d.2.: Unified Enterprise in Frame Representation/

The valuation follows the same rules and parameters as for milestone 1 - the unified enterprise in reference to the customer and versus remaining competition calculated on vector lengths. The respective result is a contribution to narrow the set of potential options with verification of contributions of enterprises leading to improved performance.

Following the flow for the application of the model is described:

Valuation (generation of parameter values)	- i)	<-|
Input Data	- ii)	|
Mathematical Model	- iii)	|
Output Data	- iv)	|
Valuation	- v)	|
Decision	- vi)	|
Verification	- vii)	---------|

i) Valuation (Generation of Parameter Values)

The first valuation done is to evaluate the cosines of the angles between

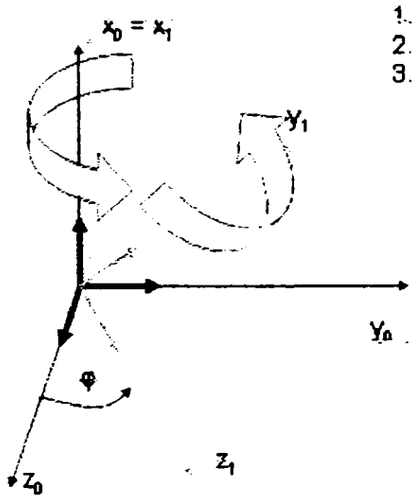
the unit vectors for formula **2.4**.

The view of the parameters of an is interpreted as an orientation of an axis. When there are several frames they may have a different views and therefore there are different angles between their axis.
The economic interpretation is, that businesses realise their output based on different processes and different technologies that may or may not be compatible or complementory to each others. A change in view also can be interpreted that a certain weakness is compensated by another strength from a complementary attribute. Therefore a rotation of a frame can be interpreted that the contribution of attributes to the overall same output is changed.

Rotation of Frames – Transformation Matrix

Procedure for Transformation (Euler-Angles):

1. Rotation around x_0-axis angle φ: result system x_1, y_1, z_1
2. Rotation around y_1-axis angle ψ: result system x_2, y_2, z_2
3. Rotation around z2-axis angle χ: result system x_3, y_3, z_3



Transformation Matrix (System 3 in 0):
interpretation by cosinus between unit vectors:

$$\begin{vmatrix} C3x0 & C3y0 & C3z0 \\ C3x1 & C3y1 & C3z1 \\ C3x0 & C3y0 & C3z0 \end{vmatrix} = E$$

Transformation Matrix (System 3 in 0):
Interpretation by Euler angles:

$$\begin{vmatrix} C\psi C\chi & -C\psi S\chi & S\psi \\ C\varphi S\chi + S\varphi S\psi C\chi & C\varphi C\chi - S\varphi S\psi S\chi & -S\varphi C\psi \\ S\varphi S\chi - C\varphi S\psi C\chi & S\varphi C\chi + C\varphi S\psi S\chi & C\varphi C\psi \end{vmatrix} = E$$

C:= cosine
S:= sinus

Hans Schwendner, Contributions for Structural Optimization of Production Systems 2003 Page 48

/Figure 6.d.3.: Rotation of Frames – Transformation Matrix/

The frames can be transformed into each others by calculation of the individual elements of the transformation matrix. For example the side elements of the matrix can be determined once the values of the main diagonale are determined. (deduction of the formulas of equality of the elements of the transformation matrices *E* - see above figure).

$C\psi C\chi = Cx_3x_0$, etc. for the three elements of the main diagonal

-> all sinus and cosines values of the Euler angles can be calculated from above three equations.

-> side elements for the Transformation matrix then are calculated.

The angles of the main diagonale are approximated by the number of views different. The program listed in the attachment does numerically calculate the side elements on input of the main diagonale in a certain interval where a Transformantion does exist (also see table on values). When several or *no solutions for the matrix are available an aproximated matrix must be* chosen most suited to reflect the mentioned business relationships of attribute contributions.

The interpretation of orientation is applied for the potential partner, as his 'view' on the competences does influence the effect on the contribution to the unified enterprise. The cosine is calculated by appreciation of the deviation in view of each individual frame. This means that the number of view parameters that are 'contradictory' in their value do determine the angle between corresponding axis x_i-x_j, y_i-y_j, and z_i-z_j. Following table does express these relations:

	number of view parameters	**angle (degree)**	**cosine between x-axis**	**cosine between y-axis**	**cosine between z-axis**
x-axis	3 times 'identical'	0	1		
	2 times 'identical'	60	0,5		
	1 times 'identical'	120	-0,5		
	3 *times* 'contradictory'	180	-1		
y-axis	6 times 'identical'	0		1	
	5 times 'identical'	30		0,87	
	4 times 'identical'	60		0,5	
	3 times 'identical'	90		0	
	2 times 'identical'	120		-0,5	
	1 times 'identical'	150		-0,87	
	6 *times* 'contradictory'	180		-1	
z-axis	3 times 'identical'	0			1
	2 times 'identical'	60			0,5
	1 times 'identical'	120			-0,5
	3 times 'contradictory'	180			-1

/Figure 6.d.4.: Table of cosine values/

The calculation of the cosine for the remaining axis relations x-y, x-z, y-x, y-z, z-x, and z-y is performed by numerical computing. For the transformation matrix the most approximate value is chosen. Therby the restrictions are applied to choose main cosines only that are positive. **(6.13)**

The transformation matrix E_{po} for the potential partner then is determined by the cosine values of the potential partner's frame and the enterprise vector:

$$\begin{vmatrix} Cx1x0 & Cy1x0 & Cz1x0 & xe \\ Cx1y0 & Cy1y0 & Cz1y0 & ye \\ Cx1z0 & Cy1z0 & Cz1z0 & ze \\ 0 & 0 & 0 & 1 \end{vmatrix} = Epo$$

The transformation matrix $E_{po\,a}$ for the potential partner on accessibility then is determined by the cosine values of the potential partner's frame and the enterprise accessibility rated:

$$\begin{vmatrix} Cx1x0 & Cy1x0 & Cz1x0 & xea \\ Cx1y0 & Cy1y0 & Cz1y0 & yea \\ Cx1z0 & Cy1z0 & Cz1z0 & zea \\ 0 & 0 & 0 & 1 \end{vmatrix} = Epoa$$

(Cx1x0 in E is equivalent to x_1x_0 and does represent the cosines of the angles between the unit vectors. *E* represents the transformation matrix from a frame '1' into '0' as all coordinate vectors and translation do describe frame '1' but are represented in frame '0'. '0' hereby is the customers' frame and '1' is the potential partner's' frame.)

ii) Input Data

The data for the input is the for the potential partners and the transformation matrix for the potential partner.

iii) Mathematical Model

- The **CV** of the unified enterprise is calculated by combination of frame related **CV**'s for enterprise and potential partner:

The coordinates of the customer value vector of the unified enterprise CV_{ue} in the reference frame of customer are calculated as follows:

$CV_{ue} = E_{po} * CV_{po}$; with $CV_{po} = [x_{po}, y_{po}, z_{po}, 1]^T$
and $CV_{ue} = [x_{ue}, y_{ue}, z_{ue}, 1]^T$ **(6.14)**

$CV_{ue\,a} = E_{po\,a} * CV_{po\,a}$; with $CV_{po\,a} = [x_{po\,a}, y_{po\,a}, z_{po\,a}, 1]^T$
and $CV_{ue\,a} = [x_{ue\,a}, y_{ue\,a}, z_{ue\,a}, 1]^T$ **(6.15)**

For determination of potential partners in a network the resulting CV of the unified enterprise is composed of all the individual CVs of the potential partners. Nether the less due to increase of complexity some degradiation factors may be applied (see chapter 2.a.).

iv) Output Data

The output is:
- $\mathbf{CV}_{ue}$: Customer Value Vector for the unified enterprise
- $\mathbf{CV}_{ue\,a}$: Customer Value Vector for the unified enterprise (accessibility rated)

v) Valuation

The output data are processed in the same way and by the adopted formulas **(6.1-3)** as the valuation in milestone 1. The own enterprise is substituted by the unified enterprise.

(I) can competition serve the customer better
(II) can competition serve better than unified enterprise ever can do
(I) := false or (II):= false => recommendation of potential partner for partnering **(6.16)**

(I): $|\Delta\mathbf{CV}_{cu\,co}| < |\Delta\mathbf{CV}_{cu\,ue}|$; (II): $|\Delta\mathbf{CV}_{cu\,co}| < |\Delta\mathbf{CV}_{cu\,ue\,a}|$

vi) Decision

For recommendation of a partnership **(6.16)** must be false; in this case the model does have the output to recommend the potential partner for further evaluation.

vii) Verification

Verification at this stage is done by generating an input for management discussion. In management in general the output of a model is to be dicussed and to be verified. Therefore management will get an input for discussion, valuated information that does guide the discussion towards the critical parameters. This input on the one hand are parameters where still competence is required. This calculation can not be done on the unified enterprise, as the dedicated parameters are not available. But it is done based on relation **(6.9)** by substitution of the enterprise parameters by the potential partner's parameters.

The set of parameters on competency of the potential partner $Q_{po}(p)$

required is defined by calculating and referencing the mean value of deviation:

Applying the relations **(6.9 ff)**:
$Q(p) = \{p|\ |V(p_{cu}) - V(p_e)| > MEAN(|V(p_{cu}) - V(p_e)|_{x,y,z})\}$
$Q'(p) = Q(p) - \{p|\ V(p_{ea}) >= 4\}$

leads to parameters indicated in table 7.b.4. with 'YES' in the column 'Competence Required e' (orange marking)

$Q''(p) = \{p|\ |V(p_{cu}) - V(p_{po})| > MEAN(|V(p_{cu}) - V(p_{po})|_{x,y,z})\}$
$Q_{po}(p) = Q''(p) - \{p|\ V(p_{po\ a}) >= 4\}$

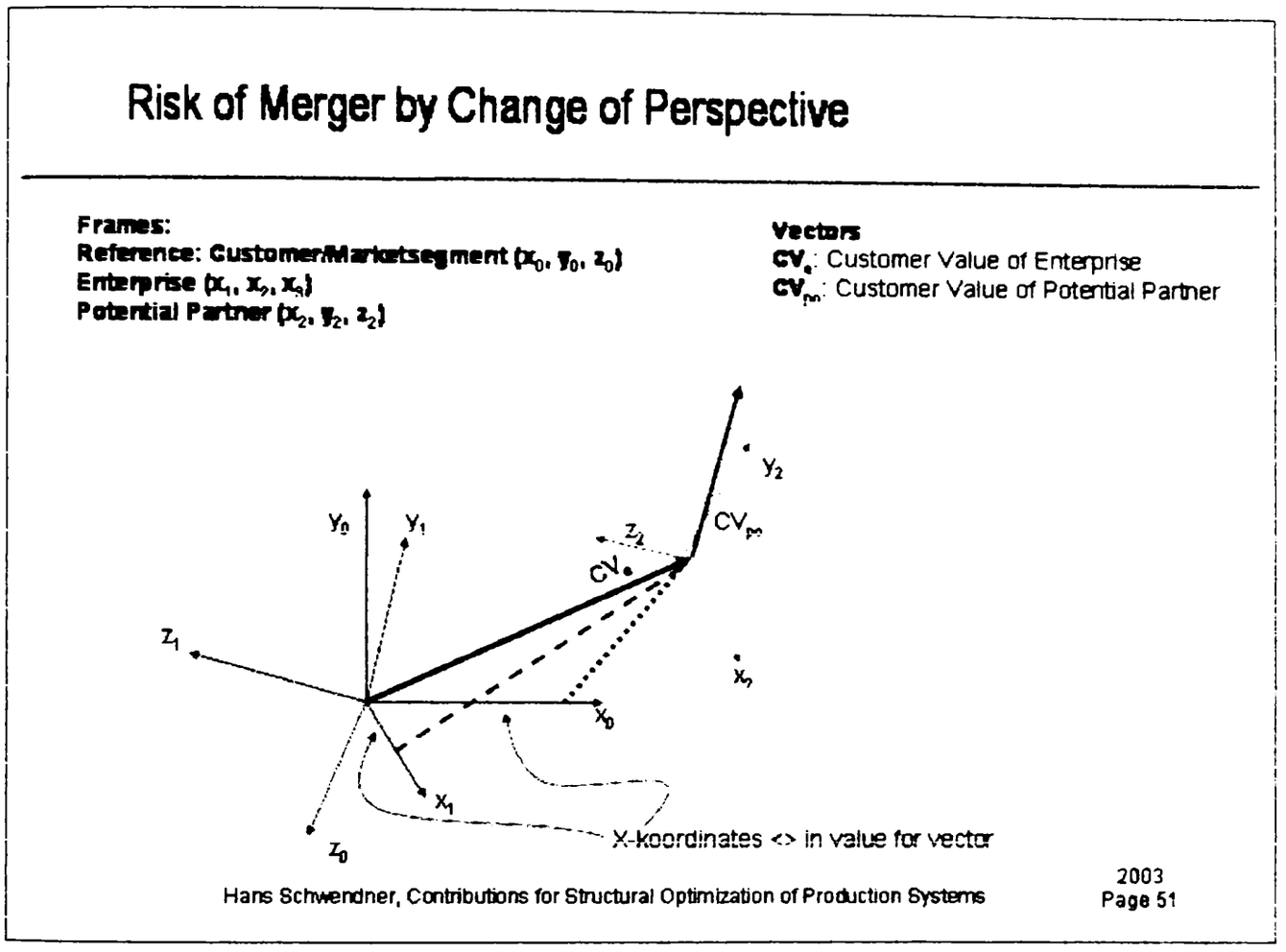
For guidance of management the competences required for the enterprise Q(p) are added to the verification. The first priority for management discussion is to be given to the set of parameters requiring competence added for the enterprise and the potential partner $Q_{prio}(p)$:

$$Q_{prio}(p) = Q'(p) \cap Q_{po}(p) \qquad \textbf{(6.17)}$$

Further verification can be performed by the guided questions of the opportunity star.

III) Modelling Milestone 3 'Valuation Unified Enterprise'

This milestone 'valuation of unified enterprise' analyses each of the potential partners on the risk in improvement in customer value generation and risk improvement in competitiveness due to change required in structure for transaction or transformation – due to difference in view and *competence*.
For valuation of the risk of change for adaptation of competences the model of frames is proposed for developed also.



/Figure 6.d.5.: Risk of Merger by Change of Perspective/

Following the flow for the application of the model is described:

Valuation (generation of parameter values)	- i)	<-|
Input Data	- ii)	|
Mathematical Model	- iii)	|
Output Data	- iv)	|
Valuation	- v)	|
Decision	- vi)	|
Verification	- vii)	---------|

i) Valuation

The model is based on the interpretation of the angles as a change of view, respectively different application of competence and different processes that are hardly compatible between the companies. Therefore the enterprise would experience change when merging with potential partner – through his frame and potential partner through the frame of the enterprise.

Therefore the inverse matrix E^{-1} for transformation of CV_{po} into the frame of

the enterprise is valuated.

And the inverse matrix Po^{-1} for transformation of $\mathbf{CV_e}$ into the frame of the potential partner is valuated.

ii) Input Data

$$\begin{vmatrix} Cx1x0 & Cy1x0 & Cz1x0 \\ Cx1y0 & Cy1y0 & Cz1y0 \\ Cx1z0 & Cy1z0 & Cz1z0 \end{vmatrix} = E$$

$$\begin{vmatrix} Cx2x0 & Cy2x0 & Cz2x0 \\ Cx2y0 & Cy2y0 & Cz2y0 \\ Cx2z0 & Cy2z0 & Cz2z0 \end{vmatrix} = Po$$

$\mathbf{CV_e}$
$\mathbf{CV_{po}}$

iii) Mathematical Model

$\mathbf{CV_e}' = Po^{-1}\ \mathbf{CV_e}^T$
$\mathbf{CV_{po}} = E^{-1}\ \mathbf{CV_{po}}^T$

Both matrices are split into a matrix with values only in their diagonals (index d) and a Matrix (index s) with values only in their side values (a_{ij} with i<>j).

$Po^{-1} = Po^{-1}_d + Po^{-1}_s$ **(6.18)**
$E^{-1} = E^{-1}_d + E^{-1}_s$
The individual contributions between the axis are calculated in order to determine the change by:

$\mathbf{CV_e}' = \mathbf{CV_{ed}} + \mathbf{CV_{es}} = Po^{-1d}\ \mathbf{CV_e}^T + Po^{-1s}\ \mathbf{CV_e}^T$
same for $\mathbf{CV_{po}}'$

iv) Output Data

$\mathbf{CV_{ed}}$
$\mathbf{CV_{es}}$
$\mathbf{CV_{pos}}$
$\mathbf{CV_{pod}}$

v) Valuation

$$risk = |CV_{es}|/|CV_{ed}| + |CV_{pos}|/|CV_{pod}| \quad (6.19)$$

Selection criterion for potential partners:

(I) Max $(|CV_{ed}| + |CV_{pod}|)$ **(6.20)**

(II) Min $(|CV_{es}|/|CV_{ed}| + |CV_{pos}|/|CV_{pod}|)$ **(6.21)**

vi) Decision

A decision to evaluate the potential partner further is done on an a ranking on valuation criterion.

Risk Model II

For detailed use in the case study the evaluation on individual parameters will be performed. Therefore a second method will be described in all details.
The risk is on the potential to execute for achieving targeted results. Additionally risk is involved in the reliability of the information the decision is based on. There is no judgement on the opportunity, as the set of competences required **(6.9ff)** and the set of evaluation parameters already guides management on parameters to look for opportunities.
The respective result is a contribution to narrow the set of potential partners to the one with the minimum risk in combination with contributions of potential partners leading to improved performance.

Dependent on the values of critical parameters legal and financial type of cooperation is judged on risk or seen in reverse – a certain level for legal and financial type of cooperation is recommended.

Following the flow for the application of the model is described:

Valuation (generation of parameter values)	- i)	<-|
Input Data	- ii)	|
Mathematical Model	- iii)	|
Output Data	- iv)	|
Valuation	- v)	|
Decision	- vi)	|
Verification	- vii)	---------|

i) Valuation (Generation of Parameter Values)

The judgment on risk also is to follow concept of the definition of an enterprise – according to customer value. The result of this valuation will be the parameters that do provide a risk in terms of change of view and in terms of the current status of the potential partner in comparison to customer and in comparison to competition. The evaluation is performed on the set of critical parameters selected Q'(p) in addition to the set of critical

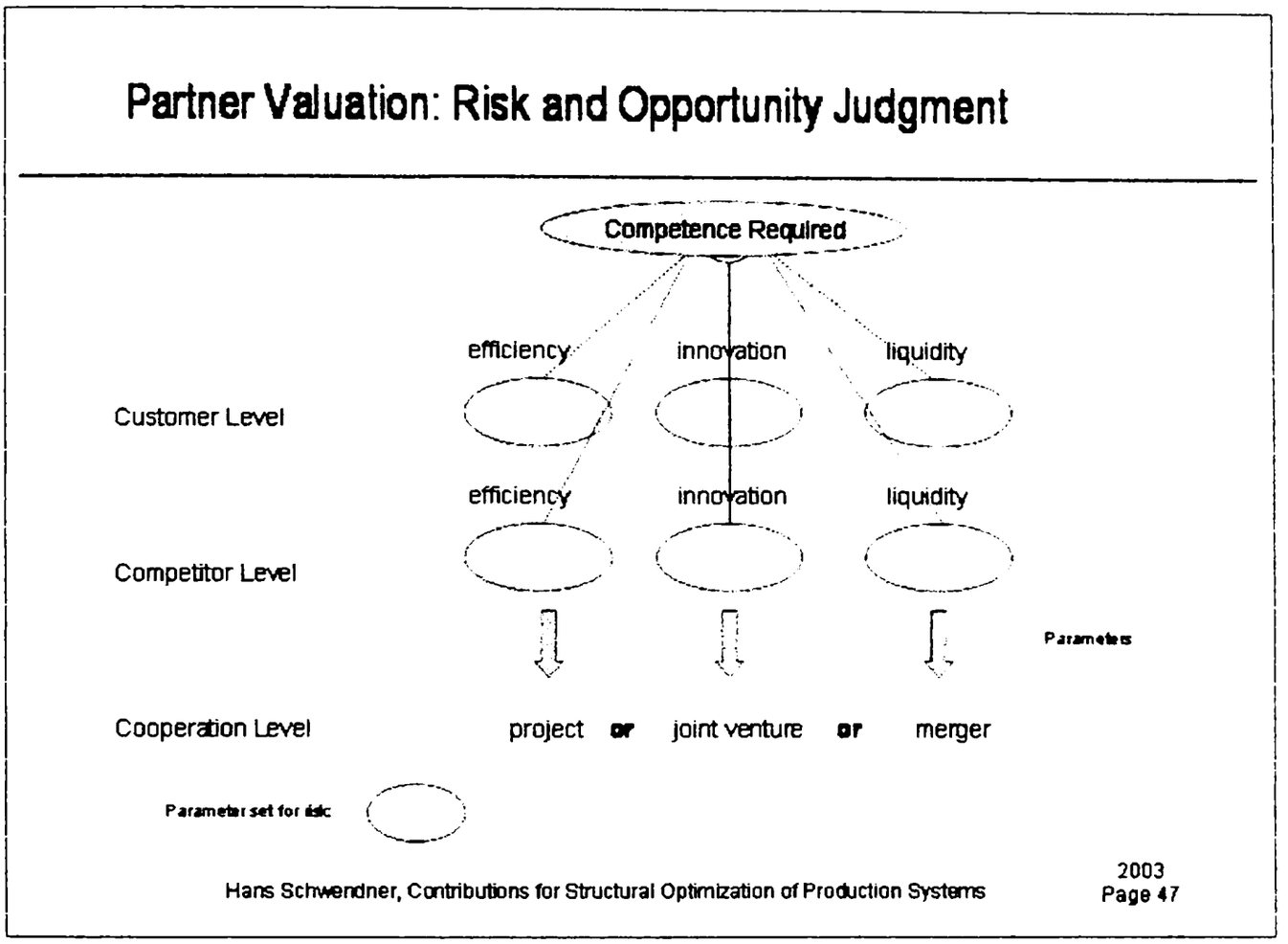
parameters $Q_{po}(p)$. Therefore the valuation will be performed in two steps:

Step 1.: Reference to customer: evaluating the competencies describing the risk of change required in comparison to CV and to own enterprise to do for alignment of structure, and the risk of loosing focus due to transformation. In figure 6.d.6. this evaluation is referenced by 'customer level'.

Step 2.: Reference to competition: evaluating the competencies describing the risk to competitors' capability to react. In this step also the risk of reliability of information is put into calculation, as it is especially difficult in some cases to obtain reasonable information about competition. Especially when targeting transformations the competitive environment may consist of new players that can not be fully judged in competence and performance. In figure 6.d.6. this evaluation is referenced by 'competitor level'.

Figure 6.d.6. illustrates the steps to be analysed from customer level via competitor level to cooperation level. Each parameter of required change will get identified and will get a certain probability for risk attached. The probability of step 2 is independent to the result of step 1 thus the steps can be represented as separate levels.

The quasi tree structure (levels) represents the combined valuation parameters of each frame axis describing the potential partner in its risk relation to the customer and competition. Through the evaluation of the branches critical parameters for risk management during a merger can be extracted. This model is a simplification for focussing (no cross correlations between the attributes) on the main issues, but is an option for steering questions from management for a wider view.
The synthesis on the level of cooperation is done in the second valuation, based on the parameters critical to change.



/Figure 6.d.6.: Partner Valuation: Risk and Opportunity Judgement/

In general risk does increase with
- increase in changes required for generation of common customer value
- uncertainty and defocus of value generation
- decrease in reliability of information
- (conditional) decrease in level of cooperation

Therefore the selection of the set of parameters for later on calculation of the risk follows the 'branches' of the tree as a rating of the potential partner through the sequence of following steps (levels):

Step 1 potential partner in reference to customer (customer level) on all three axis:

This set contains all parameters where competence is required by the enterprise – as these are the critical ones for risk. Out of these the parameters of the potential partner are selected where the value of the view is 'contradictory', all views that are different to the own enterprise' view (risk due to change required) and all parameters whose value of the potential partner are below customer parameter value. All these parameters

contribute to risk.

Thus the set of parameters for evaluation 'EP' is valuated by.

$EP = \{p | p \in Q'(p) \cup Q_{po}(p) \text{ and } (V(p_{po}) < V(p_{cu}) \text{ or } View(p_{po}) <> View(p_e) \text{ or } View(p_{po}) = \text{'contradictory'})\}$ **(6.22)**

Hereby following meanings do apply:

$V(p_{e,\ po,\ cu})$: value of the parameter for the enterprise, potential partner, customer

$View(p_{po,e})$: value of the view of parameter for the potential partner or enterprise

$\in$: Element of

Step 2 potential partner in reference to competition (competitor level) on all three axis:

This set again is a subset of the set of competences required by the enterprise and contains those parameters only where the value of the potential partner are below competitor's parameter value. All these parameters contribute to risk.

Thus the set of parameters for evaluation 'EP'' is valuated by.

$EP' = \{p | p \in Q'(p) \cup Q_{po}(p) \text{ and } V(p_{po}) < V(p_{co})\}$ **(6.23)**

Hereby following meanings do apply:

$V(p_{po,\ cu})$: value of the parameter for the potential partner or competitor

ii) Input Data

The input data are the parameter sets derived of relations **(6.22-23)**.

iii) Mathematical Model

Within this step towads the parameters of the evaluation sets EP and EP' a value for risk is attached. The parameters also are judged on their reliability of information or respectively the reference in business (deductive, inductive, and abductive). The words deductive, inductive, and abductive are translated into business terminology as follows:

- deductive := (de) coincident business concept; supplementary in system and value chain
- inductive := (in) cases in the industry and of potential partner give positive example; changes in business concept and minor changes value chain
- *abductive := (ab) assumptions on synergy and deriving ideas from other* industries; changes in business concept, value chain and synergy through system only

According to the above definitions the judgement is on risk of change for

contribution to generate customer value. The same way as for risk judgement in selection of legal framework also a first set of generic judgements on reliability of information is attached to the parameters.

The values are chosen represent generic probabilities for risk. They are synthesized from consulting companies, e.g. /EURATIO/, /McKinsey/, and /INFINEON/.
deductive: P(p) = 0,2
inductive: P(p) = 0,5
abductive: P(p) = 0,8

Following is the attachment of judgement for the semiconductor industry: (abbreviations: de: deductive, in: inductive, ab: abductive, pr: project based, jv: joint venture, mf: merger/fusion)

- 'system value chain - economic efficiency'

Parameter	**pr/jv/mf**	**de,in,a b**
system price is purchasing criterion	jv	De
system patents prohibit access	pr	De
system synergies lead to cost advantages	jv	In
system synergies lead to performance advantages	pr	In
customers capability for backwards integration	jv	Ab
system integration technological trend	mf	Ab
barriers in integrability in total system	pr	De
system components supply critical	pr	De
system partners not accessible	pr	In

/Figure 6.d.7.: Parameters x-axis information reliability/

- '*product value chain - innovation&flexibility*'

Parameter	**pr/jv/mf**	**de,in,a b**
product performance is purchasing criterion	jv	In
dominance of customer	jv	In
capability to innovate	jv	Ab
know-how transfer between customer supplier	pr	In
change of technology	mf	Ab
product differentiation	jv	In
access to distribution	jv	In
product as system	jv	De
change in segments	jv	Ab
reaction time in adaptation (time to market)	jv	Ab
forward integration more important	jv	Ab
alternate products gain share	pr	Ab
laws, regulations prohibit access	pr	De
globalisation increases	jv	In

/Figure 6.d.8.: Parameters y-axis information reliability/

- 'business concept - liquidity'

Parameter	pr/jv/mf	de,in,a b
change of players (customers and suppliers)	jv	Ab
margin unequally distributed	jv	In
liquidity available for investments	jv	Ab
brand awareness	jv	In
change in value perception	pr	Ab
mature to declining market	jv	Ab
profit growth vs. revenue growth	jv	Ab
high cyclicity (new products relative to time to market)	pr	Ab
relative market capitalisation	mf	Ab

/Figure 6.d.9.: Parameters z-axis information reliability/

The calculation of the various probabilities is done at the levels 'customer' and 'competition' each of the parameters will be valued with the probability derived out of the reliability of information. To individualise the risk for the dedicated case the total probability for success for the attribute will be calculated as an appreciated value with the customers' need.

$P(r) = (\Sigma_i V(p_{cu})*P(p))/\Sigma_i V(p_{cu})$ *with i being the number of parameters* **(6.24)**

$V(p_{cu})$:= Value of parameter of customer
P(p) := Probability of risk of parameter
P(r) := Probability of risk of attribute

Finally the potential partnership overall has to be valuated with the risk involved due to transforming/defocusing or transacting/keeping focus with the partnership.

On top of this risk judgment an overall valuation is done, whether the partnership targets a transaction or a transformation. The above risk and opportunity levels are assumed for transactions. The risk is transferred into a success (P(**S**) = (1-P(**r**))). For transformations the risk is increasing due to overall change required and their general abductive reasoning.

P(**S**) = 1-P(**r**) in case of transaction **(6.25)**
P(**S**) = (1-P(**r**)) * 0,5 in case of transformation **(6.26)**

The derating is with a value of 0,5 the same as for inductive reasoning.

iv) Output Data

The output data are risk parameters for the different potential partners.

v) Valuation

Risk Valuation:
The valuation on the different potential partners is done according to the level of risk involved. The potential partners are ranked by an apreciated product of risk (Probability of failure := P(F)). The individual risk probabilities are appreciated with the attribute values of the CV_{cu}.

$P(F) = (\Sigma_i(\text{Attribute } CV_i)*P(r_i))/2*\Sigma_i(\text{Attribute } CV_i)$; i number of parameters **(6.27)**

$V(p_{cu})$:= Value of parameter of customer
P(p) := Probability of risk of parameter
P(r) := Probability of risk of attribute

Potential Performance:
Additionally the potential partner can be valuated as a unified enterprise. Generally the potential partner is a valuable option if the combined effort leads to increased customer value generation and improved competitive position (potential to perform above average).

The potential to perform above average is rated by the individual attributes of unified enterprise's capabilities (accessibility rated) versus customer need. The customer value comparison is rated:

above average: $|\mathbf{CV}_{aue}| > |\mathbf{CV}_{cu}|$ with $x_{aue} > x_{cu} \wedge y_{aue} > y_{cu} \wedge z_{aue} > z_{cu}$ **(6.28)**
Hereby following meanings do apply:
$\mathbf{CV}_{aue}$: anticipated (accessability) customer value of unified enterprise
Word model (extended interpretation): an unified enterprise has the potential to perform above average, once all the individual attributes have the potential to surpass customer expectation.

The potential to perform outstanding is rated by the individual attributes of unified enterprise's capabilities versus competitors' capabilities.

outstanding: $|\mathbf{CV}_{aue}| > |\mathbf{CV}_{aco}|$ with $x_{aue} > x_{aco} \wedge y_{aue} > y_{aco} \wedge z_{aue} > z_{aco}$ **(6.29)**
Word model (extended interpretation): an unified enterprise has the potential to perform outstanding, once all the individual attributes have the potential to surpass competitors' anticipated potential.

Legal Framework:
The synthesis of recommended legal and financial framework is evaluating the capability to enforce certain decisions in the phase of alignment of activities. This is a valuation of change required in contrast to empowerment by legal structure to enforce change - as in emergency cases solutions are to be enforced by command and not in a team

consulting consensus oriented decision process. The level of cooperation expresses also the level of commitment of contribution and thus to support change. The level of cooperation recommended is the highest level required by the attribute parameters required to change or required to commonly contribute to the target. Each of the parameters is attached a specific recommendation for level of cooperation. The judgment for selecting the legal framework is to be read in a way that project based realisation is higher risk than joint ventures and this is higher than merger/fusion. This level judgement is individual per attribute as attributes are individual in weight for the contribution to the cooperation. A generic structuring recommendation is attached to the parameter and indicates the level of cooperation required to manage cooperation at minimum risk. This generic approach is applied to generate a recommendation for level of cooperation, even as the kind of cooperation is conditional to other parameters and thus may require a second run in evaluation.

vi) Decision

Selection of legal and financial framework:
The recommended level of cooperation is derived by the selection of the potential partner with the least risk . The highest level of cooperation required within these parameters is the level recommended.

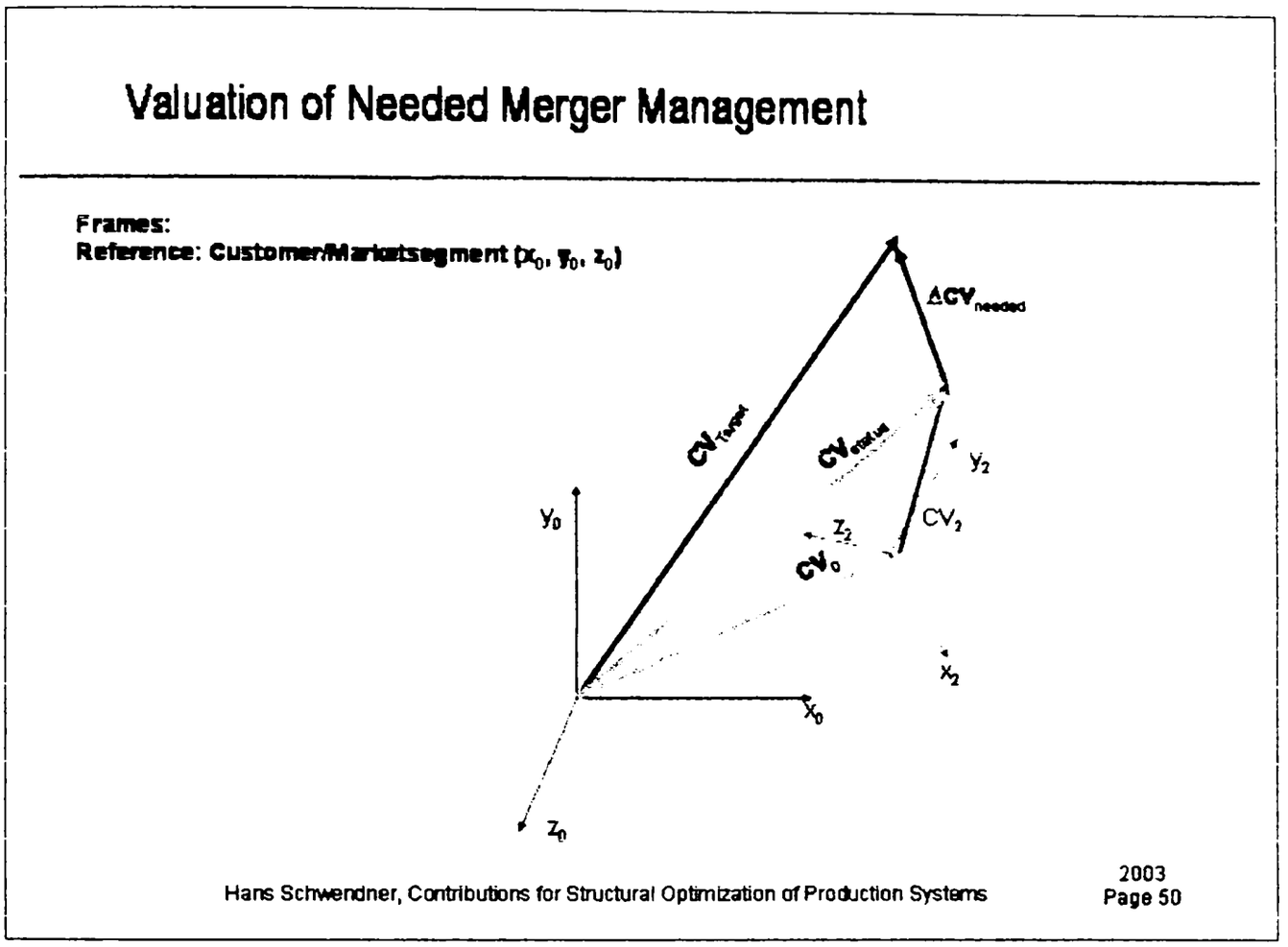
Selection of Potential Partner
From different options for partnership in general the one with the lowest probability on risk and the highest potential in performance is considered.

(vii) Verification

The selection of the potential partner is a key critical decision. Therefore a final synthesis on level of cooperation is required, done in a management discussion.

IV) Modelling Milestone 4 'Valuation at Critical Milestones'

This milestone 4 'valuation at critical milestones' is applied for the three sub milestones in execution unifying the enterprises towards one. The milestones are directly related with dedicated targets given by management and therefore will lead to quantifyable results.
The milestones are at 100d, 0.5 development cycle, and 1.5 development cycles.
The delta between a target and the status of a company is calculated and evaluated for evaluation of competencies to improve. The status thereby is the vector of the merged enterprise.



/Figure 6.c.10.: Valuation of Needed Merger Management/

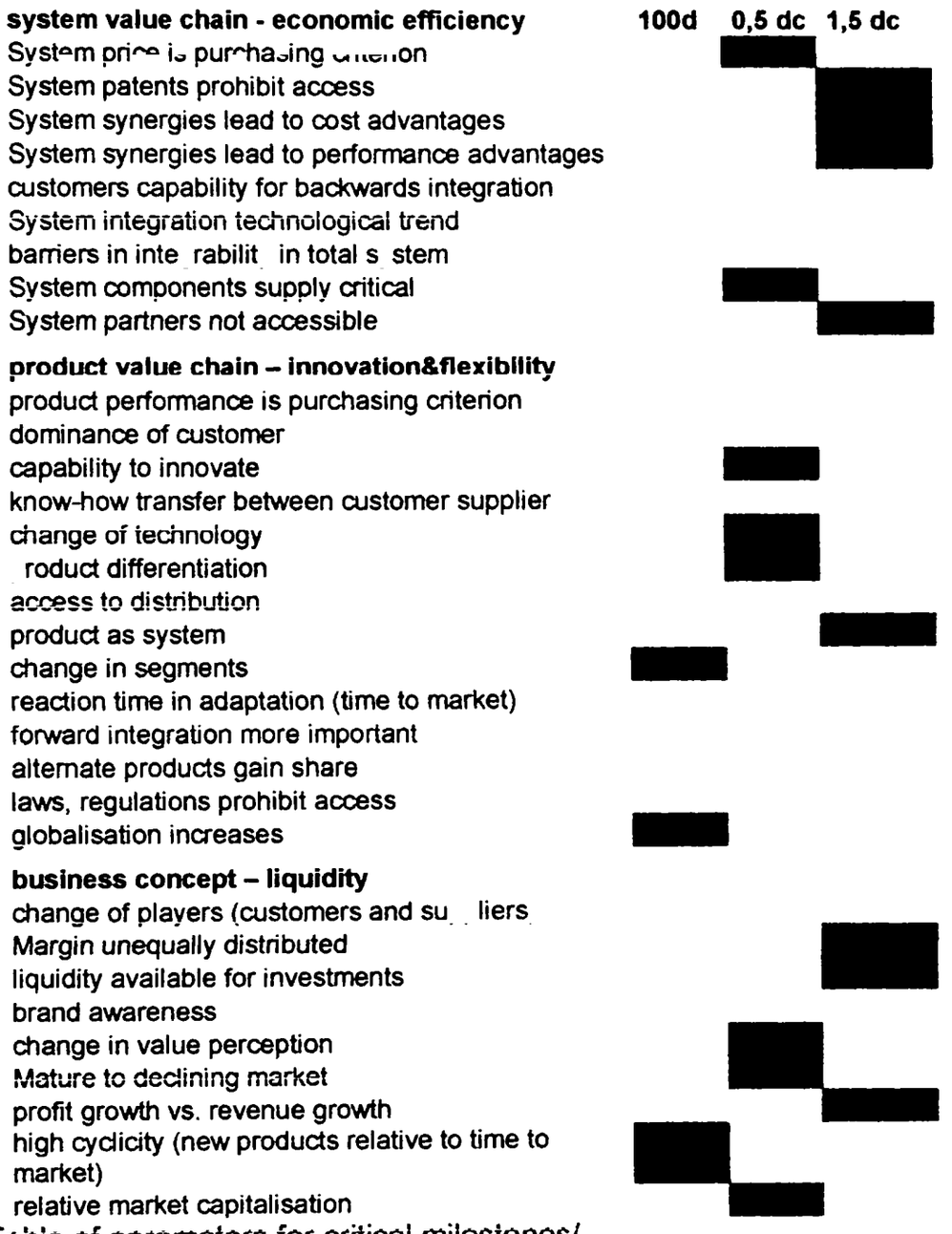
At a certain point in time status of the unified enterprise is represented as a vector and in the same way management sets a target vector to be reached at the milestone. The delta of these vectors is the input to derive the required parameters for change. In this case the frame perspective remains the same, as the delta vector is in the same perspective (same enterprise) as the status vector. The critical elements within these steps *are the parameters for structurally enabling new and improved generation* of value and increase of competiveness.

Following the flow for the application of the model is described:

Valuation (generation of parameter values)	- i)	<-|
Input Data	- ii)	|
Mathematical Model	- iii)	|
Output Data	- iv)	|
Valuation	- v)	|
Decision/Verification	- vi)	---------|

i) Valuation

Valuation for critical parameters:
Following table shows the parameters rated for relevance in management for the critical milestone. The red marked parameters have to be verified on requirement for action within the phase towards the critical milestone.



/Figure 6.d.11.: Table of parameters for critical milestones/

Valuation of the current business situation:
For the individual business situation with the customer value vectors have to be evaluated (unified enterprise, customer).

The unified enterprise is the target to be achieved. Therefore for starting the calculation of delta vectors the $\mathbf{CV}_{ue}$ at the starting point in time equals either the $\mathbf{CV}_{e}$ or the $\mathbf{CV}_{po}$ of the selected partner. The selection is a matter of the majority part of the joined activities.

$\mathbf{CV}_{ue}(t=0) = \mathbf{CV}_{e}$ or $\mathbf{CV}_{po}$ | dependent on majority partner **(6.30)**

Valuation of a target situation:
Management does define a target vector to be achieved. In case there is no target given:
$\mathbf{CV}_{target} = \mathbf{CV}_{cu}$ **(6.31)**

ii) Input Data

The input for the model are following data:
- critical parameters 'p_{cr}' according to milestone ahead $p_{cr\ x,y,z}$
- customer value vectors (unified enterprise, target vector) $\mathbf{CV}_{ue}$ and $\mathbf{CV}_{target}$

iii) Mathematical Model

Between the $\mathbf{CV}_{target}$ and $\mathbf{CV}_{ue}$ a delta $\Delta\mathbf{CV}$ is calculated:

$\Delta\mathbf{CV} = \mathbf{CV}_{target} - \mathbf{CV}_{ue}$; with $\Delta\mathbf{CV} = [\Delta x, \Delta y, \Delta z)$

For this delta vector the individual axis contributions are to be synthesized.

Δx has to be synthesized of the the potential contribution of all p_{crx}
Δy has to be synthesized of the the potential contribution of all p_{cry}
Δz has to be synthesized of the the potential contribution of all p_{crz}

For generation of further options it is possible to expand the search by allowing the change of view, to apply for the delta vector a new frame.

$\Delta\mathbf{CV} = [\Delta x, \Delta y, \Delta z]$

Thereby $\Delta\mathbf{CV}$ is expressed in the frame of the required change.

To express $\Delta\mathbf{CV}$ in the frame of the "required change" ${}^{rc}\Delta\mathbf{CV}$, **(6.7)**:

${}^{rc}\Delta\mathbf{CV}_{cu\,e} = E^{-1} * \Delta\mathbf{CV}$

${}^{rc}\Delta\mathbf{CV}_{cu\,e} = [\Delta x_{rc}, \Delta y_{rc}, \Delta z_{rc}]$

$\Delta x_{rp}, \Delta y_{rp}, \Delta z_{rp}$ do represent the 'new' values for search of parameters for change, and respectively to change in future the view of the company.

iv) Output Data

The output are sets of calculated changes in value for the critical parameters.

v) Valuation

A valuation is performed on the criterion that $\Delta \mathbf{CV}_{cr}$ (cutomer value critical) synthesized must be closest to $\Delta \mathbf{CV}$ **(6.8)**:

$\Delta \mathbf{CV}_{cr} = \{\mathbf{MIN}\ (|\Delta \mathbf{CV}| - |\Delta \mathbf{CV}_i|)\}$; i indicates number of all Δ's derived

The leadership task to derive from the parameters to improved dedicated business situations at the critical milestones is modelled through guidance for output. The guidance directly leads to a quantifyable output. The overall concept of increasing customer value generation and competitiveness is *applied in the guidance*.

Guidance for 100 days:
- common product roadmap with increased customer value
- one common organisation

Guidange for 0,5 development cycles:
- first common products
- new customers won based on new roadmap

Guidance for 1,5 development cycles:
- new products based on common competence only
- new customers won based on new products (increased market share)
- diversification based on joint competence

vi) Decision/Verification

At this stage the decision is done based on the output of the valuation. Verification by managment can be based on the questions of the opportunity star.

e. Observations and Conclusions

A process, mathematical relations and mathematical models for the process of 'structural optimisation of production systems' are developed according to /TURBAN/. For representation of business situations the model of frames and homogeneous transformation is applied.

Relevant business players are represented by frames and vectors that are compiled from individual data in generic parameter lists. Models derive verifyable outputs even from uncertain information. Maintenance and advancement of the model is applicable as input parameters and rules are

to be interpreted as a knowledge base.
The method developed hereby is intended to serve automation of managerial tasks for partner selection, valuation and execution of partnership and thereby increase in effectivity in decision and execution.

From the concept of 'generation of customer value and increase of competitiveness' the qualitative determination of parameters to describe a company is derived. The model leads from the qualitative description 'customer value' to a quantifyable dedicated output for execution of a partnership.

7. Model Verification – Case Study

In this chapter a verification of the model with the 'real world' (i.e. case study) is done. The model is applied in a representative case – the acquisition of the Business Unit from Seller by Buyer and their subsequent merger. The introduction of the model into the management decision process is discussed. For detailed background information refer to chapter 4.b.. Each of the sub chapters is concluded with a brief discussion of the model application in contrast to the business case.

Continuously abbreviations are used whereby capital letters are applied to represent frames, vectors, matrices; small letters are applied to represent individual parameters or values, or to serve as an index (explanation of abbreviations and notations see Chapter 9.d.).

a. Analysis of Partner Requirement

The analysis for partner requirement follows the seven steps of chapter 6.d.I):

i) Valuation (Generation of Parameter Values)
ii) Input Data
iii) Mathematical Model
iv) Output Data
v) Valuation
vi) Decision
vii) Verification

i) Valuation (Generation of Parameter Values)

The first valuation done is to evaluate on the kind and number of frames required.

Number of Frames:

Customer vs. Market Segment:
the customers representing about 70-80% of the market are globally acting companies that are very similar, homogeneous, in requirements for customer value. The access to customers is dependent on country of headquarter (Japan, Europe, North America, etc.) and therefore accessibility is critical. Thus the customer will be represented as one frame (= market segment).

Competition:
Overall there is one competitor (major consumer manufactuirer) that is important to be observed in terms of competencies and market penetration.

Therefore one frame for this specific competitor is required only.

Alltogether there will be three frames represented: customer, competitor, and enterprise

ii) Input Data

The following parameter lists sre filled with the respective parameter values.
Hereby following abbreviations do appear in the tables first line:
v:= parameters required for an input on 'view' (yellow marking)
a:= parameters required for an input on 'accessibility (green marking)
cu:= customer's parameters
co:= competitor's parameters
e: enterprise's parameters
a co: accessibility parameters of competitor
a e: accessibility parameters of enterprise
v co: view of competitor (value 'i' identical or 'c' contradictory)
v e: view of enterprise (value 'i' identical or 'c' contradictory)

x-axis system value chain - economic efficiency:

Parameter (Range of valuation 0-5)	**v**	**a**	**cu**	**co**	**e**	**[illegible]**	**[illegible]**	**v co**	**v e**
system price is purchasing criterion		[illegible]	1	1	0	5	0		
system patents prohibit access			0	1	0				
system synergies lead to cost advantages			1	1	0				
system synergies lead to performance advantages	v		1	1	0			i	i
customers capability for backwards integration	v	[illegible]	2	2	0	5	5	i	i
system integration technological trend	v		2	3	2			i	i
barriers in integrability in total system			1	1	1				
system components supply critical		[illegible]	1	1	1	3	0		
system partners not accessible		[illegible]	1	1	0	3	3		
Total			**10**	**12**	**4**	**16**	**8**		
[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		

/Figure 7.a.1.: Parameters x-axis/

y-axis product value chain - innovation&flexibility:

Parameter (Range of valuation 0-5)	**v**	**a**	**cu**	**co**	**e**	**[illegible]**	**[illegible]**	**v co**	**v e**
product performance is purchasing criterion	v		3	3	3			i	i
dominance of customer		[illegible]	0	0	0	0	0		
capability to innovate	v		4	5	3			i	c
know-how transfer between customer supplier	v		3	5	3			i	i
change of technology	v		3	1	4			c	i
product differentiation	v		3	3	3			c	i
access to distribution		[illegible]	5	5	4	5	3		

product as system	v		4	5	1			i	i
change in segments		a	5	5	2	5	1		
reaction time in adaptation (time to market)			4	4	3				
forward integration more important			0	2	0				
alternate products gain share			0	0	0				
laws, regulations prohibit access		a	2	2	1	5	4		
globalisation increases		a	5	5	3	5	3		
Total			**41**	**45**	**30**	**20**	**11**		

/Figure 7.a.2.: Parameters y-axis/

z-axis business concept - liquidity:

Parameter (Range of valuation 0-5)	v	a	cu	co	e	co	a e	v co	v e
change of players (customers and suppliers)	v		3	3	2			i	i
margin unequally distributed			1	1	3				
liquidity available for investments			4	4	0				
brand awareness	v	a	1	1	1	3	3	i	i
change in value perception	v	a	4	4	2	5	2	i	i
mature to declining market		a	4	4	4	5	3		
profit growth vs. revenue growth			3	3	0				
high cyclicity (new products relative to time to market)		a	4	5	2	4	2		
relative market capitalisation		a	3	3	1	3	0		
Total			**27**	**28**	**15**	**20**	**10**		

/Figure 7.a.3.: Parameters z-axis/

iii) Mathematical Model

- Based on the parameter values the individual axis values of the customer value vectors are calculated **(6.0)**.
- According to **(2.6)** the accessibility matrix elements are calculated.
- According to **(2.7)** the accessibility vectors are calculated.

The results are represented by the purple marking in above tables.

The comparison between two companies is done by calculation of their value (length):

$$|\Delta \mathbf{CV}_{ij}| = |\mathbf{CV}_i| - |\mathbf{CV}_j| \qquad \textbf{(6.3)}$$

For further valuation (comparison) of the companies the **CV**'s values are calculated.
For later on search of characteristics of a potential partner
$\Delta \mathbf{CV}_{cu\,e} = \mathbf{CV}_{cu} - \mathbf{CV}_e$ is calculated

iv) Output Data

Customer Value Vectors:

$\mathbf{CV}_{cu}$ = [1,1; 2,9; 3,0]
$\mathbf{CV}_{co}$ = [1,3; 3,2; 3,1]
$\mathbf{CV}_{e}$ = [0,4; 2,1; 1,7]

Accessibility Matrices:

$$\begin{vmatrix} 1,6 & 0 & 0 & 0 \\ 0 & 1,6 & 0 & 0 \\ 0 & 0 & 1,6 & 0 \\ 0 & 0 & 0 & 1 \end{vmatrix} = A_{co}$$

$$\begin{vmatrix} 0,8 & 0 & 0 & 0 \\ 0 & 0,9 & 0 & 0 \\ 0 & 0 & 0,8 & 0 \\ 0 & 0 & 0 & 1 \end{vmatrix} = A_{e}$$

Scaled Customer Value Vectors:

$[ax, by, cz, 1]^T = A\ [x, y, z, 1]^T$
$CV_a = A\ CV$

$CV_{co\,a} = A_{co}\ CV_{co}$ => $\mathbf{CV}_{co\,a}$ = [2,1; 5,1; 5,0]
$CV_{e\,a} = A_{e}\ CV_{e}$ => $\mathbf{CV}_{e\,a}$ = [0,4; 1,9; 1,3]

$\Delta\mathbf{CV}_{cu\,e}$ = [0,7; 0,8; 1,3]

$|\mathbf{CV}_{cu}|$ = 4,34
$|\mathbf{CV}_{co}|$ = 4,67
$|\mathbf{CV}_{e}|$ = 2,75
$|\mathbf{CV}_{aco}|$ = 7,47
$|\mathbf{CV}_{ae}|$ = 2,34

v) Valuation

(I): $|\Delta\mathbf{CV}_{cu\,co}| = |\mathbf{CV}_{cu}|-|\mathbf{CV}_{co}| < |\Delta\mathbf{CV}_{cu\,e}| = |\mathbf{CV}_{cu}|-|\mathbf{CV}_{e}|$ true
(II): $|\Delta\mathbf{CV}_{cu\,co}| < |\Delta\mathbf{CV}_{cu\,ae}| = |\mathbf{CV}_{cu}| - |\mathbf{CV}_{ae}|$ true

Valuation for attributes required by partner:

$\Delta\mathbf{CV}_{cu\,e}$ = [0,7; 0,8; 1,3]

The calculated $\Delta\mathbf{CV}_{cu\,e}$ reveals a comparatively strong contribution in Δx, the system value chain; the case is to be investigated what options are for the competences if the view on the business concept is changed (general

priority as discussed in previous chapters) and thus also a change in view on the other attributes is the consequence. Therefore the cosine of the z-axis is changed to 0,5 and also change allowed in x- and y- with 0,87 each. With an numerical calculation the resulting matrix with the cosine values is:

$${}^{rp}\Delta\mathbf{CV}_{cu\,e} = Erp^{-1} * \Delta\mathbf{CV}_{cu\,e}$$

$$\begin{vmatrix} 0,77 & 0 & 0,64 & 0 \\ 0,41 & 0,77 & 0,49 & 0 \\ -0,49 & 0,64 & 0,59 & 0 \\ 0 & 0 & 0 & 1 \end{vmatrix} = Erp$$

$${}^{rp}\Delta\mathbf{CV}_{cu\,e} = [\Delta x_{rp}, \Delta y_{rp}, \Delta z_{rp}] = [0,2,\ 1,4,\ 1,6]$$

Δx_{rp}, Δy_{rp}, Δz_{rp} do represent the characteristics of the required partner.

The required partner in this 'aspect' requires by far less contribution in the overall system competence and must compensate this delta in liquidity and product value chain. This does extend the view much more to pure focussed semiconductor manufacturers.

vi) Decision

Above rules are rated '**true**' and thus do lead to the recommendation to search for a partnership: YES.

According to the valuation of competence required there is the search for liquid complemetary product partners. **(6.8)** The values for this case were derived experimentally.

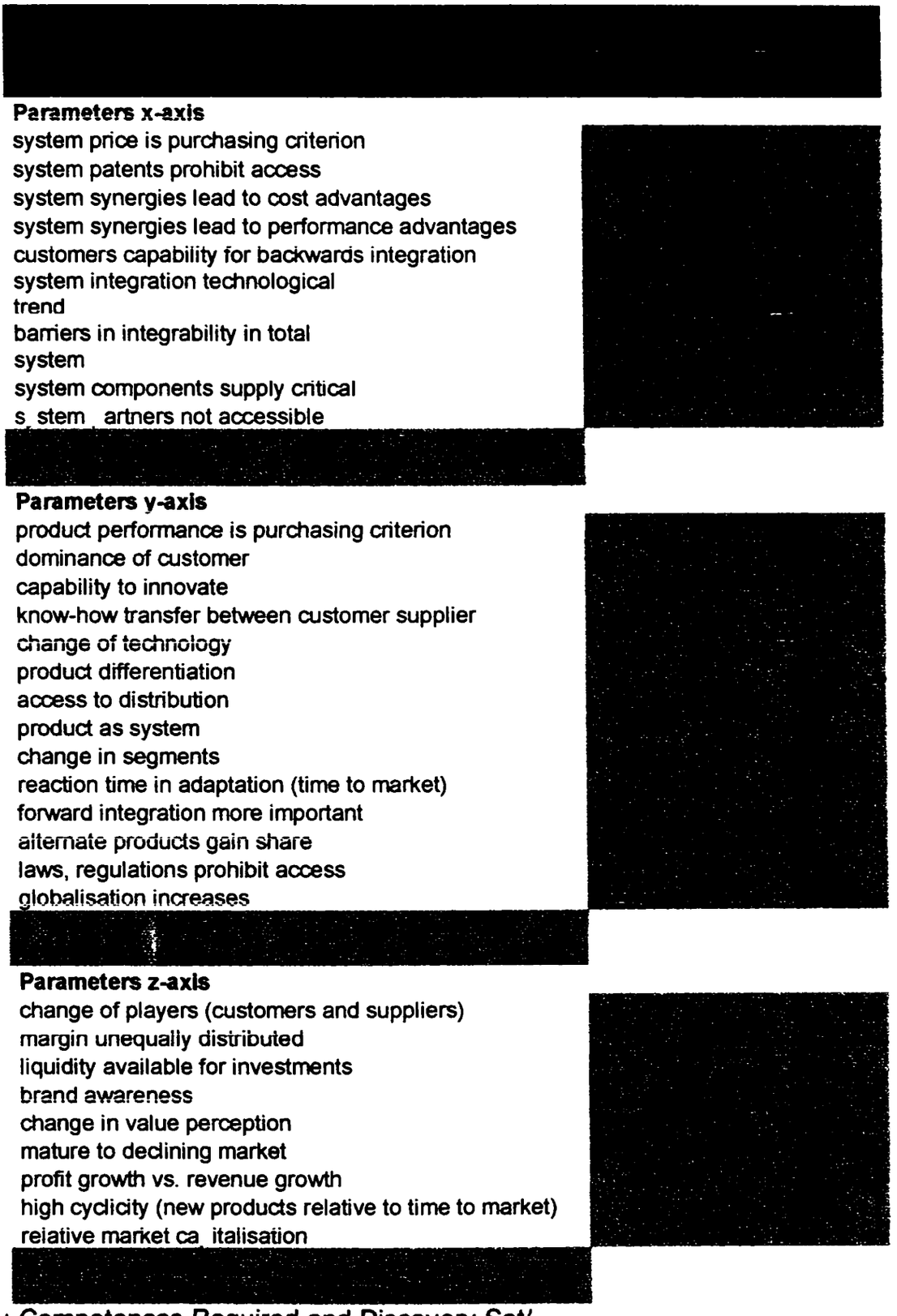
vii) Verification

Synthesis for Competences Required

Applying the relations **(6.9-10)**:
$Q(p) = \{p|\ |V(p_{cu}) - V(p_e)| > MEAN(|V(p_{cu}) - V(p_e)|_{x,y,z})\}$
$Q'(p) = Q(p) - \{p|\ V(p_{ea}) >= 4\}$

leads to parameters indicated in table 7.a.4. with 'YES' in the column 'Competence Required'.

Applying the relations **(6.11ff)**:
leads to the set of parameters for discovery and further evaluation. Those parameters are indicated in table 7.a.4. with 'YES' in the column 'Evaluation Parameters'.



/Figure 7.a.4.: Competences Required and Discovery Set/

The parameters lead to competencies required in complementing the system and the product (= intellectual property). Complementing intellectual property must be available as product already, as cyclicity is high. A partner

must be able to complement in customer access by sales channels (globalisation). Financially the partner must have capability to invest flexible to change in customer requirements.

For further analysis the parameters on competence and evaluation with the highest deviation are collected in following figure 7.a.5.. The yellow cells indicate parameters with highest deviation between vector attributes, deviation in view, and highest deviation in accessibility with competitor. The deviation in view represents the different strategies of enterprise and competitor, whereby technology and system competence is differently used and thus differently viewed upon. Nethertheless the competitor has a by far better position in terms of product completion to a system and better realisation and investment capability for emerging market segments.

Competences Required – Evaluation Set - Sample

Parameter (Range of valuation 0-5)	v	a	cu	co	e	a co	a e	v co	v e	ods		
system price is purchasing criterion		a	1	1	0	5	0			x		
system components supply critical		a	1	1	1	3	0			x		
capability to innovate	v		4	5	3			i	o		y	
change of technology	v		3	1	4			o	i		y	
product differentiation	v		3	3	3			o	i		y	
product as system	v		4	5	1			i	i		y	
change in segments		a	5	5	2	5	1				y	
globalisation increases		a	5	5	3	5	3				y	
margin unequally distributed			1	1	3							z
liquidity available for investments			4	4	0							z
change in value perception	v	a	4	4	2	5	2	i	i			z
mature to declining market		a	4	4	4	5	3					z
profit growth vs. revenue growth			3	3	0							z
high cyclicity (new products relative to time to market)		a	4	5	2	4	2					z
relative market capitalisation		a	3	3	1	3	0					z

Hans Schwendner, Contributions for Structural Optimization of Production Systems 2003 Page 48

/Figure 7.a.5.: Competences Required – Evaluation Set – Sample/

The table shows the higher correlation (all attributes) of competitor with customer need. Also the accessability of competitor is by far higher than enterprise accessability. Customer's need for system synergy is of relatively lower importance than completing product to a system and improving product value chain and business concept (liquidity). In the

business case this can be interpreded that there is no reasonable buyer from a system house and thus this effort for looking for a potential partner in this direction can be neglected.

Opportunity star:

- is independence of location taken into account
- can targets be harmonised (especially through management harmony)
- are processes considered or targets
- does intensity increase within the area of activity

especially the question of independence of location could have been of advantage. Management of Business Unit was reluctant to a set-up with a partner in remote locations for assuming high risk in managing the merger. This led to low level of promotion of sale abroad and a potential market for partnering was neglected.

Resulting options for partnership:

- close, in case no partner found (generic option)
- partner with system expertise, competencies and financial backing
- network system, competence, sales, funding (investor)

In contrast to the options of the case study the analysis with the model immediately reveals the consequences of an MBO requiring a wider network and thus the by far higher risk of realisation.

Conclusion (Model vs. Case Study):
The overall results correlate with the case study.

The model does focus in the decision for a partnership with a financially liquid and complementary in competence potential partner.

In contrast to the options of the case study the analysis with the model (guided questions) additionally reveals the consequences of an MBO for a wider network and thus the by far higher risk of realisation. Thus the model reveals an added value for analysis as it leads to this result in an analytical approach. Also the guidance with questions to new solutions is verified for improvement.

b. Valuation of Partner

In this case the option for a strategic partnership with Buyer is the only option for analysis, as the network option was not investigated to a deep enough level due to assumed too high risk.

According to the flow for the application the valuation is sequenced:

i) Valuation (generation of parameter values)
ii) Input Data
iii) Mathematical Model
iv) Output Data
v) Valuation
vi) Decision
vii) Verification

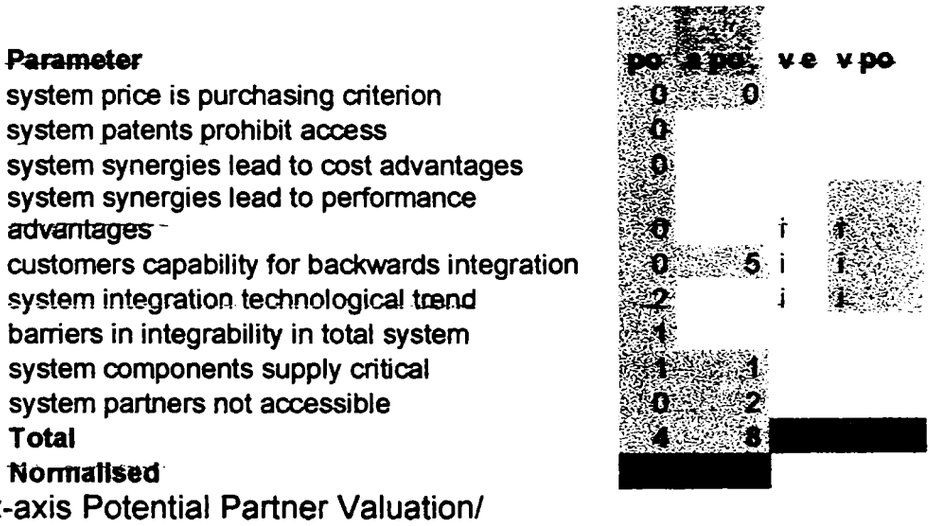
i) Valuation (Generation of Parameter Values)

For the valuation Buyer ('po' potential partner) data are put into the parameter tables for the frame attributes (orange marking).

The cosines between identical attribute axis are determined by the view (purple marking)

The coordinate and scaling values are calculated (red marking).

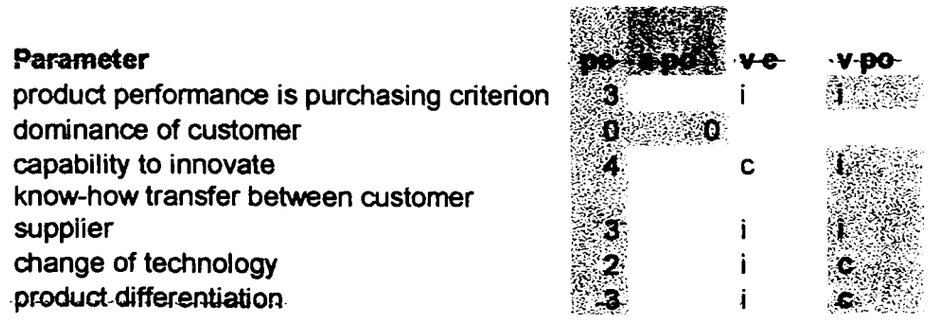
x-axis: system value chain - economic efficiency:



Parameter	po	∆ po	v e	v po
system price is purchasing criterion	0	0		
system patents prohibit access	0			
system synergies lead to cost advantages	0			
system synergies lead to performance advantages	0		i	i
customers capability for backwards integration	0	5	i	i
system integration technological trend	-2		i	i
barriers in integrability in total system	1			
system components supply critical	1	1		
system partners not accessible	0	2		
Total	4	8		
Normalised				

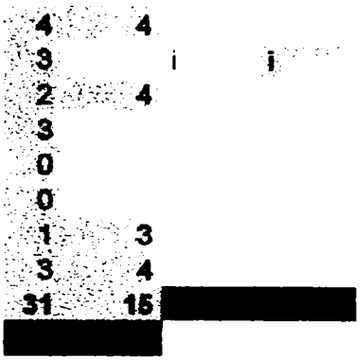
/Figure 7.b.1.: x-axis Potential Partner Valuation/

y-axis: product value chain - innovation&flexibility:



Parameter	po	∆ po	v e	v po
product performance is purchasing criterion	3		i	i
dominance of customer	0	0		
capability to innovate	4		c	i
know-how transfer between customer supplier	3		i	i
change of technology	2		i	c
product differentiation	-3		i	c

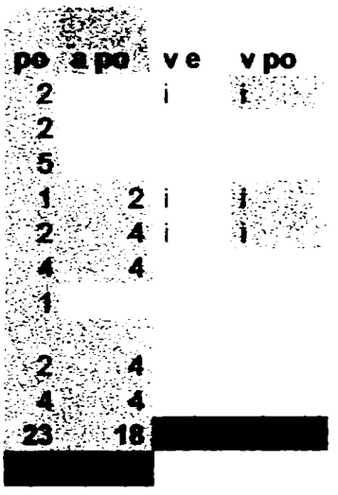
access to distribution	4	4
product as system	3	
change in segments	2	4
reaction time in adaptation (time to market)	3	
forward integration more important	0	
alternate products gain share	0	
laws, regulations prohibit access	1	3
globalisation increases	3	4
Total	31	15
Normalised		



/Figure 7.b.2.: y-axis Potential Partner Valuation/

z-axis: business concept - liquidity:

Parameter	**po**	**a po**	**v e**	**v po**
change of players (customers and suppliers)	2		i	i
margin unequally distributed	2			
liquidity available for investments	5			
brand awareness	1	2	i	i
change in value perception	2	4	i	i
mature to declining market	4	4		
profit growth vs. revenue growth	1			
high cyclicity (new products relative to time to market)	2	4		
relative market capitalisation	4	4		
Total	23	18		
Normalised				



/Figure 7.b.3.: z-axis Potential Partner Valuation/

The transformation matrix E_{po} for the potential partner then is determined by the cosine values of the potential partner frame (the values are taken from the numerical calculation table and are the closest approximation calculated):

$$\begin{vmatrix} 0,9 & 0,29 & 0,31 & 0,9 \\ -0,38 & 0,87 & 0,29 & 1,9 \\ -0,18 & -0,38 & 0,9 & 2,1 \\ 0 & 0 & 0 & 1 \end{vmatrix} = Epo$$

$$\begin{vmatrix} 0,9 & 0,29 & 0,31 & 0,7 \\ -0,38 & 0,87 & 0,29 & 1,6 \\ -0,18 & -0,38 & 0,9 & 1,7 \\ 0 & 0 & 0 & 1 \end{vmatrix} = Epoa$$

ii) Input Data

$\mathbf{CV}_{e}$ = [0,4; 2,1; 1,7]
$\mathbf{CV}_{e\,a}$ = [0,4; 1,9; 1,3]
$\mathbf{CV}_{po}$ = [0,4; 2,2; 2,6]
$\mathbf{CV}_{po\,a}$ = [0,4; 2,7; 3,7]
$\mathbf{CV}_{co}$ = [1,3; 3,2; 3,1]
$\mathbf{CV}_{co\,a}$ = [2,1; 5,1; 5,0]

iii) Mathematical Model

On above input the processing for information is performed.

The coordinates of the customer value vector of the unified enterprise $\mathbf{CV}_{ue}$ in the reference frame of customer are calculated as follows:

$CV_{ue} = E_{po} * CV_{po} = [2,7, 4,4, 3,5; 1]^{T}$
$CV_{ue\,a} = E_{po\,a} * CV_{po\,a} = [3,0, 4,9, 3,9; 1]^{T}$

iv) Output Data

$\mathbf{CV}_{ue}$ = [2,7, 4,4, 3,5]
$\mathbf{CV}_{ue\,a}$ = [3,0, 4,9, 3,9]

v) Valuation

(I): $|\Delta\mathbf{CV}_{cu\,co}| < |\Delta\mathbf{CV}_{cu\,ue}|$ false
(II): $|\Delta\mathbf{CV}_{cu\,co}| < |\Delta\mathbf{CV}_{cu\,aue}|$ false

(I) := false or (II):= false => recommendation of potential partner for partnering

vi) Decision

Above rules are rated '**false**' and thus do lead to the recommendation of potential partner for a partnership: YES.

vii) Verification

Synthesis for Competences Required

Applying the relations **(6.9-10)**:
$Q(p) = \{p|\ |V(p_{cu}) - V(p_{e})| > MEAN(|V(p_{cu}) - V(p_{e})|_{x,y,z})\}$
$Q'(p) = Q(p) - \{p|\ V(p_{ea}) >= 4\}$

leads to parameters indicated in table 7.b.4. with 'YES' in the column 'Competence Required e' (orange marking)

Applying the relations **(6.11ff)** to the potential partner instead of the own enterprise:

$Q''(p) = \{p| \, |V(p_{cu}) - V(p_{po})| > MEAN(|V(p_{cu}) - V(p_{po})|_{x,y,z})\}$

$Q'''(p) = Q''(p) - \{p| \, V(p_{po\,a}) >= 4\}$

leads to parameters indicated in table 7.b.4. with 'YES' in the column 'Competence Required po' (yellow marking)

The verification and guided questions will then be applied on those focus parameters with a priority on the parameters contained in $Q''''(p) = Q'(p) \cap Q'''(p)$ 'Competence required simultaneously in e and po' (red marking in table 7.b.4).

[redacted]

Parameters x-axis

system price is purchasing criterion	YES
system patents prohibit access	
system synergies lead to cost advantages	YES
y e ynergies lead to performance dv n ge	YES
customers capability for backwards integration	
system integration technological trend	
barriers in integrability in total system	
system components supply critical	
s stem artners not accessible	YES

Parameters y-axis

product performance is purchasing criterion	
dominance of customer	
capability to innovate	
know-how transfer between customer supplier	
change of technology	YES
product differentiation	
access to distribution	
product as system	YES
change in segments	
a aptation (tim o mark)	YES
forward integration more important	
alternate products gain share	
laws, regulations prohibit access	YES
lobalisation increases	

Parameters z-axis

change of players (customers and suppliers)	YES
margin unequally distributed	
liquidit available for investments	

brand awareness change in value perception mature to declining market profit growth vs. revenue growth high cyclicity (new products relative to time to market) relative market ca italisation	[redacted] YES	[redacted]

Figure 7.' .4.: Tab'e Compe ences Required by Potential Partner – Verification/

The potential partner has the same competence requirements than the enterprise in complementing the system value chain.

In the product value chain 'product as a system' (= intellectual property) and the reaction time would require additional competence.

Within the business concept/liquidity both companies seem to have grown above investment.

Opportunity star:

- is independence of location taken into account
- can targets be harmonised (especially through management harmony)
- are processes considered or targets
- does intensity increase within the area of activity

Especially the questions for harmonisation of targets in this case does support to identify the complementing of the products and thus the capability of speed in achieving required reaction time as cyclicity is high. The partner is able to complement in customer access by sales channels (globalisation). The companies together have the capability to invest flexible to change in customer requirements.

The question for intensity also has the potential to lead to a conclusion in the area of system value chain, where both companies have a deficit. Due to the complementation in products and potential to gain speed the intensity might increase in a way that new system partners do get interest in cooperation – and thus compensate for the (anyway less absolutely valued) attribute deficits in contrast to competition.

Resulting options for partnership:

- partner with system expertise, competencies and financial backing
- competitor still ahead in value generation

The potential partner does complement the enterprise, but not in a way to surpass the existing competitor immediately.

Conclusion (Model vs. Case Study):

The overall results correlate with the case study. Especially the derivations of the opportunity star were realised, as especially customers got interest in complementing their own systems and even substitute their own systems by the unified enterprise.

c. Valuation of Unified Enterprise

This milestone 'valuation of unified enterprise' analyses each of the potential partners on the risk in improvement in customer value generation and risk improvement in competitiveness due to change required in structure for transaction or transformation – due to difference in view and competence. The risk is on the potential to execute for achieving targeted results. Additionally risk is involved in the reliability of the information the decision is based on. The respective result is a contribution to narrow the set of potential partners to the one with the minimum risk in combination with contributions of potential partners leading to improved performance. This step is contrasting milestone 2 in looking at the risk instead the opportunity by competence added.

Dependent on the values of critical parameters legal and financial type of cooperation is judged on risk or seen in reverse – a certain level for legal and financial type of cooperation is recommended.

Following the flow for the application of the model is described:

i) Valuation (generation of parameter values)
ii) Input Data
iii) Mathematical Model
iv) Output Data
v) Valuation
vi) Decision
vii) Verification

i) Valuation (Generation of Parameter Values)

The judgment on risk also is to follow concept of the definition of an enterprise – according to customer value. The result of this valuation will be the parameters that do provide a risk in terms of change of view and in terms of the current status of the potential partner in comparison to customer and in comparison to competition. The evaluation is performed on the set of critical parameters selected by relation **(6.5)** Q'(p) and in addition by the set of competences required by the potential partner $Q_{p\sigma}(p)$. Therefore the valuation will be performed in two steps:

Reference to customer:
Evaluating the competencies describing the risk of change required in

comparison to CV and to own enterprise (see figure 7.c.1. column 'risk customer level' yellow marking)

Reference to competition:
Evaluating the competencies describing the risk to competitors' capability to react (see figure 7.c.1. column 'risk level competitor' green marking).

[redacted] [redacted]

Parameters x-axis

system price is purchasing criterion	[redacted]	YES YES
system patents prohibit access		
system synergies lead to cost advantages		YES YES
y m yner_ies lead to performance advantages		YES YES
customers capability for backwards integration		
system integration technological trend		
barriers in integrability in total system		
system components supply critical		
system partners not accessible		YES YES

Parameters y-axis

product performance is purchasing criterion	[redacted]	
dominance of customer		
capability to innovate		YES YES
know-how transfer between customer supplier		
change of technology		YES
product differentiation		
access to distribution		YES YES
product as system		YES YES
change in segments		YES YES
reaction time in adaptation (time to market)		YES YES
forward integration more important		
alternate products gain share		
laws, regulations prohibit access		YES YES
globalisation increases		YES YES

Parameters z-axis

change of players (customers and suppliers)	[redacted]	YES YES
margin unequally distributed		
liquidity available for investments		
brand awareness		
change in value perception		YES YES
mature to declining market		
profit growth vs. revenue growth		YES YES
high cyclicity (new products relative to time to market)		YES YES
relative market capitalisation		

/Figure 7.c.1.: Table Risk at Customer and Competitor Level/

ii) Input Data

There are two sets of parameters from the valuation:
EP (all parameters with 'YES' in column for risk customer level)
EP' (all parameters with 'YES' in column for risk competitor level)

iii) Mathematical Model

The level of risk for the attributes per level dependent on competences required is calculated. This risk is deducted by the reliability of information and the importance of the parameter in reference to the customer.

Figure 7.c.2. shows the calculated risk values per attribute and per level (red marking). Highlighted are also the dominant contributors to the risk (light blue marking) due too the importance of these parameters to the customer.

Parameters x-axis	**de,in,ab**	**cu**			
system price is purchasing criterion	de		1	0,2	0,2
system synergies lead to cost advanta_e	i		1	0,5	0,5
system synergies lead to performance advantages	in		1	0,5	0,5
system partners not accessible	in		1	0,5	0,5
Parameters y-axis	**de,in,ab**	**cu**			
capability to innovate	ab		4	0,8	0,8
change of technology	ab		3	0,8	
access to distribution	in		5	0,5	0,5
product as system	de		4	0,2	0,2
change in segments	ab		5	0,8	0,8
reaction time in adaptation (time to market)	ab		4	0,8	0,8
laws, regulations prohibit access	de		2	0,2	0,2
globalisation increases	in		5	0,5	0,5
Parameters z-axis	**de,in,ab**	**cu**			
change of players (customers and suppliers)	ab		3	0,8	0,8
change in value perception	ab		4	0,8	0,8
profit growth vs. revenue growth	ab		3	0,8	0,8
high cyclicit_ new _roducts relative to time to market)	ab		4	0,8	0,8

/Figure 7.c.2.: Table of Calculated Risk Levels/

The unification with this potential partner does not reflect a

transformation.Therefore the risk is not be increased any further.

v) Valuation

Risk Valuation:
The valuation on the different potential partners is done according to the level of risk involved **(6.23)**.

P(F) = 0,64

The level of risk is calculated in between inductive and abductive.
Therefore it can be assumed that there is no real case in the industry that can be taken as a reference.

Additionally the potential partner is to be valuated as a unified enterprise.

Potential Performance:
The customer value of the accessibility rated unified enterprise is done according to relation **(6.28-29)**.

The potential to perform above average is rated by the individual attributes of unified enterprise's capabilities (accessibility rated) versus customer need.

above average: $|\mathbf{CV}_{aue}| > |\mathbf{CV}_{cu}|$ with $x_{aue} > x_{cu} \wedge y_{aue} > y_{cu} \wedge z_{aue} > z_{cu}$

The potential to perform outstanding is rated by the individual attributes of unified enterprise's capabilities versus competitors' capabilities.

outstanding: $|\mathbf{CV}_{aue}| > |\mathbf{CV}_{aco}|$ with $x_{aue} > x_{aco} \wedge y_{aue} > y_{aco} \wedge z_{aue} > z_{aco}$

$\mathbf{CV}_{aue}$ = [1,6; 4,0; 5,9)
$\mathbf{CV}_{cu}$ = [1,1; 2,9; 3,0)
$\mathbf{CV}_{co\,a}$ = [2,1; 5,1; 5,0)
$\mathbf{CV}_{co}$ = [1,3; 3,2; 3,1)

The unified enterprise has the potential to perform above average.

Legal Framework:
the recommended level of cooperation is derived from the parameters of the combined set of competences required. The highest level of cooperation required within these parameters is the level recommended.

Parameters x-axis

pr/jv/mf

system price is purchasing criterion	jv
system synergies lead to cost advantages	jv
system synergies lead to performance advantages	pr
system partners not accessible	pr
Parameters y-axis	**pr/jv/mf**
capability to innovate	jv
change of technology	**mf**
access to distribution	jv
product as system	jv
change in segments	jv
reaction time in adaptation (time to market)	jv
laws, regulations prohibit access	pr
globalisation increases	jv
Parameters z-axis	**pr/jv/mf**
change of players (customers and suppliers)	jv
change in value perception	pr
profit growth vs. revenue growth	jv
high cyclicity (new products relative to time to market)	pr

/Figure 7.c.3.: Table Level of Cooperation/

The highest level of cooperation recommended per attribute is:

system value chain - economic efficiency:
- joint venture

product value chain - innovation&flexibility:
- merger/fusion

business concept - liquidity:
- joint venture

vi) Decision

Selection of legal and financial framework:
The recommended level of cooperation is merger/fusion.

Selection of Potential Partner
At this stage there is no alternate potential partner. Therefore the decision is the alternative between no partner or the partnership with the potential partner. The decision in this case can not be derived from the model, but from a management discussion.

(vii) Verification

The selection of the potential partner is a key critical decision. Therefore a final synthesis on level of cooperation is required, done in a management discussion.

The opportunities for the unified enterprise are especially in the immediate access to complementing the product spectrum and improved access to customers. Also there is the opportunity to expand the customer value generation by liquidity or business concepts supported by the stock market.

Conclusion (Model vs. Case Study):
The results for the model correlate with the case study. Also management of Buyer and Enterprise were aware of the gaps versus customer needs and gaps in competitiveness.
The use of the model is advantageous in having a framework that very rationally shows gaps and requirement for action based on stringent valuation parameters.
The model also is sensitive to reveal remaining deltas but 'reasonable enough' not to prevent this partnership – as this business case overall is rated successful.

d. Valuation at Critical Milestones

This milestone 'valuation at critical milestones' is applied for two sub milestones in management execution of aligning the enterprises towards one. These are sub milestones at 100d and 0.5 development cycles:

Following the flow for the application of the model is described:

i) Valuation (generation of parameter values)
ii) Input Data
iii) Mathematical Model
iv) Output Data
v) Valuation
vi) Decision/Verification

i) Valuation

Valuation for critical parameters:
Following table 6.d.9. shows the parameters rated for relevance in management for the critical milestone (applicable for the industry of case study).

Valuation of the current business situation:
For the individual business situation with the customer value vectors have to be evaluated (unified enterprise, customer). According to **(6.30)**:
$CV_{ue}(t=0) = CV_{po}$

is selected (potential partner is the majority contributor to the merger).

Valuation of a target situation:

Management does define a target – in this case **(6.31)**:
$CV_{target} = CV_{cu}$

ii) Input Data

Table 7.d.1. shows the input data CV_{target}, CV_{ue} and the critical parameters:

Parameters x-axis	**target**	**ue**	**100d**	**0,5 dc**	**1,5 dc**
system price is purchasing criterion	1	0			
system patents prohibit access	0	0			
system synergies lead to cost advantages	1	0			
s stem synergies lead to performance advantages	1	0			
customers capability for backwards integration	2	0			
system integration technological trend	2	2			
barriers in inte_rabilit_ in total s_stem	1	1			
system components supply critical	1	1			
system partners not accessible	1	0			

Parameters y-axis	**target**	**ue**	**100d**	**0,5 dc**	**1,5 dc**
product performance is purchasing criterion	3	3			
dominance of customer	0	0			
capability to innovate	4	4			
know-how transfer between customer supplier	3	3			
change of technology	3	2			
product differentiation	3	3			
access to distribution	5	4			
product as system	4	3			
change in segments	5	2			
reaction time in adaptation (time to market)	4	3			
forward integration more important	0	0			
alternate products gain share	0	0			
laws, re_ulations _rohibit access	2	1			
globalisation increases	5	3			

Parameters z-axis	**target**	**ue**	**100d**	**0,5 dc**	**1,5 dc**
chan_e of players (customers and suppliers)	3	2			
margin unequally distributed	1	2			
liquidity available for investments	4	5			
brand awareness	1	1			
change in value perception	4	2			
mature to declining market	4	4			
profit growth vs. revenue growth	3	1			
high cyclicity (new products relative to time to market)	4	2			
relative market capitalisation	3	4			

/Figure 7.d.1.: Table Input Parameters for Critical Milestone Model/

iii) Mathematical Model

100days:

Based on the $\mathbf{CV}_{target}$ and $\mathbf{CV}_{ue}$ $\Delta\mathbf{CV}$ is calculated:

$\Delta\mathbf{CV} = \mathbf{CV}_{target} - \mathbf{CV}_{ue}$
$\Delta\mathbf{CV} = [0,7;\ 0,7;\ 0,4]$

For this delta vector the individual axis contributions are to be synthesized to achieve targeted change.

$\Delta x_i = 0$, as there are no p_{crx} @ 100d
$0 <= \Delta y_i <= 0,4$ for different p_{cry} (unchanged to 5)
$0 <= \Delta z_i <= 0,3$ for different p_{crz} (unchanged to 5)

So far $\Delta\mathbf{CV}$ is expressed in the frame of the customer and the potential contributions from all attributes are unsufficient. Therefore the model is applied to calculate change of view to enable search for further parameters. This is done in the same direction as for milestone 1, by focussing on the business concept.

To express $\Delta\mathbf{CV}$ in the frame of the "required change" ${}^{rc}\Delta\mathbf{CV}$, following equation applies:

${}^{rc}\Delta\mathbf{CV}_{cu\,e} = E^{-1} * \Delta\mathbf{CV}$

$$\begin{vmatrix} 0,77 & 0 & 0,64 & 0 \\ 0,41 & 0,77 & 0,49 & 0 \\ -0,49 & 0,64 & 0,59 & 0 \\ 0 & 0 & 0 & 1 \end{vmatrix} = Erc$$

${}^{rc}\Delta\mathbf{CV}_{cu\,e} = [\Delta x_{rc},\ \Delta y_{rc},\ \Delta z_{rc}] = [0,6,\ 0,8,\ 1,0]$

This allows the interpretation of higher efforts required for business concept and product value chain with only little reduction in system competence.

0,5dc:

Based on the case study $\mathbf{CV}_{target}$ remains unchanged while current $\mathbf{CV}_{ue}$ @ 100d already is improved to [0,4; 2,4; 2,7]:

$\Delta\mathbf{CV} = \mathbf{CV}_{target} - \mathbf{CV}_{ue}$

$\Delta CV = [0,7; 0,5; 0,3]$

For this delta vector the individual axis contributions are to be synthesized to achieve targeted change.

$0 <= \Delta x_i <= 1,0$ for different p_{crx} (unchanged to 5)
$0 <= \Delta y_i <= 0,4$ for different p_{cry} (unchanged to 5)
$0 <= \Delta z_i <= 0,5$ for different p_{crz} (unchanged to 5)

iv) Output Data

100d:
The output is shown in table 7.d.2. (for the maximum in change; column 'evaluation'):

Parameters y-axis	**target**	**ue**	**delta**	**evaluation**	**100d**
change in segments	5	2		5	[redacted]
globalisation increases	5	3		5	
[redacted]					

Parameters z-axis	**target**	**ue**	**delta**	**evaluation**	**100d**
high cyclicity (new products relative to time to market)	4	2		5	[redacted]
[redacted]					

/Figure 7.d.2.: Table Critical Parameters 100d/

By the result of the change of view, several more possibilities for immediate targets and realisation do get obvious:
- customer capability for backwards integration
- know-how transfer between customer and supplier
- change in value perception

0,5dc:
The output is shown in table 7.d.3. (for the maximum in change; column 'evaluation'):
'ue 0,5dc' means the parameter values for the CVue for calculation for milestone 0,5dc. The other naming conventions are equivalent.

Parameters x-axis	**targe t**	**ue 0,5dc**	**eval 0,5dc**	**0,5 dc**
system price is purchasing criterion	1	0	5	[redacted]
system components supply critical	1	1	5	
[redacted]				

Parameters y-axis	**targe t**	**ue**	**eval 0,5dc**	**0,5 dc**
capability to innovate	4	4	5	[redacted]
change of technology	3	2	5	

product differentiation	3	3	5	
Parameters z-axis	**target**	**value 0,5dc**	**eval 0,5dc**	**0,5 dc**
change in value perception	4	2	5	
mature to declining market	4	4	5	
relative market capitalisation	3	4	5	

/Figure 7.d.3.: Table Critical Parameters 0,5dc/

v) Valuation

100d:

A valuation is performed on the criterion that the delta CV_{cr} (cutomer value critical) synthesized must be the closest one with the calculated delta:

$\Delta CV_{cr} = MIN (|\Delta CV| - |\Delta CV_i|)$ by applying the change in view

The giudance on the parameters derives dedicated quantifyable results:

- change in segments: -> the product roadmap has to reflect the opportunity for innovation into new segments (e.g. enhanced digital TV)
- *globalisation increases -> the organisation especially in the global regions* must be set (e.g. access to customers z,w potential sales €...)
- high cyclicity: -> the product roadmap has to reflect the acquired products (minor modifications only, focus on adaptation of existing products for expansion of productline with x products available in...)
- customer capability for backwards integration -> approach integrated manufacturers for partnership (partner selected by...)
- change in value perception -> change marketing approach to new value (increase of customer satisfaction by x% in ... time)

0,5dc:

A valuation is performed on the criterion that the delta CV_{cr} (customer value critical) synthesized must be the closest one with the calculated delta **(6.34)**:

$\Delta CV_{cr} = MIN (|\Delta CV| - |\Delta CV_i|)$ for parameters get values of 5 each for x- and y- parameters; z- parameters especially at levels <5 fulfill criterion best (not to exceed target).

The guidance on the parameters derives dedicated quantifyable results:

- system price is purchasing criterion: -> substitute by forward integration of

microelectronics (products defined by...)
- system components supply critical: -> secure supply for not being tackled by competitor (delivery performance at...)
- capability to innovate: -> new joint products must be available (by...)
- change of technology: -> secure access to technology (contracts) for common road map (until...)
- product differentiation: -> unify differentiation factors (by...)
- change in value perception: -> win new lead customers (in segment by...)
- mature to declining market -> developments for higher growth markets according to value requirement of customers started (segments by...)
- relative market capitalisation: -> acquire fresh capital/ maintain investors

vi) Decision/Verification

Reference with parameter values from competition (CV_{∞}) reveals that the targets are achievable.

Conclusion (Model vs. Case Study):
The results for the model correlate with the case study. The application of the model and guidelines could have improved the business case in several aspects. The model did directly lead to more focus on change of views and thus effective targets could be added. The effort for the merger project initiated could have been reduced to focus teams getting in action sequentially all over, instead of an immediate overall merger project.

e. Observations and Conclusions

The application of flow and model in the case study 'Consumer' (chapter 4.b.) lead to improvement for the process of 'structural optimisation of production systems' by comparison of the model output with business case. The estimation is that about 10-25% management effort could have been saved by applying the flow and model.

The intended improvements are verified:
- rational processing (e.g. rational valuation of competencies required and judging options for partnership; milestone 1, 2, and 3)
- effectiveness in management (e.g. reduction of effort by focused judgment leading to quantifyable action in execution of merger milestone 4)
- new solution can be generated through guided leadership discussion

According to the procedure of /TURBAN/ the proposed flow and model are verified in their intended results. They can be continuously improved. They are verified and can be continuously improved by adding experience in form of rules, formulas and fine tuning of parameters. The flow and model are applicable and can be implemented in the management decision process

8. Contributions and Conclusion

Enterprises are there to create customer value and to improve competitiveness in a dynamic and complex environment. Management therefore has to increase enterprises' performance in customer value generation and competitiveness continuously. Especially in high tech industry structuring the production with external partnerships is capable to increase performance. Nether the less about half of these partnerships fail. Analysis of state of the art concepts and valuation tools reveals that existing processes and models are not appropriate in all aspects to support management in objectivising decision processes and deriving dedicated executable outputs for realisation of the partnership. The gap in performance of concepts, models and processes especially is obvious when deriving decisions based upon uncertain information and evaluation based on emotions instead of rational facts and targets.

The outcome of the research is the advancement in a concept that focuses the acitivities of an enterprise completely to the outside – the customer and the increase of competitiveness and its transfer into a flow and tools for 'structural optimisation of production systems through partnerships' - to increase management effectiveness in decision and execution of partnerships, especially mergers.

Embedded in a management decision process a structured approach to all relevant decisions required in analysis of partner requirement to unifying and networking enterprises is developed. The flow has clearly described outputs for further optimisation. For getting a result at each milestone a qualitative toolset – representation of companies and a business situation by frames - is developed for generating objective decision criterion, steering questions to find so far 'unsought solutions', and to result in executable and quanitfyable outputs. Flow and tools are set up that experience gained can be incorporated in the model as knowledge for further improvement in preparation and decision.

The contributions of this research are:

i) a concept to derive the description of current and future business situation: The concept focusses the management to the company external (customer and competition) and transfers to qualitative description of business situations

ii) an output oriented flow for the evaluation process up to unifying the partners: The flow guides management in a structured way through the evaluation on partner requirement to merging enterprises.

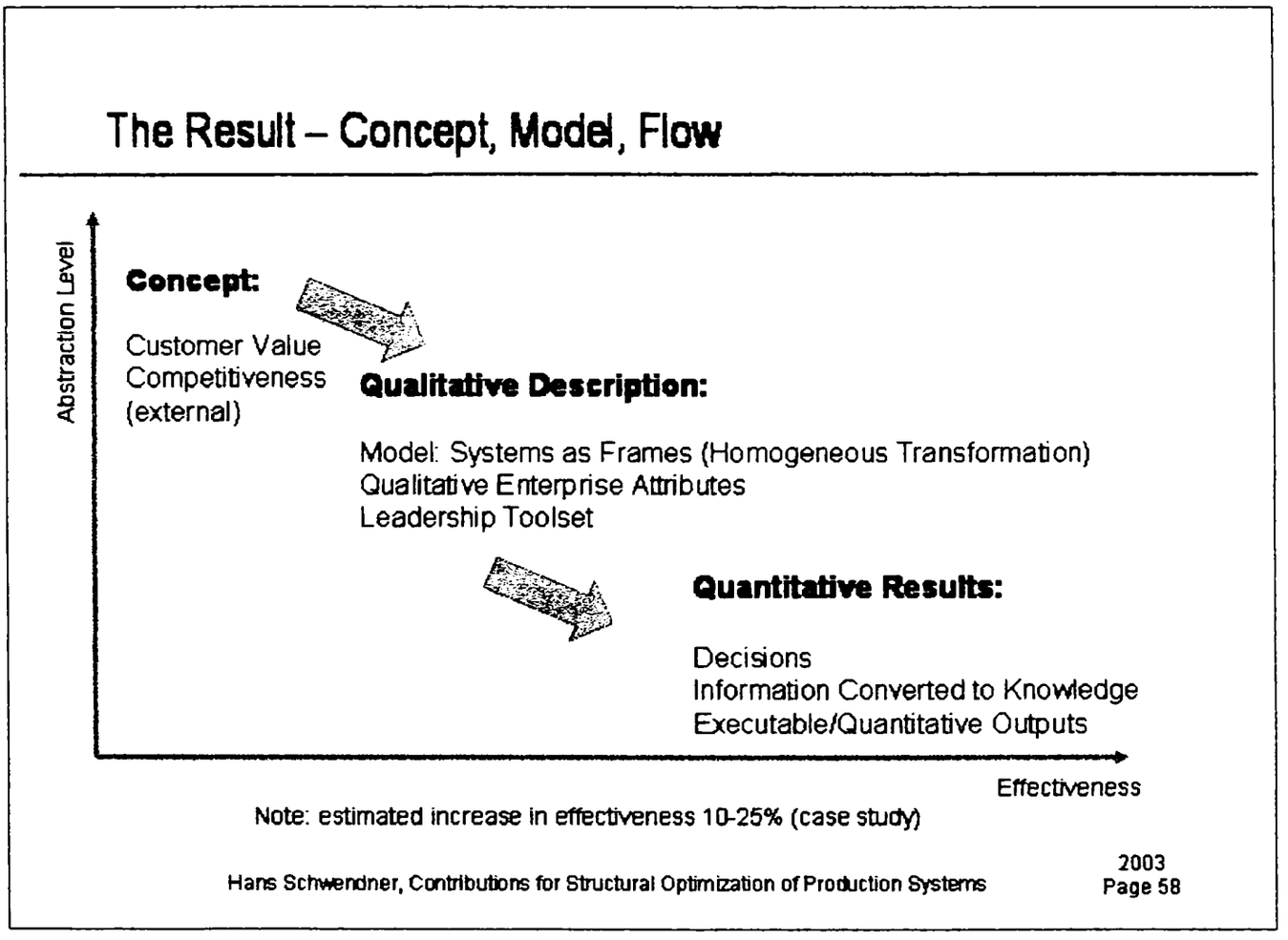
iii) a qualitative description set for business situation and for discovery of new solutions – the application of frames

iv) a model – homogeneous transformation - that allows manipulation of uncertain

information in a stringent flow, and knowledge processing through relations and rules. The output are dedicated decisions and dedicated executable and quantifyable results for executing the partnership

v) a leadership toolset for guiding discovery for new solutions

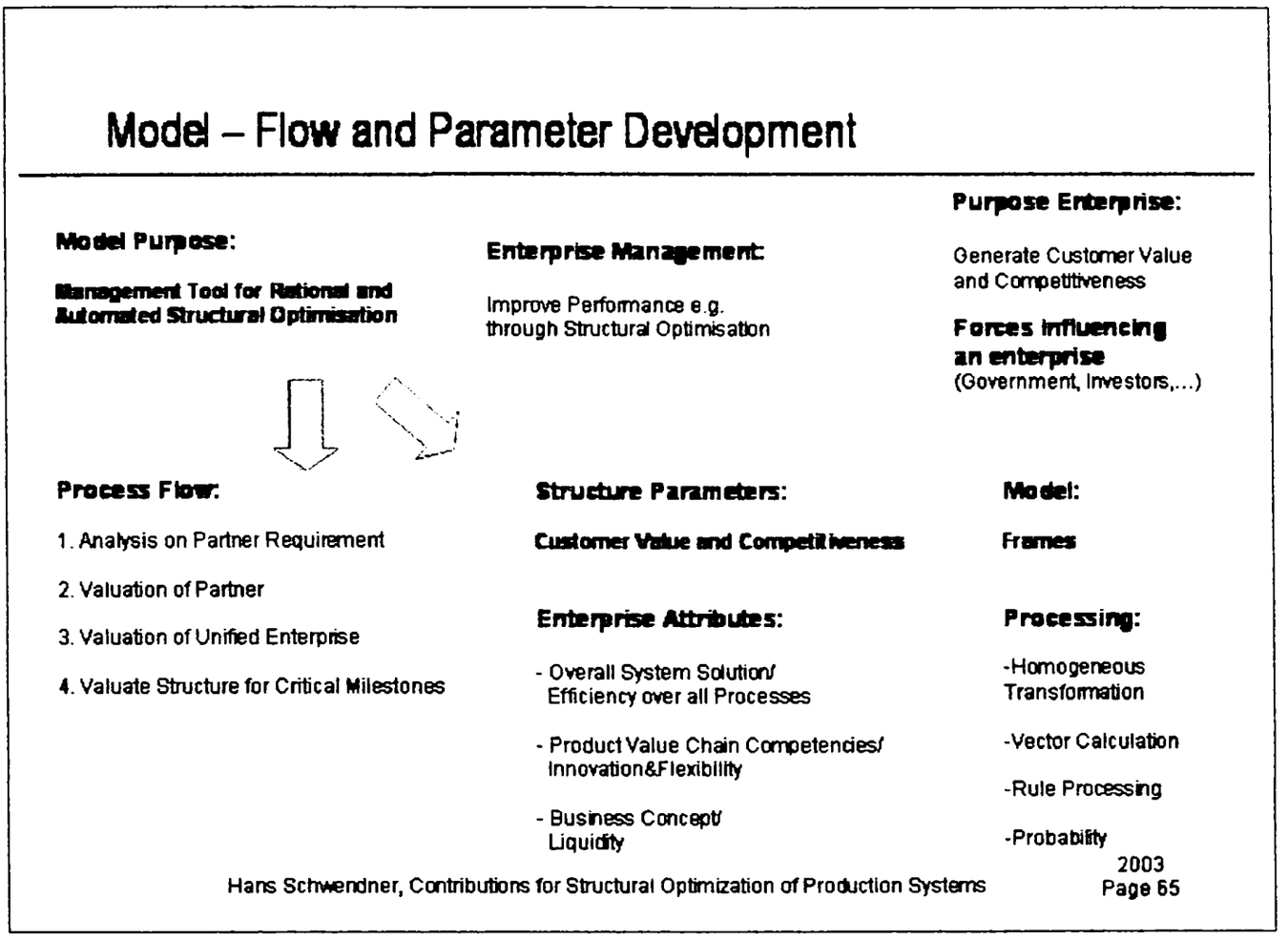
The results are summarized in figure 8.1.



/Figure 8.1.: The Result – Concept, Model, Flow/

Concept, flow and model were developed on theory, experience of consultants and business cases recursively by building hypothesises on assumed behaviour. Hypothesises will lead to adaptation of the model while the application of the model in a case study will lead to verification in comparison of predicted result of model with reality/experiment. These steps are done for verification to implement flow and tools into the management decision process.

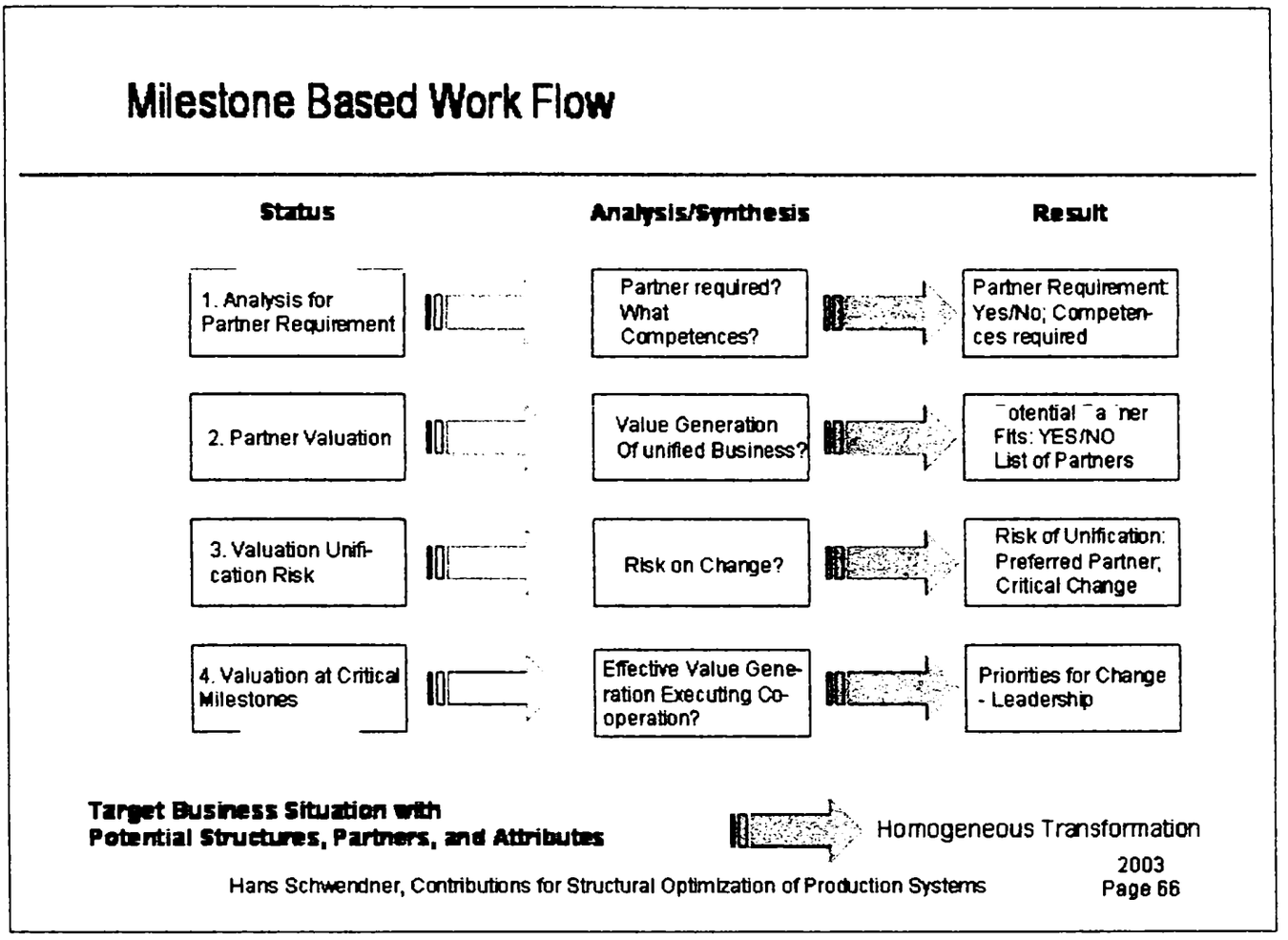
The overall flow on development of flow and model within this thesis is illustrated in figure 8.2..



/Figure 8.2.: Model – Flow and Parameter Development/

The overall concept for deriving the purpose of an enterprise is developed through state of the art analysis of a multitude of concepts and deriving ideasy from philosophy and psychology for rationalising processes. The clear distinction between enterprise and management drawn concluded to the purpose of the model. Derived from case studies and research a dedicated flow is developed from analysis to unification. Throughout the flow parameters for description of the *current and future business situation were developed. The parameters allow a* qualitative description of enterprises for further processing the informatio by homogeneous transformation, rules, and relations.

Figure 8.2. gives an overview on the process for transforming an enterprise from its current to a future business situation – through external partnership. Each step is defined by a dedicated task on synthesis and/or analysis for generating a result for management.

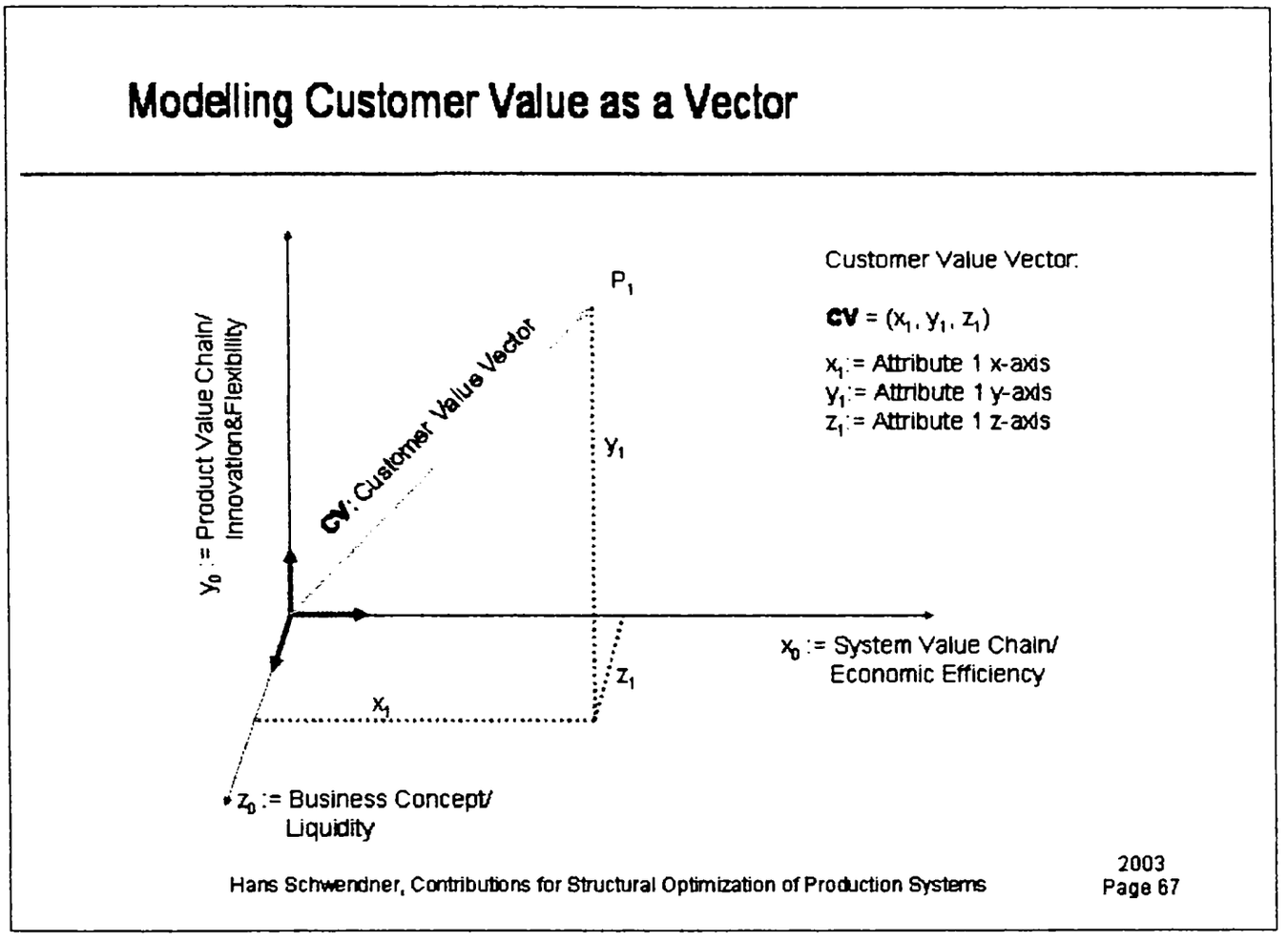


/Figure 8.3.: Milestone Based Work Flow/

Mangement can use the results for decision and as guidance for effectively executing a cooperating to generate improved customer value.
Theoretical analysis and business cases were combined to develop and verify these dedicated model characteristics and their applicability in the different process steps.

For representation of a business situation and its manipulation different models from mathematics, production management, etc. are investigated. The representation of systems by frames is selected. Frames allow a mathematical description for simple comparison of system attributes.

Figure 8.4. shows one frame. One company is represented by its frame and respective customer value vector. By frames the core players: the customer, the competitor and the enterprise can be represented. Each of them is described by dedicated attribute values – their customer value. The customer thereby is the reference for any enterprise and competitor.



/Figure 8.4.: Modelling Customer Value as a Vector/

Customer value is mapped onto capability (demand and contribution) attributes. Three attributes are developed:

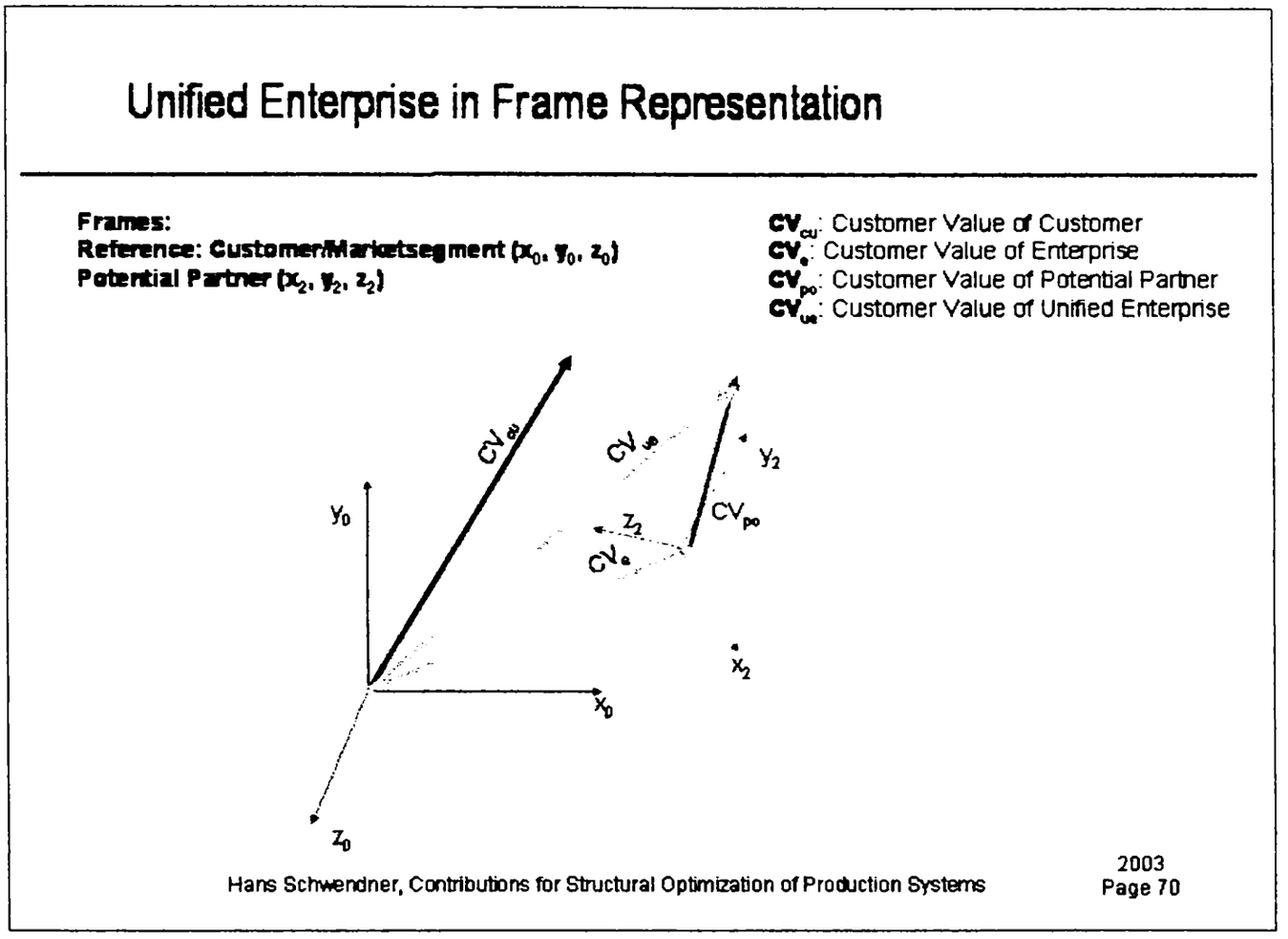
- x-axis: describing the economic efficiency for the system value chain the enterprises' product is part of
- y-axis: describing the value chain of the product generation and the enterprises' competencies for innovation and flexibility
- z-axis: describing the capability to change the business concept and financial capabilities for execution

The individual attribute values are gathered through dedicated input list and are calculated out of these qualitative parameter values.

The description by a customer value vector represents valuation of respective competencies and capability of a company to contribute competence to demand. The orientation represents the companies' view, or valuation on kind of realisation.

Based on this representation a business situation can be described by an arrangement of frames and the merging of companies can be calculated through

frame manipulation. Figure 8.5. shows the arrangment of the customer, the enterprise and a company 'merged' with the enterprise.

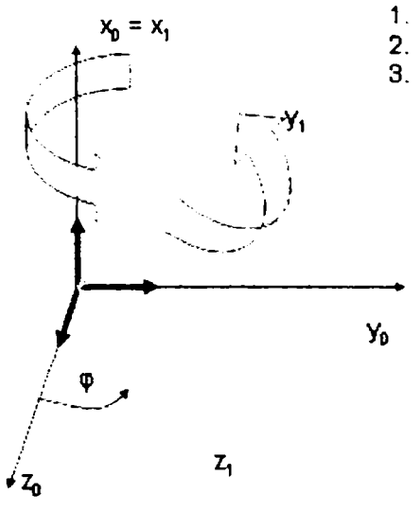


/Figure 8.5.: Unified Enterprise in Frame Representation/

The analysis for deriving decisions is performed by processing the frame-vectors by homogeneous transformation and evaluation of the result by given rules 'knowledge'. In case a partnership is recommended as a result (based on analysis of delta vectors), parameter list are manipulated by rules to synthesize the required contributions (competencies) a partner should bring in. The contributions required represent scan vectors for search of potential partners.

Figure 8.6. shows the derivation of the transformation matrix from the angles of the frame vectors. The angles between the axis in business are interprested as different realisation/processes for generation of value – that are not necessarily compatible or complementary. The matrix for the transformation is aproximated by deriving the main angles between the axis from the parameter list (attribute parameters).

Rotation of Frames – Transformation Matrix



Procedure for Transformation (Euler-Angles):

1. Rotation around x_0-axis angle φ: result system x_1, y_1, z_1
2. Rotation around y_1-axis angle ψ: result system x_2, y_2, z_2
3. Rotation around z2-axis angle χ: result system x_3, y_3, z_3

Transformation Matrix (System 3 in 0):
Interpretation by cosinus between unit vectors:

$$\begin{vmatrix} Cx3x0 & Cy3x0 & Cz3x0 \\ Cx3y0 & Cy3y0 & Cz3y0 \\ Cx3z0 & Cy3z0 & Cz3z0 \end{vmatrix} = E$$

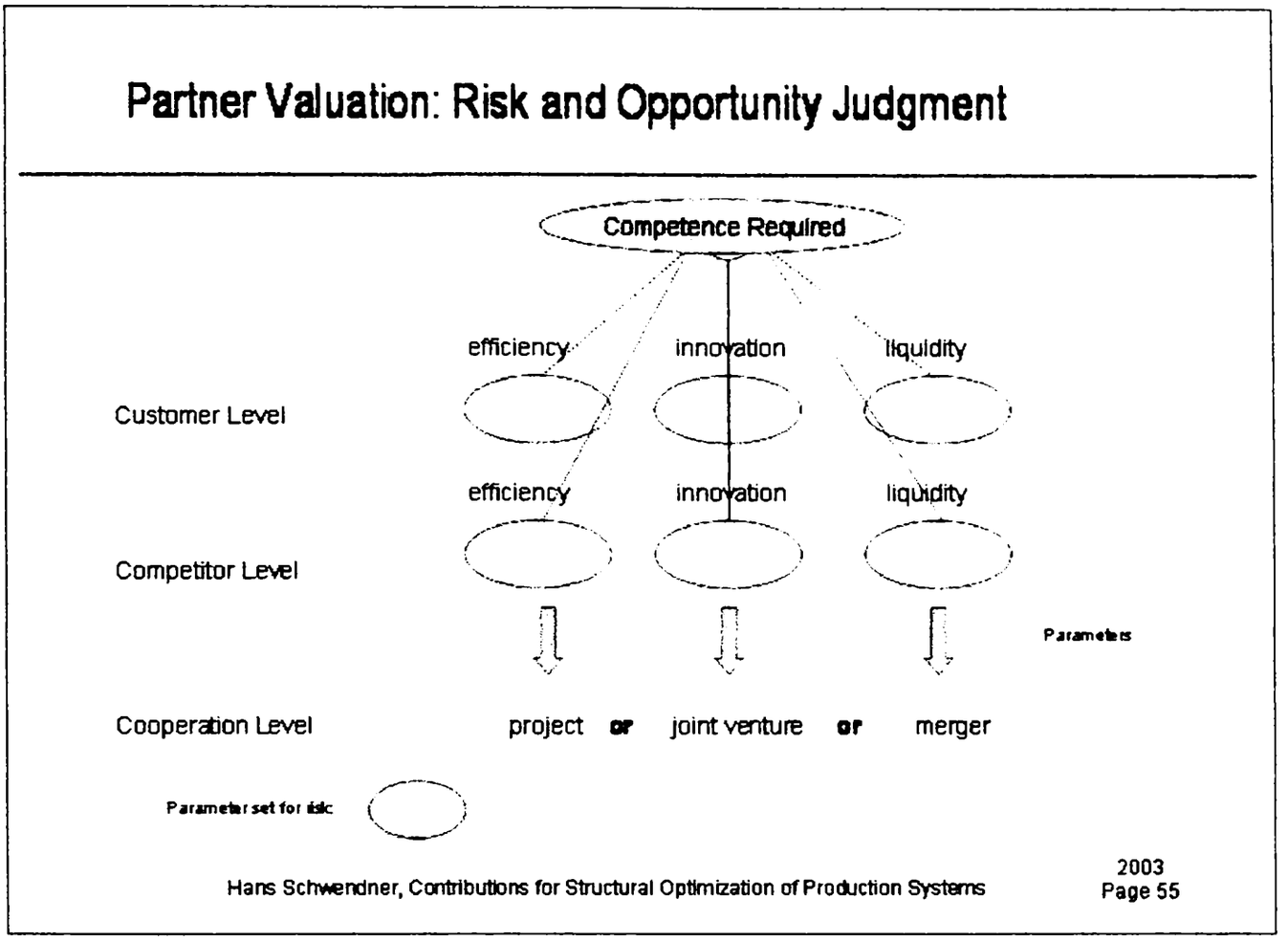
Transformation Matrix (System 3 in 0):
Interpretation by Euler angles:

$$\begin{vmatrix} C\psi C\chi & -C\psi S\chi & S\psi \\ C\varphi S\chi + S\varphi S\psi C\chi & C\varphi C\chi - S\varphi S\psi S\chi & -S\varphi C\psi \\ S\varphi S\chi - C\varphi S\psi C\chi & S\varphi C\chi + C\varphi S\psi S\chi & C\varphi C\psi \end{vmatrix} = E$$

C:= cosine
S:= sinus

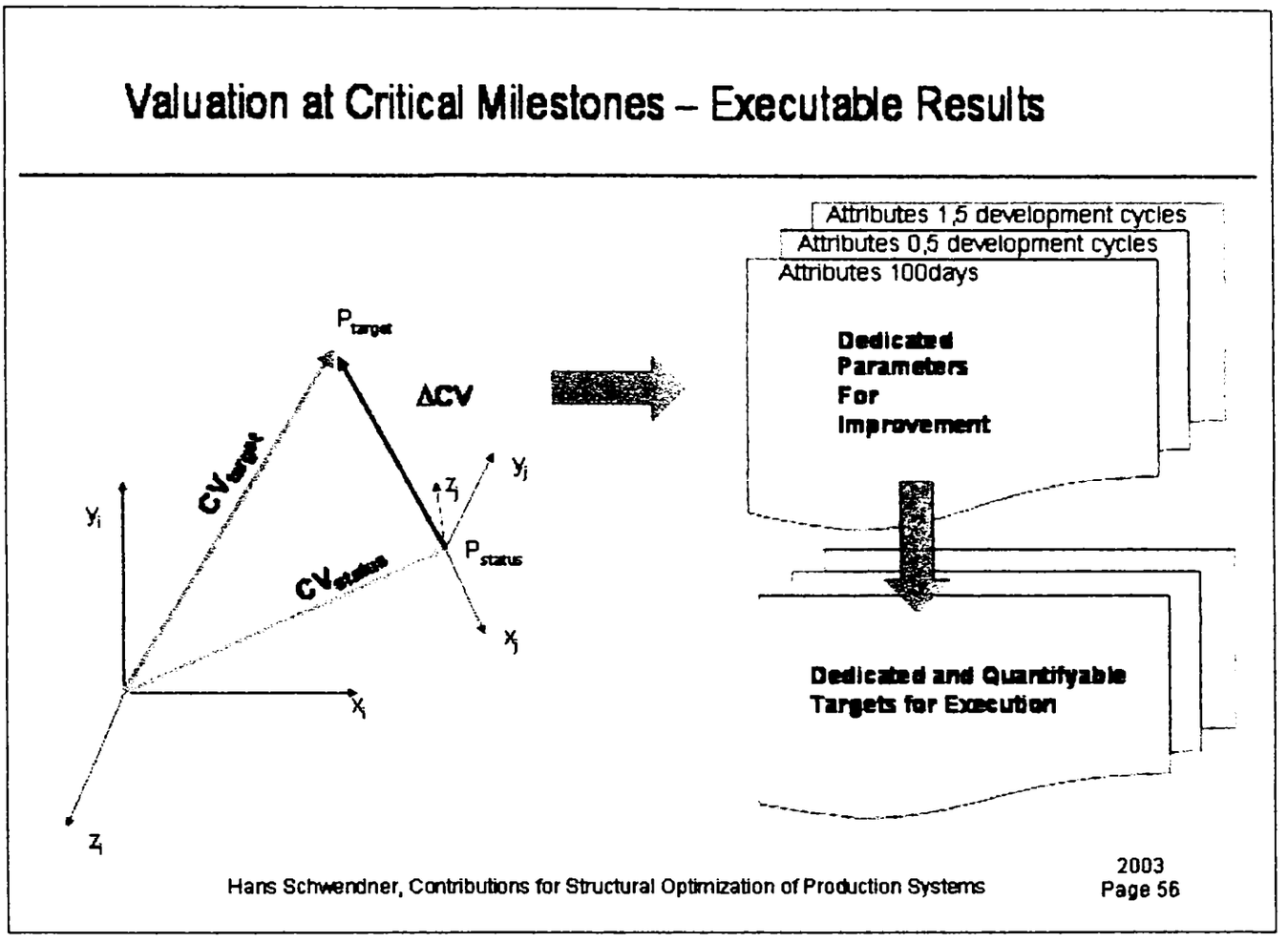
/Figure 8.6.: Rotation of Frames – Transformation Matrix/

Once requirement for partnership is verified potential partners are evaluated on fit and potential success of the partnership (figure 8.7). Potential partners are also represented by frame attributes and then compared for risk and opportunity in cooperation. This step includes risk judgment on reliability of information (fault tolerance), as business information is uncertain and could be belief instead of real knowledge. Transactions in change and transformations in business environment are analysed in a dedicated sub-step to care for the special risk involved in a business transformation.
The results of this step are valuations for success and failure, a recommendation on legal structure, and critical parameters management has to handle for change. The set of potential partners and partnership structure can be reduced by those parameters indicating manageability of risk and respective opportunities for success.



/Figure 8.7.: Risk and Opportunity Judgement – Partner Valuation/

The final step throughout the process is the realisation of the cooperation itself. Independent of intending a project based loosely connected network or a merger of companies changes have to be realised within all involved partners.
For increasing management effectivity industry independent sub-milestones for a cooperation are synthesized as industry independent at 100 days, 0,5 product development cycles and 1,5 product development cycles after a cooperation kick off. Dedicated executable targets are results - linked with these milestones. These results are mapped with the critical parameters and parameters for contribution. Therby a priority structure of results for management in executing the cooperation is generated. Figure 8.8 shows the procedure to derive a delta vector between target and status. Out of this delta the dedicated resulting targets for action for improvement are derived.

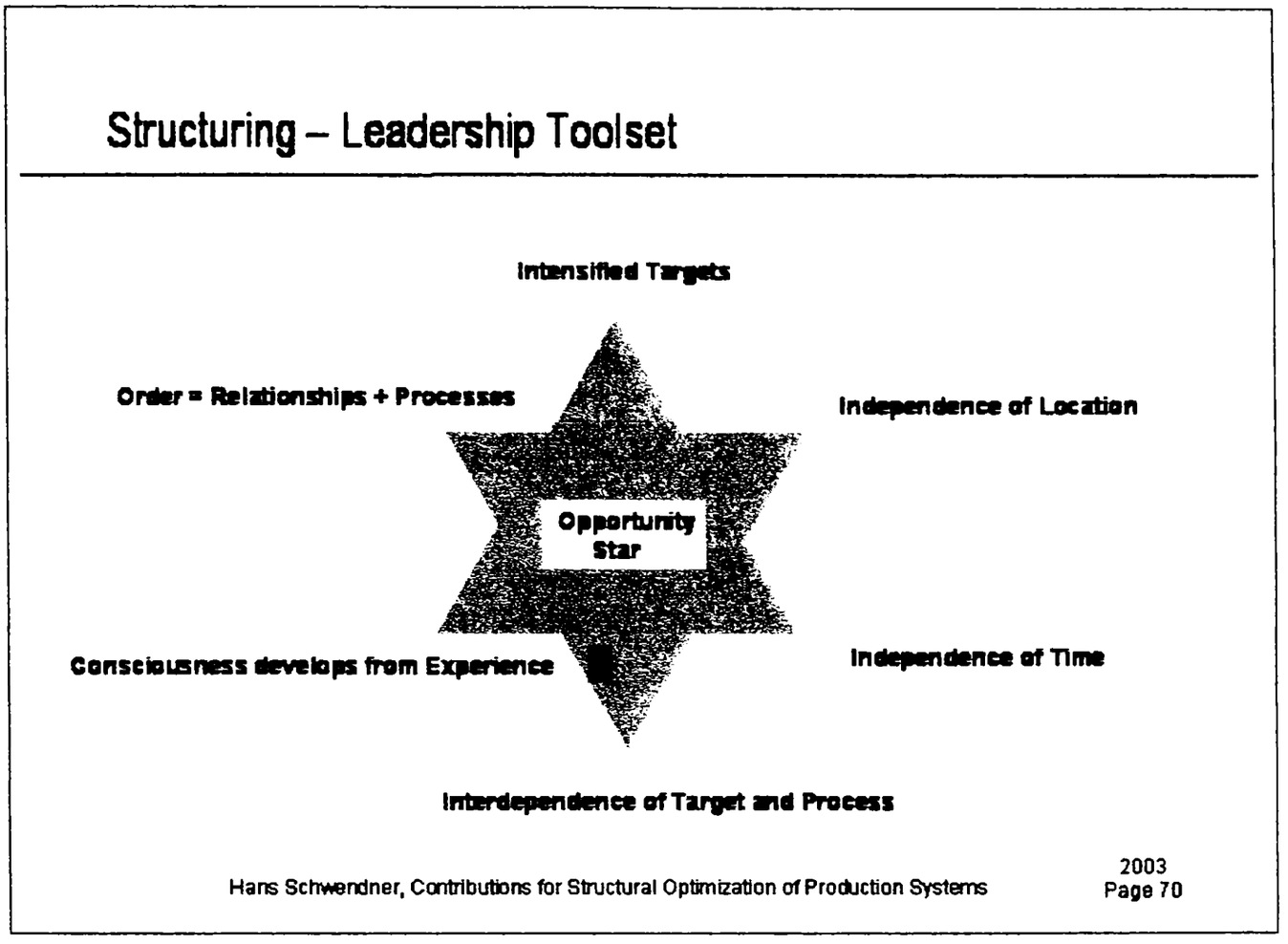


/Figure 8.8.: Valuation at Critical Milestones – Executable Results/

To overcome conventional change barriers in minds of people a leadership toolset is developed. Its application targets steering questions to generate innovative partnership approaches and to give guidance guidance for questions regarding change in business concept and leadership:

- is independence of location taken into account
- can targets be harmonised (especially through management harmony)
- are processes considered or targets
- does intensity increase within the area of activity

Figure 8.9. shows the 'opportunity star' for deriving these questions. The concepts of the opportunity star are applied also for the execution of the cooperation. This is by supporting leaders in defining targets, measuremet of results and appropriate action on deviation.



/Figure 8.9.: Structuring – Leadership Toolset/

The model is verified throughout the complete flow with an industry case. The application proved the validity of the model and even revealed contributions at certain steps that could have made real case more rational in decision and management more effective if the model had been available.

Overall a new comprehensive flow and model is developed for the structural optimisation of production systems through partnerships. The advantages are in:

- a clearly structured process supported by rationalised conceptual procedure
- improveable process through knowledge-add capability in valuation
- provision of external information for 'transformation' and driving for new solutions

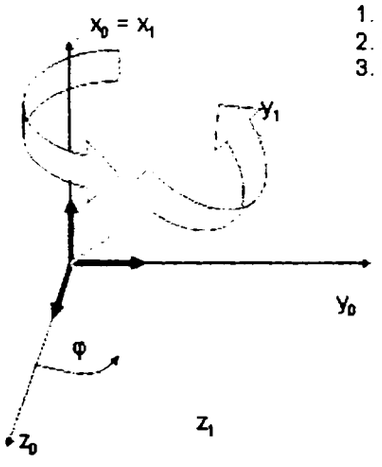
Still there is room for improvement, that may be base for advanced research:
- the verification of the model for a network. Special focus can be given to deal with complexity of options.
- the application and adaptation of the model to a different industry (e.g. service)
- the adaptation of the model to continuous change of views instead of discrete changes and thus making it a dynamic model

9. Annex

a. Programs and Tables

Program for calculation of transformation matrix side elements based on diagonal cosine values

Rotation of Frames – Transformation Matrix



Procedure for Transformation (Euler-Angles):

1. Rotation around x_0-axis angle φ: result system x_1, y_1, z_1
2. Rotation around y_1-axis angle ψ: result system x_2, y_2, z_2
3. Rotation around z2-axis angle χ: result system x_3, y_3, z_3

Transformation Matrix (System 3 in 0):
Interpretation by cosinus between unit vectors:

$$\begin{vmatrix} Cx3x0 & Cy3x0 & Cz3x0 \\ Cx3y0 & Cy3y0 & Cz3y0 \\ Cx3z0 & Cy3z0 & Cz3z0 \end{vmatrix} = E$$

Transformation Matrix (System 3 in 0):
Interpretation by Euler angles:

$$\begin{vmatrix} C\psi C\chi & -C\psi S\chi & S\psi \\ C\varphi S\chi + S\varphi S\psi C\chi & C\varphi C\chi - S\varphi S\psi S\chi & -S\varphi C\psi \\ S\varphi S\chi - C\varphi S\psi C\chi & S\varphi C\chi + C\varphi S\psi S\chi & C\varphi C\psi \end{vmatrix} = E$$

C:= cosine
S:= sinus


```
Option Explicit

Const PI = 3.141592

Private Sub cmdCompute_Click()
   FindSolutions
End Sub

'-------------------------
'i rotation about x axis
'j rotation about y axis
'k rotation about z axis
'rot(x,i),rot(y,j),rot(z,k)
'-----------------------------------------------------------------
'Notations:
'* rotations:
```

```
'   i rotation value in radians about x axis
'   j rotation value in radians about y axis
'   k rotation value in radians about z axis
'* elements of the orientation matrix M:
'   m11 m12 m13
'   m21 m22 m23
'   m31 m32 m33
' * angles in degree:
'   iAngInDeg angle in degree coresponding to value i expressed in radians
'   jAngInDeg angle in degree coresponding to value j expressed in radians
'   kAngInDeg angle in degree coresponding to value k expressed in radians
'Input values: m11, m22, m23
'For each of variables m11, m22, m33 we have a collection with discrete values
' m11 ={-1,-0.5,0.5,1}
' m22 ={-1,-0.87,-0.5,0,0.5,0.87,1}
' m33 ={-1,-0.5,0.5,1}
'Output values:i,j,k values coresponding to input values
'Alghoritm:
'- We have as inputs : m11, m22, m23 elements from orientation matrix
'- We compute the elements of the matrix M for each combination between
'  iAngInDeg, jAngInDeg , kAngInDeg where : iAngInDeg = {0,10,20, .... 350}
'  jAngInDeg = {0,10,20, .... 350}, kAngInDeg = {0,10,20, .... 350}
'- if the values for m11, m22 and m23 we put all the elements of the matrix M
'  and angles corespondind to theis matrix in a text file
'-------------------------------------------------------------------
Private Sub FindSolutions()

    '--------------------------------------
    'Declare some variables fo write in file
    '--------------------------------------
    Dim numberOfSol As Long
    Dim strFilePath As String
    Dim strEulerAngles As String
    Dim strLine1Mat As String
    Dim strLine2Mat As String
    Dim strLine3Mat As String
    Dim strDiagonalElements As String

    numberOfSol = 0
    strFilePath = App.Path & "\resultsDiscreteValues.txt"

    '-----------------------------
    'Open a file for write the result
    '-----------------------------
    Dim fso As FileSystemObject
    Dim txtstr As TextStream
    Dim f As File
    Set fso = CreateObject("Scripting.FileSystemObject")
    Dim IsFileExist As Boolean
    IsFileExist = fso.FileExists(strFilePath)
    'If IsFileExist Then
    '   Set txtstr = fso.OpenTextFile(strFilePath, ForAppending)
    'Else
       Set txtstr = fso.CreateTextFile(strFilePath, True)
    'End If
```

```
'------------------------------
'Set a tolerance for comparison
'------------------------------
Dim tol As Double
tol = 0.01 'HARDCODED

Dim isValidSol As Boolean
isValidSol = False

'------------------------------
'Coolections for discrete values
'------------------------------
Dim colA As New Collection
Dim colB As New Collection
Dim colC As New Collection

colA.Add 0.9
colA.Add 0.5
colA.Add -0.5
colA.Add -0.9

colB.Add 1
colB.Add 0.87
colB.Add 0.5
colB.Add 0
colB.Add -0.5
colB.Add -0.87
colB.Add -1

colC.Add 0.9
colC.Add 0.5
colC.Add -0.5
colC.Add -0.9

'---------------------------
'Declare necessary variables
'---------------------------
Dim iAngInDeg As Double
Dim jAngInDeg As Double
Dim kAngInDeg As Double
Dim m, n, p As Integer
Dim u, v, w As Integer
Dim aVal, bVal, cVal As Double
Dim m11, m12, m13, m21, m22, m23, m31, m32, m33 As Double
Dim i, j, k As Double
Dim isLessOneValueNegative As Boolean

u = colA.Count
v = colB.Count
w = colC.Count

Dim stepIncrement As Double
stepIncrement = 3# 'HARDCODED
For iAngInDeg = 0 To 180 Step stepIncrement
```

```
For jAngInDeg = 0 To 180 Step stepIncrement
   For kAngInDeg = 0 To 180 Step stepIncrement

      '----------------------------------------
      'Get angle in radians to use in computation
      '----------------------------------------
      i = GradeToRad(CDbl(iAngInDeg))
      j = GradeToRad(CDbl(jAngInDeg))
      k = GradeToRad(CDbl(kAngInDeg))

      m11 = Cos(j) * Cos(k)
      m22 = Cos(i) * Cos(k) - Sin(i) * Sin(j) * Sin(k)
      m33 = Cos(i) * Cos(j)

      '---------------------
      'Check if values are ok
      '---------------------
      For m = 1 To u
         If (Abs(m11 - CDbl(colA(m))) < tol) Then
            aVal = m11
            For n = 1 To v
               If (Abs(m22 - CDbl(colB(n))) < tol) Then
                  bVal = m22
                  For p = 1 To w
                     If (Abs(m33 - CDbl(colC(p))) < tol) Then
                        cVal = m33
                        isValidSol = True
                        If (isValidSol = True) Then

                           '----------------------------------------
                           'compute all terms of the orientation matrix
                           '----------------------------------------
                           m12 = -1 * Cos(j) * Sin(k)
                           m13 = Sin(j)
                           m21 = Cos(i) * Sin(k) + Sin(i) * Sin(j) * Cos(k)
                           m23 = -1 * Sin(i) * Cos(j)
                           m31 = Sin(i) * Sin(k) - Cos(i) * Sin(j) * Cos(k)
                           m32 = Sin(i) * Cos(k) + Cos(i) * Sin(j) * Sin(k)

                           '-----------------------
                           'Eliminate negative values
                           '-----------------------
                           isLessOneValueNegative = False
                           If (m12 < 0) Then
                              isLessOneValueNegative = True
                           End If
                           If (m13 < 0) Then
                              isLessOneValueNegative = True
                           End If
                           If (m21 < 0) Then
                              isLessOneValueNegative = True
                           End If
                           If (m23 < 0) Then
                              isLessOneValueNegative = True
                           End If
```

```
    If (m31 < 0) Then
       isLessOneValueNegative = True
    End If
    If (m32 < 0) Then
       isLessOneValueNegative = True
    End If

    '---------------------------------
    'For the moment without restriction
    '---------------------------------
    isLessOneValueNegative = False

    If (isLessOneValueNegative = False) Then
       numberOfSol = numberOfSol + 1

       '-------------------------------
       'Limiting the number of solutions
       '-------------------------------
       If (numberOfSol > 2000) Then 'HARDCODED
          MsgBox "End"
          Exit Sub
       End If

       '----------------------
       'prepeare the parameters
       '----------------------
strEulerAngles = "Angles are : " & CStr(Round(iAngInDeg, 2)) & ", " & _
                        CStr(Round(jAngInDeg, 2)) & ", " & _
                        CStr(Round(kAngInDeg, 2))
       strLine1Mat = CStr(Round(m11, 2)) & "  " & _
                     CStr(Round(m12, 2)) & "  " & _
                     CStr(Round(m13, 2))
       strLine2Mat = CStr(Round(m21, 2)) & "  " & _
                     CStr(Round(m22, 2)) & "  " & _
                     CStr(Round(m23, 2))
       strLine3Mat = CStr(Round(m31, 2)) & "  " & _
                     CStr(Round(m32, 2)) & "  " & _
                     CStr(Round(m33, 2))
    strDiagonalElements = "Diagonal :" & CStr(Round(m11, 2)) & "," & _
                     CStr(Round(m22, 2)) & "," & _
                     CStr(Round(m33, 2))

       '----------------------
       'print the result in file
       '----------------------
       txtstr.WriteLine " "
       txtstr.WriteLine "* " & CStr(numberOfSol)
       txtstr.WriteLine strEulerAngles
       txtstr.WriteLine strDiagonalElements
       txtstr.WriteLine "-------------------------------"
       txtstr.WriteLine strLine1Mat
       txtstr.WriteLine strLine2Mat
       txtstr.WriteLine strLine3Mat

     End If
```

```
                        End If
                    End If
                Next p
            End If
        Next n
    End If
Next m

'-------------------
'Reset some variables
'-------------------
isValidSol = False
aVal = 0
bVal = 0
cVal = 0

    Next kAngInDeg
  Next jAngInDeg
Next iAngInDeg

MsgBox "Solutions were printed in file : " & strFilePath

'-------------
'Close the file
'-------------
txtstr.Close

End Sub

'Get value of the angle in radians from degree
Private Function GradeToRad(dblGrade As Double) As Double
  GradeToRad = (dblGrade * PI) / 180#
End Function

Private Sub cmdFind_Click()

  Dim stepIncrement As Double
  stepIncrement = Val(txtStep.Text)
  Dim tol As Double
  tol = Val(txtTol.Text)
  Dim m11Ref As Double
  Dim m22Ref As Double
  Dim m33Ref As Double
  m11Ref = Val(txtM11.Text)
  m22Ref = Val(txtM22.Text)
  m33Ref = Val(txtM33.Text)

  '--------------------------------------
  'Declare some variables fo write in file
  '--------------------------------------
  Dim numberOfSol As Long
  Dim strFilePath As String
  Dim strEulerAngles As String
  Dim strLine1Mat As String
```

```
Dim strLine2Mat As String
Dim strLine3Mat As String
Dim strDiagonalElements As String

numberOfSol = 0
strFilePath = App.Path & "\resultsFind.txt"

'--------------------------------
'Open a file for write the result
'--------------------------------
Dim fso As FileSystemObject
Dim txtstr As TextStream
Dim f As File
Set fso = CreateObject("Scripting.FileSystemObject")
Set txtstr = fso.CreateTextFile(strFilePath, True)

Dim isValidSol As Boolean
isValidSol = False

'---------------------------
'Declare necessary variables
'---------------------------
Dim iAngInDeg As Double
Dim jAngInDeg As Double
Dim kAngInDeg As Double
Dim m, n, p As Integer
Dim u, v, w As Integer
Dim m11, m12, m13, m21, m22, m23, m31, m32, m33 As Double
Dim i, j, k As Double

For iAngInDeg = 0 To 180 Step stepIncrement
  For jAngInDeg = 0 To 180 Step stepIncrement
    For kAngInDeg = 0 To 180 Step stepIncrement

      '---------------------------------------
      'Get angle in radians to use in computation
      '---------------------------------------
      i = GradeToRad(CDbl(iAngInDeg))
      j = GradeToRad(CDbl(jAngInDeg))
      k = GradeToRad(CDbl(kAngInDeg))

      m11 = Cos(j) * Cos(k)
      m22 = Cos(i) * Cos(k) - Sin(i) * Sin(j) * Sin(k)
      m33 = Cos(i) * Cos(j)

      '--------------------
      'Check if values are ok
      '--------------------
      If (Abs(m11 - m11Ref) < tol) Then
        If (Abs(m22 - m22Ref) < tol) Then
          If (Abs(m33 - m33Ref) < tol) Then

            '---------------------------------------
            'compute all terms of the orientation matrix
            '---------------------------------------
```

```
        m12 = -1 * Cos(j) * Sin(k)
        m13 = Sin(j)
        m21 = Cos(i) * Sin(k) + Sin(i) * Sin(j) * Cos(k)
        m23 = -1 * Sin(i) * Cos(j)
        m31 = Sin(i) * Sin(k) - Cos(i) * Sin(j) * Cos(k)
        m32 = Sin(i) * Cos(k) + Cos(i) * Sin(j) * Sin(k)

        numberOfSol = numberOfSol + 1

        '------------------------------
        'Limiting the number of solutions
        '------------------------------
        If (numberOfSol > 200) Then 'HARDCODED
           MsgBox "More than 200 solutions"
           Exit Sub
        End If

        '----------------------
        'prepeare the parameters
        '----------------------
        strEulerAngles = "Angles are : " & CStr(Round(iAngInDeg, 2)) & ", " & _
                         CStr(Round(jAngInDeg, 2)) & ", " & _
                         CStr(Round(kAngInDeg, 2))
        strLine1Mat = CStr(Round(m11, 2)) & "  " & _
                      CStr(Round(m12, 2)) & "  " & _
                      CStr(Round(m13, 2))
        strLine2Mat = CStr(Round(m21, 2)) & "  " & _
                      CStr(Round(m22, 2)) & "  " & _
                      CStr(Round(m23, 2))
        strLine3Mat = CStr(Round(m31, 2)) & "  " & _
                      CStr(Round(m32, 2)) & "  " & _
                      CStr(Round(m33, 2))
        strDiagonalElements = "Diagonal :" & CStr(Round(m11, 2)) & "," & _
                      CStr(Round(m22, 2)) & "," & _
                      CStr(Round(m33, 2))

        '----------------------
        'print the result in file
        '----------------------
        txtstr.WriteLine " "
        txtstr.WriteLine "* " & CStr(numberOfSol)
        txtstr.WriteLine strEulerAngles
        txtstr.WriteLine strDiagonalElements
        txtstr.WriteLine "----------------------------"
        txtstr.WriteLine strLine1Mat
        txtstr.WriteLine strLine2Mat
        txtstr.WriteLine strLine3Mat

     End If
   End If
End If

'-------------------
'Reset some variables
'-------------------
```

```
            isValidSol = False

        Next kAngInDeg
    Next jAngInDeg
Next iAngInDeg

txtNrSolutions.Text = CStr(numberOfSol)

If (numberOfSol > 0) Then
    MsgBox CStr(numberOfSol) & " solutions were printed in file : " & strFilePath
Else
    MsgBox "No solution found!"
End If

'--------------
'Close the file
'--------------
txtstr.Close

End Sub
```

Table of Transformation Matrix elements and respective angles between axis; angles are in degree and are arranged x,y,z; 'diaginal' means the cosines values of the diagonal elements of the matrix

* 1
Angles are : 0, 27, 0
Diagonal :0.89,1,0.89

0.89 0 0.45
0 1 0
-0.45 0 0.89

* 2
Angles are : 0, 27, 180
Diagonal :-0.89,-1,0.89

-0.89 0 0.45
0 -1 0
0.45 0 0.89

* 3
Angles are : 0, 60, 0
Diagonal :0.5,1,0.5

0.5 0 0.87
0 1 0
-0.87 0 0.5

* 4
Angles are : 0, 60, 3
Diagonal :0.5,1,0.5

0.5 -0.03 0.87
0.05 1 0
-0.86 0.05 0.5

* 5
Angles are : 0, 60, 6
Diagonal :0.5,0.99,0.5

0.5 -0.05 0.87
0.1 0.99 0
-0.86 0.09 0.5

* 6
Angles are : 0, 60, 174
Diagonal :-0.5,-0.99,0.5

-0.5 -0.05 0.87
0.1 -0.99 0
0.86 0.09 0.5

* 7
Angles are : 0, 60, 177
Diagonal :-0.5,-1,0.5

-0.5 -0.03 0.87
0.05 -1 0
0.86 0.05 0.5

* 8
Angles are : 0, 60, 180
Diagonal :-0.5,-1,0.5

-0.5 0 0.87
0 -1 0
0.87 0 0.5

* 9
Angles are : 0, 120, 0
Diagonal :-0.5,1,-0.5

-0.5 0 0.87
0 1 0
-0.87 0 -0.5

* 10
Angles are : 0, 120, 3
Diagonal :-0.5,1,-0.5

-0.5 0.03 0.87
0.05 1 0
-0.86 0.05 -0.5

* 11
Angles are : 0, 120, 6
Diagonal :-0.5,0.99,-0.5

-0.5 0.05 0.87
0.1 0.99 0
-0.86 0.09 -0.5

* 12
Angles are : 0, 120, 174
Diagonal :0.5,-0.99,-0.5

0.5 0.05 0.87
0.1 -0.99 0
0.86 0.09 -0.5

* 13
Angles are : 0, 120, 177
Diagonal :0.5,-1,-0.5

0.5 0.03 0.87
0.05 -1 0
0.86 0.05 -0.5

* 14
Angles are : 0, 120, 180
Diagonal :0.5,-1,-0.5

0.5 0 0.87
0 -1 0
0.87 0 -0.5

* 15
Angles are : 0, 153, 0
Diagonal :-0.89,1,-0.89

-0.89 0 0.45
0 1 0
-0.45 0 -0.89

* 16
Angles are : 0, 153, 180
Diagonal :0.89,-1,-0.89

0.89 0 0.45
0 -1 0
0.45 0 -0.89

* 17
Angles are : 3, 60, 0
Diagonal :0.5,1,0.5

0.5 0 0.87
0.05 1 -0.03
-0.86 0.05 0.5

* 18
Angles are : 3, 60, 3
Diagonal :0.5,0.99,0.5

0.5 -0.03 0.87
0.1 0.99 -0.03
-0.86 0.1 0.5

* 19
Angles are : 3, 60, 171
Diagonal :-0.49,-0.99,0.5

-0.49 -0.08 0.87
0.11 -0.99 -0.03
0.86 0.08 0.5

* 20

Angles are : 3, 60, 174
Diagonal :-0.5,-1,0.5

-0.5 -0.05 0.87
0.06 -1 -0.03
0.87 0.04 0.5

* 21
Angles are : 3, 60, 177
Diagonal :-0.5,-1,0.5

-0.5 -0.03 0.87
0.01 -1 -0.03
0.87 -0.01 0.5

* 22
Angles are : 3, 60, 180
Diagonal :-0.5,-1,0.5

-0.5 0 0.87
-0.05 -1 -0.03
0.86 -0.05 0.5

* 23
Angles are : 3, 120, 0
Diagonal :-0.5,1,-0.5

-0.5 0 0.87
0.05 1 0.03
-0.86 0.05 -0.5

* 24
Angles are : 3, 120, 3
Diagonal :-0.5,0.99,-0.5

-0.5 0.03 0.87
0.1 0.99 0.03
-0.86 0.1 -0.5

* 25
Angles are : 3, 120, 171
Diagonal :0.49,-0.99,-0.5

0.49 0.08 0.87
0.11 -0.99 0.03
0.86 0.08 -0.5

* 26
Angles are : 3, 120, 174
Diagonal :0.5,-1,-0.5

0.5 0.05 0.87
0.06 -1 0.03
0.87 0.04 -0.5

* 27
Angles are : 3, 120, 177
Diagonal :0.5,-1,-0.5

0.5 0.03 0.87
0.01 -1 0.03
0.87 -0.01 -0.5

* 28
Angles are : 3, 120, 180
Diagonal :0.5,-1,-0.5

0.5 0 0.87
-0.05 -1 0.03
0.86 -0.05 -0.5

* 29
Angles are : 6, 24, 57
Diagonal :0.5,0.51,0.91

0.5 -0.77 0.41
0.86 0.51 -0.1
-0.13 0.4 0.91

* 30
Angles are : 6, 24, 174
Diagonal :-0.91,-0.99,0.91

-0.91 -0.1 0.41
0.06 -0.99 -0.1
0.41 -0.06 0.91

* 31
Angles are : 6, 60, 0
Diagonal :0.5,0.99,0.5

0.5 0 0.87
0.09 0.99 -0.05
-0.86 0.1 0.5

* 32
Angles are : 6, 60, 171
Diagonal :-0.49,-1,0.5

-0.49 -0.08 0.87
0.07 -1 -0.05
0.87 0.03 0.5

* 33
Angles are : 6, 60, 174
Diagonal :-0.5,-1,0.5

-0.5 -0.05 0.87
0.01 -1 -0.05
0.87 -0.01 0.5

* 34
Angles are : 6, 60, 177
Diagonal :-0.5,-1,0.5

-0.5 -0.03 0.87
-0.04 -1 -0.05
0.87 -0.06 0.5

* 35
Angles are : 6, 60, 180
Diagonal :-0.5,-0.99,0.5

-0.5 0 0.87
-0.09 -0.99 -0.05
0.86 -0.1 0.5

* 36
Angles are : 6, 120, 0
Diagonal :-0.5,0.99,-0.5

-0.5 0 0.87
0.09 0.99 0.05
-0.86 0.1 -0.5

* 37
Angles are : 6, 120, 171
Diagonal :0.49,-1,-0.5

0.49 0.08 0.87
0.07 -1 0.05
0.87 0.03 -0.5

* 38
Angles are : 6, 120, 174
Diagonal :0.5,-1,-0.5

0.5 0.05 0.87
0.01 -1 0.05
0.87 -0.01 -0.5

* 39
Angles are : 6, 120, 177
Diagonal :0.5,-1,-0.5

0.5 0.03 0.87
-0.04 -1 0.05
0.87 -0.06 -0.5

* 40
Angles are : 6, 120, 180
Diagonal :0.5,-0.99,-0.5

0.5 0 0.87
-0.09 -0.99 0.05
0.86 -0.1 -0.5

* 41

Angles are : 6, 156, 57
Diagonal :-0.5,0.51,-0.91

-0.5 0.77 0.41
0.86 0.51 0.1
-0.13 0.4 -0.91

* 42
Angles are : 6, 156, 174
Diagonal :0.91,-0.99,-0.91

0.91 0.1 0.41
0.06 -0.99 0.1
0.41 -0.06 -0.91

* 43
Angles are : 9, 60, 171
Diagonal :-0.49,-1,0.49

-0.49 -0.08 0.87
0.02 -1 -0.08
0.87 -0.02 0.49

* 44
Angles are : 9, 60, 174
Diagonal :-0.5,-1,0.49

-0.5 -0.05 0.87
-0.03 -1 -0.08
0.87 -0.07 0.49

* 45
Angles are : 9, 60, 177
Diagonal :-0.5,-0.99,0.49

-0.5 -0.03 0.87
-0.08 -0.99 -0.08
0.86 -0.11 0.49

* 46
Angles are : 9, 120, 171
Diagonal :0.49,-1,-0.49

0.49 0.08 0.87
0.02 -1 0.08
0.87 -0.02 -0.49

* 47
Angles are : 9, 120, 174
Diagonal :0.5,-1,-0.49

0.5 0.05 0.87
-0.03 -1 0.08
0.87 -0.07 -0.49

* 48
Angles are : 9, 120, 177
Diagonal :0.5,-0.99,-0.49

0.5 0.03 0.87
-0.08 -0.99 0.08
0.86 -0.11 -0.49

* 49
Angles are : 18, 18, 18
Diagonal :0.9,0.88,0.9

0.9 -0.29 0.31
0.38 0.88 -0.29
-0.18 0.38 0.9

* 50
Angles are : 18, 162, 18
Diagonal :-0.9,0.87,-0.9

-0.9 0.29 0.31
0.38 0.87 0.29
-0.18 0.38 -0.9

* 51
Angles are : 24, 6, 120
Diagonal :-0.5,-0.49,0.91

-0.5 -0.86 0.1
0.77 -0.49 -0.4
0.4 -0.12 0.91

* 52
Angles are : 24, 9, 156
Diagonal :-0.9,-0.86,0.9

-0.9 -0.4 0.16
0.31 -0.86 -0.4
0.3 -0.31 0.9

* 53
Angles are : 24, 12, 156
Diagonal :-0.89,-0.87,0.89

-0.89 -0.4 0.21
0.29 -0.87 -0.4
0.34 -0.29 0.89

* 54
Angles are : 24, 168, 156
Diagonal :0.89,-0.87,-0.89

0.89 0.4 0.21
0.29 -0.87 0.4
0.34 -0.29 -0.89

* 55
Angles are : 24, 171, 156
Diagonal :0.9,-0.86,-0.9

0.9 0.4 0.16
0.31 -0.86 0.4
0.3 -0.31 -0.9

* 56
Angles are : 24, 174, 120
Diagonal :0.5,-0.49,-0.91

0.5 0.86 0.1
0.77 -0.49 0.4
0.4 -0.12 -0.91

* 57
Angles are : 30, 54, 33
Diagonal :0.49,0.51,0.51

0.49 -0.32 0.81
0.81 0.51 -0.29
-0.32 0.8 0.51

* 58
Angles are : 30, 126, 33
Diagonal :-0.49,0.51,-0.51

-0.49 0.32 0.81
0.81 0.51 0.29
-0.32 0.8 -0.51

* 59
Angles are : 33, 54, 30
Diagonal :0.51,0.51,0.49

0.51 -0.29 0.81
0.8 0.51 -0.32
-0.32 0.81 0.49

* 60
Angles are : 33, 126, 30
Diagonal :-0.51,0.51,-0.49

-0.51 0.29 0.81
0.8 0.51 0.32
-0.32 0.81 -0.49

* 61
Angles are : 57, 24, 6
Diagonal :0.91,0.51,0.5

0.91 -0.1 0.41
0.4 0.51 -0.77
-0.13 0.86 0.5

* 62

Angles are : 57, 156, 6
Diagonal :-0.91,0.51,-0.5

-0.91 0.1 0.41
0.4 0.51 0.77
-0.13 0.86 -0.5

* 63
Angles are : 60, 6, 156
Diagonal :-0.91,-0.49,0.5

-0.91 -0.4 0.1
0.12 -0.49 -0.86
0.4 -0.77 0.5

* 64
Angles are : 60, 174, 156
Diagonal :0.91,-0.49,-0.5

0.91 0.4 0.1
0.12 -0.49 0.86
0.4 -0.77 -0.5

* 65
Angles are : 120, 6, 24
Diagonal :0.91,-0.49,-0.5

0.91 -0.4 0.1
-0.12 -0.49 -0.86
0.4 0.77 -0.5

* 66
Angles are : 120, 174, 24
Diagonal :-0.91,-0.49,0.5

-0.91 0.4 0.1
-0.12 -0.49 0.86
0.4 0.77 0.5

* 67
Angles are : 123, 24, 174
Diagonal :-0.91,0.51,-0.5

-0.91 -0.1 0.41
-0.4 0.51 -0.77
-0.13 -0.86 -0.5

* 68
Angles are : 123, 156, 174
Diagonal :0.91,0.51,0.5

0.91 0.1 0.41
-0.4 0.51 0.77
-0.13 -0.86 0.5

* 69

Angles are : 147, 54, 150
Diagonal :-0.51,0.51,-0.49

-0.51 -0.29 0.81
-0.8 0.51 -0.32
-0.32 -0.81 -0.49

* 70
Angles are : 147, 126, 150
Diagonal :0.51,0.51,0.49

0.51 0.29 0.81
-0.8 0.51 0.32
-0.32 -0.81 0.49

* 71
Angles are : 150, 54, 147
Diagonal :-0.49,0.51,-0.51

-0.49 -0.32 0.81
-0.81 0.51 -0.29
-0.32 -0.8 -0.51

* 72
Angles are : 150, 126, 147
Diagonal :0.49,0.51,0.51

0.49 0.32 0.81
-0.81 0.51 0.29
-0.32 -0.8 0.51

* 73
Angles are : 156, 6, 60
Diagonal :0.5,-0.49,-0.91

0.5 -0.86 0.1
-0.77 -0.49 -0.4
0.4 0.12 -0.91

* 74
Angles are : 156, 9, 24
Diagonal :0.9,-0.86,-0.9

0.9 -0.4 0.16
-0.31 -0.86 -0.4
0.3 0.31 -0.9

* 75
Angles are : 156, 12, 24
Diagonal :0.89,-0.87,-0.89

0.89 -0.4 0.21
-0.29 -0.87 -0.4
0.34 0.29 -0.89

* 76

Angles are : 156, 168, 24
Diagonal :-0.89,-0.87,0.89

-0.89 0.4 0.21
-0.29 -0.87 0.4
0.34 0.29 0.89

* 77
Angles are : 156, 171, 24
Diagonal :-0.9,-0.86,0.9

-0.9 0.4 0.16
-0.31 -0.86 0.4
0.3 0.31 0.9

* 78
Angles are : 156, 174, 60
Diagonal :-0.5,-0.49,0.91

-0.5 0.86 0.1
-0.77 -0.49 0.4
0.4 0.12 0.91

* 79
Angles are : 162, 18, 162
Diagonal :-0.9,0.87,-0.9

-0.9 -0.29 0.31
-0.38 0.87 -0.29
-0.18 -0.38 -0.9

* 80
Angles are : 162, 162, 162
Diagonal :0.9,0.87,0.9

0.9 0.29 0.31
-0.38 0.87 0.29
-0.18 -0.38 0.9

* 81
Angles are : 171, 60, 3
Diagonal :0.5,-0.99,-0.49

0.5 -0.03 0.87
0.08 -0.99 -0.08
0.86 0.11 -0.49

* 82
Angles are : 171, 60, 6
Diagonal :0.5,-1,-0.49

0.5 -0.05 0.87
0.03 -1 -0.08
0.87 0.07 -0.49

* 83

Angles are : 171, 60, 9
Diagonal :0.49,-1,-0.49

0.49 -0.08 0.87
-0.02 -1 -0.08
0.87 0.02 -0.49

* 84
Angles are : 171, 120, 3
Diagonal :-0.5,-0.99,0.49

-0.5 0.03 0.87
0.08 -0.99 0.08
0.86 0.11 0.49

* 85
Angles are : 171, 120, 6
Diagonal :-0.5,-1,0.49

-0.5 0.05 0.87
0.03 -1 0.08
0.87 0.07 0.49

* 86
Angles are : 171, 120, 9
Diagonal :-0.49,-1,0.49

-0.49 0.08 0.87
-0.02 -1 0.08
0.87 0.02 0.49

* 87
Angles are : 174, 24, 6
Diagonal :0.91,-0.99,-0.91

0.91 -0.1 0.41
-0.06 -0.99 -0.1
0.41 0.06 -0.91

* 88
Angles are : 174, 24, 123
Diagonal :-0.5,0.51,-0.91

-0.5 -0.77 0.41
-0.86 0.51 -0.1
-0.13 -0.4 -0.91

* 89
Angles are : 174, 60, 0
Diagonal :0.5,-0.99,-0.5

0.5 0 0.87
0.09 -0.99 -0.05
0.86 0.1 -0.5

* 90
Angles are : 174, 60, 3
Diagonal :0.5,-1,-0.5

0.5 -0.03 0.87
0.04 -1 -0.05
0.87 0.06 -0.5

* 91
Angles are : 174, 60, 6
Diagonal :0.5,-1,-0.5

0.5 -0.05 0.87
-0.01 -1 -0.05
0.87 0.01 -0.5

* 92
Angles are : 174, 60, 9
Diagonal :0.49,-1,-0.5

0.49 -0.08 0.87
-0.07 -1 -0.05
0.87 -0.03 -0.5

* 93
Angles are : 174, 60, 180
Diagonal :-0.5,0.99,-0.5

-0.5 0 0.87
-0.09 0.99 -0.05
-0.86 -0.1 -0.5

* 94
Angles are : 174, 120, 0
Diagonal :-0.5,-0.99,0.5

-0.5 0 0.87
0.09 -0.99 0.05
0.86 0.1 0.5

* 95
Angles are : 174, 120, 3
Diagonal :-0.5,-1,0.5

-0.5 0.03 0.87
0.04 -1 0.05
0.87 0.06 0.5

* 96
Angles are : 174, 120, 6
Diagonal :-0.5,-1,0.5

-0.5 0.05 0.87
-0.01 -1 0.05
0.87 0.01 0.5

* 97
Angles are : 174, 120, 9
Diagonal :-0.49,-1,0.5

-0.49 0.08 0.87
-0.07 -1 0.05
0.87 -0.03 0.5

* 98
Angles are : 174, 120, 180
Diagonal :0.5,0.99,0.5

0.5 0 0.87
-0.09 0.99 0.05
-0.86 -0.1 0.5

* 99
Angles are : 174, 156, 6
Diagonal :-0.91,-0.99,0.91

-0.91 0.1 0.41
-0.06 -0.99 0.1
0.41 0.06 0.91

* 100
Angles are : 174, 156, 123
Diagonal :0.5,0.51,0.91

0.5 0.77 0.41
-0.86 0.51 0.1
-0.13 -0.4 0.91

* 101
Angles are : 177, 60, 0
Diagonal :0.5,-1,-0.5

0.5 0 0.87
0.05 -1 -0.03
0.86 0.05 -0.5

* 102
Angles are : 177, 60, 3
Diagonal :0.5,-1,-0.5

0.5 -0.03 0.87
-0.01 -1 -0.03
0.87 0.01 -0.5

* 103
Angles are : 177, 60, 6
Diagonal :0.5,-1,-0.5

0.5 -0.05 0.87
-0.06 -1 -0.03
0.87 -0.04 -0.5

* 104

Angles are : 177, 60, 9
Diagonal :0.49,-0.99,-0.5

0.49 -0.08 0.87
-0.11 -0.99 -0.03
0.86 -0.08 -0.5

* 105
Angles are : 177, 60, 177
Diagonal :-0.5,0.99,-0.5

-0.5 -0.03 0.87
-0.1 0.99 -0.03
-0.86 -0.1 -0.5

* 106
Angles are : 177, 60, 180
Diagonal :-0.5,1,-0.5

-0.5 0 0.87
-0.05 1 -0.03
-0.86 -0.05 -0.5

* 107
Angles are : 177, 120, 0
Diagonal :-0.5,-1,0.5

-0.5 0 0.87
0.05 -1 0.03
0.86 0.05 0.5

* 108
Angles are : 177, 120, 3
Diagonal :-0.5,-1,0.5

-0.5 0.03 0.87
-0.01 -1 0.03
0.87 0.01 0.5

* 109
Angles are : 177, 120, 6
Diagonal :-0.5,-1,0.5

-0.5 0.05 0.87
-0.06 -1 0.03
0.87 -0.04 0.5

* 110
Angles are : 177, 120, 9
Diagonal :-0.49,-0.99,0.5

-0.49 0.08 0.87
-0.11 -0.99 0.03
0.86 -0.08 0.5

* 111
Angles are : 177, 120, 177
Diagonal :0.5,0.99,0.5

0.5 0.03 0.87
-0.1 0.99 0.03
-0.86 -0.1 0.5

* 112
Angles are : 177, 120, 180
Diagonal :0.5,1,0.5

0.5 0 0.87
-0.05 1 0.03
-0.86 -0.05 0.5

* 113
Angles are : 180, 27, 0
Diagonal :0.89,-1,-0.89

0.89 0 0.45
0 -1 0
0.45 0 -0.89

* 114
Angles are : 180, 27, 180
Diagonal :-0.89,1,-0.89

-0.89 0 0.45
0 1 0
-0.45 0 -0.89

* 115
Angles are : 180, 60, 0
Diagonal :0.5,-1,-0.5

0.5 0 0.87
0 -1 0
0.87 0 -0.5

* 116
Angles are : 180, 60, 3
Diagonal :0.5,-1,-0.5

0.5 -0.03 0.87
-0.05 -1 0
0.86 -0.05 -0.5

* 117
Angles are : 180, 60, 6
Diagonal :0.5,-0.99,-0.5

0.5 -0.05 0.87
-0.1 -0.99 0
0.86 -0.09 -0.5

* 118
Angles are : 180, 60, 174
Diagonal :-0.5,0.99,-0.5

-0.5 -0.05 0.87
-0.1 0.99 0
-0.86 -0.09 -0.5

* 119
Angles are : 180, 60, 177
Diagonal :-0.5,1,-0.5

-0.5 -0.03 0.87
-0.05 1 0
-0.86 -0.05 -0.5

* 120
Angles are : 180, 60, 180
Diagonal :-0.5,1,-0.5

-0.5 0 0.87
0 1 0
-0.87 0 -0.5

* 121
Angles are : 180, 120, 0
Diagonal :-0.5,-1,0.5

-0.5 0 0.87
0 -1 0
0.87 0 0.5

* 122
Angles are : 180, 120, 3
Diagonal :-0.5,-1,0.5

-0.5 0.03 0.87
-0.05 -1 0
0.86 -0.05 0.5

* 123
Angles are : 180, 120, 6
Diagonal :-0.5,-0.99,0.5

-0.5 0.05 0.87
-0.1 -0.99 0
0.86 -0.09 0.5

* 124
Angles are : 180, 120, 174
Diagonal :0.5,0.99,0.5

0.5 0.05 0.87
-0.1 0.99 0
-0.86 -0.09 0.5

* 125

Angles are : 180, 120, 177
Diagonal :0.5,1,0.5

0.5 0.03 0.87
-0.05 1 0
-0.86 -0.05 0.5

* 126
Angles are : 180, 120, 180
Diagonal :0.5,1,0.5

0.5 0 0.87
0 1 0
-0.87 0 0.5

* 127
Angles are : 180, 153, 0
Diagonal :-0.89,-1,0.89

-0.89 0 0.45
0 -1 0
0.45 0 0.89

* 128
Angles are : 180, 153, 180
Diagonal :0.89,1,0.89

0.89 0 0.45
0 1 0
-0.45 0 0.89

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d. Abbreviations and Notations

- Matrices are written in capital slope letters: *A*
- nxm matrices are written as $\begin{vmatrix} a11 & a12 & a1n \\ a21 & a22 & a2n \\ \dots & \dots & \dots \\ am1 & am2 & amn \end{vmatrix} = A$
- Vectors are written in capital bold letters: **CV**
- Vectors are written [a1, a1, ...,an]
- Transposed vectors (1xn matrix) are written $[a1, a1, ...,an]^T$
- The value of a vector is written |**A**|
- Unit vectors are written in small bold letters with an index "i" for the system; unit vectors are $\mathbf{x}_i$, $\mathbf{y}_i$, and $\mathbf{z}_i$
- A set of values is written {a1, a2,...}
- A function generally is written V(..) (for example probability of P(...))
- a: Accessability
- ab: Abductive
- c: Contradictory
- CEO: Chief Executive Office
- CFO: Chief Financial Officer
- CO: Competitor
- comp: Competency

- COO: Chief Operating Officer
- COS: Cost of Sales
- cri: Critical
- CU: Customer
- CV: Customer value
- D: Germany (Deutschland)
- d: Day
- de: Deductive (in parameter tables only)
- dc: Development Cycle
- E: Enterprise, own company
- EACAM: European Association of Consumer Electronic Manufacturers
- EBIT: Earnings before Interest and Taxes
- EBITDA: Earnings before Interest, Tax, Depreciation, Amortisation
- EDI: Electronic Data Interface
- Et al.: et alteri (and others)
- ETSI: European Telecommunications Standards Institute
- EU: Europe
- ff: and following
- FV: Firm Value = Market Capitalisation + Debt - Cash
- FY: Fiscal Year
- GDP: Gross Domestic Product
- G&V: Profit&Loss Statement (Gewinn- und Verlustrechnung)
- HR: Human Resources
- i: Identical (in parameter tables regarding 'view')
- in: Inductive (in parameter tables regarding knowledge reliability)
- IC: Integrated Circuit
- IP: Intellectual Property
- IT: Information Technology
- JV: Joint Venture
- KISS: Keep it simple and stupid
- KOR: Korea

- MBO: Management Buy Out
- MF: merger/Fusion
- MFG: Manufacturing
- MON: Month
- NM: Not Mentioned
- O: Opportunity
- P: Parameter
- PO: Potential Partner
- PR: Project
- P&L: Profit and Loss
- R: Risk
- R&D: Research and Development
- SG&A: Sales, General and Administration Cost
- SW: Software
- SWOT: Strength Weakness Opportunity Threat
- S&M: Sales and Marketing
- T: Tag (Day)
- TAM: Total Available Market
- Thai: Thailand
- TV: Television Set
- UE: Unified Enterprise
- v: View
- VP: Vice President
- W: Week
- Y: Year