coden:LUTMDN/(TMMV-1046)/1-125/(2001)

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JOHANSSON COMMUNICATION TOOLS

LUND UNIVERSITY

JOHANSSON COMMUNICATION TOOLS

A Set of Seven Management Tools for Empowering Strategic Growth in the Communication of Technical Information

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Licentiate Thesis

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A Set of Seven Management Tools for Empowering Strategic Growth in the Communication of Technical Information

JCT Leadership Communication Cycle

JCT Communication Surface

JCT Communication Measuring Method

JCT Communication Key Ratio

JCT Communication Diagram

JCT Communication Cube

JCT Communication Growth Potential Graph

Nils Johansson
Olofström, August 2001

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coden: LUTMDN/(TMMV-1046)/1-125/(2001)

Dedicated to Inger, Anders and Peter

Abstract

The Johansson Communication Tools for empowering strategic growth in the communication of technical information constitute a set of seven tools: JCT Leadership Communication Cycle, JCT Communication Surface, JCT Communication Cube, JCT Communication Diagram, JCT Communication Measuring Method, JCT Communication Key Ratio and JCT Communication Growth Potential Graph.

This thesis describes the collection and processing of data relevant to determining the status of communication effectiveness in a company. The thesis demonstrates how the Johansson Communication Tools can be used with the data to create the basis for strategic management decisions and resource allocation concerning targets, follow-up activities and strategic growth in communication, especially the external communication of technical information.

The Johansson Communication Tools have been created for Senior Management, Middle Management and Communication Management. Senior Management sets and controls visions, strategies and objectives. Middle Management allocates the funds to meet the targets according to the visions, strategies and objectives. Communication Management investigates new technology for developing effective communication.

By creating a common platform for managers at different levels, Johansson Communication Tools enable a more harmonized, competent effort toward correct allocation of resources to achieve effective communication, thereby driving growth. Furthermore, employees are encouraged to develop and achieve win/win targets and visions both in-house and in external relations with partners (customers and suppliers).

Supply chain efficiency is based on communication effectiveness. Today, many persons at different levels in a company realize the importance of communication effectiveness. However, many persons may not realize *how much money, time and human resources can be saved by considering communication effectiveness at the very start of negotiations in a new project and by evaluating and following up communication effectiveness in all business operations.* Senior management and communication managers must establish a joint forum for discussing communication effectiveness, analyzing communication needs, determining communication strategies, and allocating monetary and human resources to the communication process, to ensure supply chain efficiency. The Johansson Communication Tools provide managers with extremely relevant information for making managerial decisions. Implementing the Johansson Communication Tools can lead to substantial returns, both tangible and intangible, generating corporate competitive power and improving the potential for corporate survival.

Key words: communication, external communication of technical information, leadership, management, communication cube, EDI , growth potential, Odette

Acknowledgements

The author recognizes the assistance of many individuals without whom an effort of this scope could not have been possible.

I regret that for reasons of brevity I can only single out a few of the persons who have supported me in my work.

In the first place I would like to thank the members of my family for loving support and coaching.

I also owe thanks to my managers and colleagues at the Volvo stamping plants in Olofström and Gothenburg, who have not only provided the generous funding and other resources but also the encouragement to carry out this research.

In addition, my research would not have been possible without the kind co-operation of the suppliers and customers of the Volvo plants in Olofström.

My sincere thanks to Louise Henry who has made decisive contributions in the appearance of this thesis and the correctness of the used language.

Finally, I am very much obliged to Assoc. Prof. Giorgos Nikoleris for his unstinting guidance and thoughtful comments throughout the evolution of this work.

Preface

I have chosen the quotes below to illustrate a fundamental aspect of my research, i.e. the application of knowledge primarily in engineering but also in human communication to the field of external communication of technical information.

Three quotes from the book:

Världsmästarna, En ny generation av tillverkningsföretag by Jan Helling

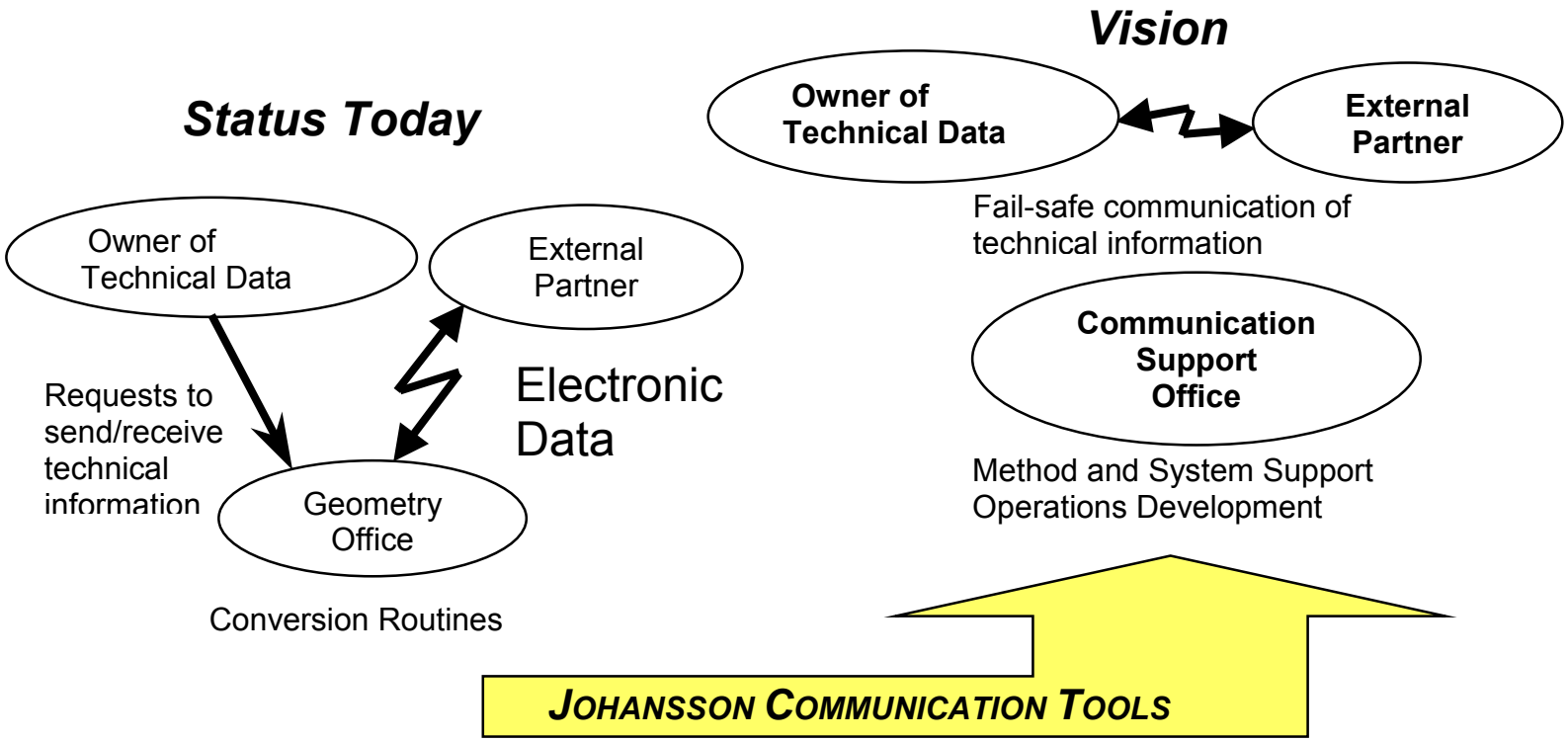
(title in English = *World Champions, A new generation of manufacturing companies*)

> "It's difficult to understand how the technical systems in (an automotive) company function, if you do not simultaneously view them in their economic, human and organisational context." (pg 204)
>
> "I recommend the Swedish industry, in co-operation with research institutes and relevant public organisations, to establish a special institute or reinforce one of the existing ones that has the task of attracting *"multidisciplinary" knowledge concerning world class production industry*. The purpose shall be to have a continuously up-dated database and source of inspiration for Swedish companies that are involved in global competition." (pg 279)
>
> "Winning does not mean conquering others, it simply means achieving your own goals." (pg 287)

The humanistic component represented in the quotes above creates the basis for a multidisciplinary approach. This approach represents the best method for creating a win/win situation in the external communication of technical information.

Nils Johansson
August 2001

External Communication of Technical Information



List of Key Words

3-D hard copy	Laser emulgation procedure for making a physical copy based on a CAD model without using a milling machine.
ADDAM	Two-dimensional Computer Aided Manufacturing system made in-house at Volvo for use in the Volvo Olofström Plants.
AP	Application Protocol, used in STEP.
BCD	BCD is the abbreviation for Volvo Car Components Corporation, Body Components Division, which is today named Volvo Car Corporation Body Components (abbreviated VCBC). The company is located in Olofström, Sweden. BCD represents the Brand Owner in this investigation.
Benchmarking	The study of the procedures, products or services of several companies to find a company that can serve as a model for improving your company's procedures, products or services.
Brand Owner	The company that legally owns the brand under which the product being designed and manufactured will be sold to the end user (consumer).
Brand Owner's Communication Policy	The Brand Owner's Communication Policy defines the guidelines for ensuring communication effectiveness.
CAD/CAM	Computer Aided Design / Computer Aided Manufacturing.
CALMA DDM	An interactive, modular graphic system for computer aided design in 3 D. Trademark of General Electric.
Changes in the Transfer Conditions	Dimension 3 in the JCT Communication Cube.
Chip	A small rectangular piece of silicon on which thousands of integrated circuits can be engraved. Chip technology was developed in Silicon Valley in the USA, but today, Sweden, more specifically the suburb of Kista outside of Stockholm, is one of the world centers for research on applications for this technology.
CL	Abbreviation for Communication Loop.
Communication	Info (data) back and forth between nodes, but in the correct quality. Fax, telephone call, electronic, degenerate the information (lines to screen), some information doesn't have to be returned but some does. (new information, feedback) Autocad to CATIA, conversions are time-consuming, impossible, money-consuming.

Communication Agreement for External Communication of Technical Information	An agreement between Partners stipulating the transfer routines, transfer media (hardware and software), other transfer conditions and contact person(s) at both companies.
Communication Channel	A means of communication between a sender and a receiver who are both able to send and/or receive.
Communication Cube	See JCT Communication Cube.
Communication Cycle	See JCT Leadership Communication Cycle.
Communication Interface	Point of interaction between one human being and another, or between human beings and computerized information.
Communication Loop	A path along which information can be sent, received, and returned to the sender after being processed by the receiver.
Communication Node	A site where information is received, and from which information can be sent. For example, a communication node can be a human being or a server or a personal computer. In this paper, a communication node is a work station with computer hardware and software that follows protocols to send and receive technical information with other work stations that follow the same protocols.
Communication Point	The one person who is the "interface" at a company for all communication with that company regarding a certain project for example. See also Communication Surface.
Communication Process	Includes everything: Cube, Loop, Leadership Cycle, Agreements, JCT Communication Diagrams. As any process, this Process can be broken down into steps, improved, and implemented at all organization levels.
Communication Surface	Several persons at different levels who together create a broad "interface" at a company for all communication with that company regarding a certain project for example. See also Communication Point.
Communication Test	A test to verify that the data that is sent from the Brand Owner's database is useable by the Partner for the intended purpose. The test is usually carried out in two steps: 1) the Brand Owner sends the data to the Partner 2) the Partner sends the data back to the Brand Owner. The returned data should appear in the Brand Owner's database as identical to the original data that was sent.
Correct Data	Data that is received in a form that can be read correctly. Data is correct when it is not distorted in any way.

Customer	A company that purchases products and/or services. In this paper a customer is usually referred to as a *partner*.
DAL	Design Analysis Language - a programming tool for the user when tailoring individual programs for repetitive functions and for special design requirements. For each DDM command, there is a corresponding DAL program. Everything a designer drew could be written as a DAL program.
DDM	Design Drafting Manufacturing.
DMIS	Dimension Measurement Inspection Specification.
DSM	Digital Shape Model, the math data that describes a certain component.
ESPRIT	European Strategic Programme For Research and Development in Information Technology.
EXTER	*External Communication of Technical Information*, the support system for handling the communication of technical information, implemented at Volvo Car Corporation since 1991. This system contains two main databases: the Math Model Database and the Partner Database. The reasons for establishing the EXTER system were: - Reduce cost per unit - Increase quality through establishing agreements specifying communication parameters that are stored and retrieved digitally (The Partner Database). - Improve traceability by establishing a journal function of all transfers of technical information.
Factor	Something that has an effect on a process or situation, but cannot directly itself be affected by a process or situation.
GPV	Growth Potential Volume.
Growth Potential Graph	See JCT Growth Potential Graph.
Human Communicators	Dimension 1 in the JCT Communication Cube.
IGES	Initial Graphics Exchange Specification (IGES), issued by the U.S. National Bureau of Standards in 1980.
IVF	Institutet för Verkstadsteknisk Forskning. In English: The Swedish Institute of Production Engineering Research.

JCT Communication Cube	The JCT Communication Cube is a three dimensional visualisation of communication effectiveness and can be used both by managers and communication engineers to make decisions regarding resource allocation. The JCT Communication Cube is based on three dimensions, see JCT Communication Cube Dimensions. For each dimension there are nine parameters, see JCT Communication Cube Parameter.
JCT Communication Cube Dimensions	The three basic dimensions of the JCT Communication Cube: 1. Human Communicators 2. Transfer Media 3. Changes in the Transfer Conditions over time
JCT Communication Cube Parameter	Any of the nine parameters used for assessing communication effectiveness. The Partners of the Brand Owner assess each parameter by indicating two values, one value for their satisfaction with the Brand Owner and one value for their satisfaction with a Benchmark company. There are three parameters in each JCT Communication Cube Dimension.
JCT Communication Diagram	A diagram that graphically shows the Partner's experience of the Brand Owner and the Benchmark in each of the nine parameters in the JCT Communication Cube. The JCT Communication Diagram indicates the parameter ID numbers for the pair, the percentages concerning the Partner's answers and the calculated JCT Key Ratios.
JCT Communication Key Ratio	The ratio that is the result of applying the JCT Measuring Method. These ratios are used by managers and communications experts to determine areas of investment to improve communication effectiveness.
JCT Communication Measuring Method	A method based on the use of questionnaires and calculation of key ratios to measure communication effectiveness and to determine where to make investments to improve communication effectiveness.
JCT Communication Surface	A strategic interface consisting of numerous contact points between persons with the corresponding responsibilities or competence. This interface demonstrates the importance of many effective communication channels between the right persons for each transmission of information.
JCT Growth Potential Graph	A graph that shows the gap between the existing position of a company and the position of the company considered to be the benchmark with regard to best practice in communication. The gap represents the potential for improvement.

JCT Leadership Communication Cycle	A graphical presentation of how corporate leadership can successfully promote a joint vision and interpretation in order to achieve the corporate objectives by means of first fulfilling the established simplified targets. The corporate organization automatically adjusts its path by using simplified targets as a guide and by following the Leadership Communication Cycle.
JCT Satisfaction Value	The value that indicates the degree of satisfaction of the respondent when answering the questionnaire. The value is stated as a percentage and is used to calculate the JCT Key Ratio.
JOHANSSON Communication Tools	A set of management tools for making strategic decisions regarding communication effectiveness. The JOHANSSON Communication Tools are tools to measure, analyze, present and transform the collected data from investigations in communication effectiveness in different ways. The results of the investigations can then be used by financial managers of finance and managers of technology to allocate resources and determine investments to improve communication effectiveness. The Tools are as follows: • JCT Leadership Communication Cycle • JCT Communication Surface • JCT Communication Measuring Method • JCT Communication Key Ratio • JCT Communication Diagram • JCT Communication Cube • JCT Growth Potential Graph
Management by Objectives	Briefly, this is a management strategy where managers define the objectives and make sure that deadlines are established and fulfilled for achieving these goals. In the 1970's, this strategy was based on quantitiy, i.e. to strive to fulfil as many objectives as possible at the same time. Personal satisfaction was supposed to come only after achieving the objective, not in the actual work towards the objective. The manager acted as a supervisor to make sure the employees were fulfilling their objectives and always defining new ones. This strategy has developed over the last three decades. It is now based on a manager acting as a facilitator who provides help, resources, and planning to define and achieve objectives that benefit the organization.
Math Data	Data stored in the computer in numerical form as the legal basis for the appearance and dimensions of the physical models for the automobile parts and manufacturing equipment for the auto parts.
Multidisciplinary approach	An method of solving problems that is based on close cooperation between and the application of knowledge from different research institutes, university departments and business partners.

NUFO	In Swedish: Numerisk Formgivning. In English: Numerical Design. This was the nickname used in Sweden for CAD models. Today, the term NUFO is no longer used, instead the more international term Digital Shape Model (DSM) is used.
Odette	Acronym for the Organisation for Data Exchange by Tele Transmission in Europe.
PAL	Parametric Analysis Language is an application based on DDM and DAL. PAL picks up allocated parametric values and calculates the corresponding geometry.
Parameter	A parameter is a constant, with variable values. A parameter can be assessed and improved.
Partner	A company with whom a Brand Owner communicates. A partner can be either a supplier, a customer or both. No economic cooperation is necessary.
Satisfaction Intervals	A tool used to prepare collected data for further statistical processing.
SIND	Abbreviation for Statens Industriverk (The Swedish National Industrial Board).
STEP	Standard for Exchange of Product model data.
Supplier	A company that has a contract and obligation to deliver approved products to the Brand Owner for further processing and final sales to the end user (consumer). In this paper, a supplier is usually referred to as a *partner*.
Supply Chain Efficiency	The effectiveness of the logistical routines selected in the manufacturing and transport of products as well as communication of technical information, from original concept to consumer market.
SVEP	Surface generation by vector-defined parameter curves. Software developed in-house at Volvo Car Corporation.
Technical Information	In this investigation, technical information refers to: a) Computer Aided Design engineering data for the purpose of manufacturing a product b) inspection data, ie measurement points, as per DMIS c) statistical information for quality assessment of a product
Transfer Media	Dimension 2 in the JCT Communication Cube.

Transistor	Electronic switches that replaced radio tubes. These radio tubes were the size of an adult finger. Transistors are about the size of the sulphur tip of a match. Transistors enabled evaluation of the binary (zero/one) position of the switch allowing "read" and "write" possibilities.
VCBC	The abbreviation used today for Volvo Car Corporation Body Components, located in Olofström, Sweden, formerly known as BCD.
VDA-Arbeitskreis CAD/CAM	VDA/Flächen-Schnittstelle (VDAFS) Version 1.0 July 1983.

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1 INTRODUCTION

1.1 Purpose

Industrial business operations demand the monitoring of three key aspects: lead time to market, quality, and costs. This research investigates the possibility of reducing lead time, increasing quality and decreasing costs by improving the effectiveness of communication between a company and its partners, i.e. the effectiveness of a company's communication with its customers and suppliers.

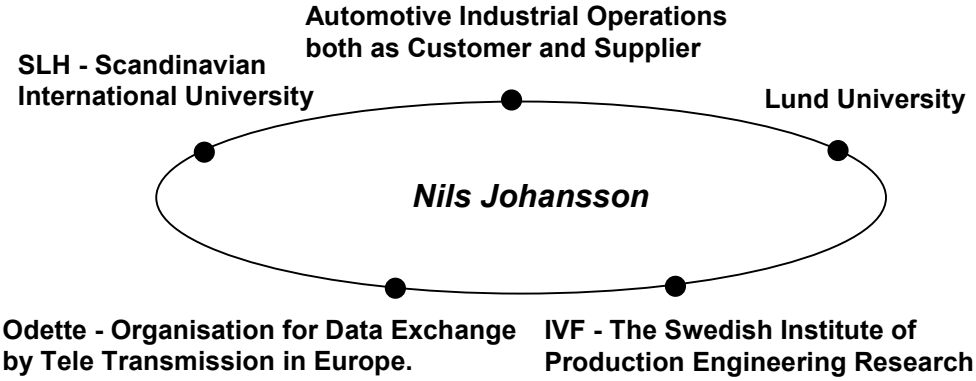
1.2 Scope

Communication is vital to all aspects of corporate operations. Thus, effective communication is crucial to the survival of companies. Communication can be internal (within the walls of the company) or external (between two or more different companies no matter where in the world they are located) or both. There are different types of information that can be communicated. Some examples of the different types of information are financial information, public relations information, and technical information. Examples of technical information are math data, engineering drawings, material specifications, and the specific coordinates of welding points and measuring points.

In the automotive industry it is necessary to communicate technical information between companies throughout the life of a car model. However, *in order to impact lead time, quality and costs as significantly as possible*, it is especially important to execute the external communication of technical information as efficiently as possible during the pre-production phase of a project to introduce and manufacture a new automobile model. The pre-production phase includes the stages from concept to production start. This means that the technical information can describe automotive components as well as the equipment to produce, assemble and inspect the components. The automotive industrial business operations that are the basis for this research are specifically oriented to the production of automotive body components, also known as body-in-white components.

The research described here deals with how to assess the effectiveness of the *external communication of technical information* relevant to automotive industrial business operations. The research also demonstrates how *benchmarking* is an important aspect of correctly assessing communication effectiveness.

The author of the research has had the advantage of a unique viewpoint in the automotive industry, combining experience in the automotive industry with post-graduate research in communication effectiveness, knowledge and training in human communication, and participation in industrial organizations that promote the resolution of communication issues. The operations of the automotive brand owner where the author works are unusual in that they include operations as *both* a supplier to and a customer of other companies in the automotive sector. Such dual-oriented operations demand the development of highly effective external communication of technical information to ensure short lead times, high quality, and low costs.



The research presented here has resulted in seven tools for analyzing, measuring, assessing and presenting the effectiveness of the communication of technical information between an automotive brand owner and its customers and suppliers, i.e. between the Brand Owner and its Partners. These tools have been named Johansson Communication Tools.

1.3 JCT - Johansson Communication Tools

- The JCT Leadership Communication Cycle
- The JCT Communication Surface
- The JCT Communication Measuring Method
- The JCT Communication Key Ratio
- The JCT Communication Diagram
- The JCT Communication Cube
- The JCT Communication Growth Potential Graph

The Johansson Communication Tools function in several ways:

1. The tools *provide feedback* regarding the success of existing communication, e.g. the JCT Communication Measuring Method provides feedback:
   a) in figures, which can be used as JCT Communication Key Ratios or as Simplified Targets
   b) in text, as concrete advice from Partners to improve communication.

2. The tools *present essential information* to persons who must make decisions regarding resources for communication purposes. For managers especially, the JCT Communication Cube and the JCT Communication Diagram are examples of tools for clear presentation that can facilitate strategic decisions to ensure long-term corporate success.

3. The tools *create a common platform* for senior management, middle management and communication technicians to discuss communication needs and appropriate allocation of resources to achieve effective communication.

4. The tools *provide insight across departmental borders*. Thus, they are multidisciplinary in that they are intended to be used by engineers, purchasing personnel,

communications experts, financial officers, and other key persons who must make decisions regarding, for example

a) financial resources for communication requirements (senior management)
b) communication cost requirements to be included in contract negotiations for a new project (purchasing personnel)
c) allocation of budget resources to improve communication (middle management)
d) which hardware/software to buy or recommend (communications experts)
e) how to best revise a software to adapt it to a Partner's expressed communication needs (communication technicians).

1.4 Limitations

The limitations of the research are:

1. The results are not based on communication of information in real time.
2. The results are based on communication of batches of data.
3. The human communicators who were respondents in the investigation are communication professionals who work only with technical information.

With these limitations in mind, the author would like to emphasize that the research has resulted in essential management tools that constitute a toolbox which can be used by corporate managers and computer technicians alike for making strategic decisions to achieve effective external communication of technical information.

2 COMMUNICATION

2.1 The Importance of Communication

The ability of human beings to communicate has always been the basis of survival. Today, the ability of human beings to communicate both with other human beings and with technical equipment is becoming more and more important.

For this reason it is vital for a company to monitor how well it can communicate from the viewpoint of the surrounding world. In just one generation the potential to communicate has multiplied far beyond the imagination of most persons. Further extensive communication potential can be anticipated as telephone networks, hardware and software are developed to handle the demand for access to and travel on communication by-ways, highways, and superhighways.

2.2 Methods and Dimensions of Communication

Much can and has been said about communication. The research presented here is based on the assumption that there are *two methods of communication* and *three dimensions of communication.*

2.2.1 Methods of Communication

1. Human

a) Communication occurs directly between two or more persons, face to face.

b) Communication occurs between two or more persons with the aid of electro-mechanical devices, e.g. via the telephone, video conferencing equipment.

2. Technical

a) Communication is effected via physical bearers of information, e.g. letters, engineering drawings and physical models of equipment, etc.

b) Communication is effected via the interchange of math data intended to be read by a machine, e.g. via diskette, CD-rom or the Internet.

2.2.2 Dimensions of Communication

1. **Impression Dimension**
   This dimension relates to the purpose of communication to disseminate general positive impressions, i.e. "good will" between human beings around the world.

2. **Information Dimension**
   This dimension relates to the purpose of communication to transfer some kind of information from one party to another.

3. **Change Dimension**
   This dimension relates to the purpose of communication to transfer some kind of vision from one person to another, where one person creates pictures in the mind of another person or several persons of what the future will look like. These pictures guide the persons toward the future.

2.3 The Communication Loop (CL)

The term *Communication Loop* (CL) is the conventional name for the activity where information (data) is sent out and information (data) is sent back, usually in the form of feedback. In popular biological terminology, we could compare this to information that is sent from the Brain to a processing unit and the information about the results of the processing activities that is sent back to the Brain.

In a company there are different networks with different types of Communication Loops (CL's), such as Personnel Information CL's, Technical Information CL's, Logistical Information CL's. The present research is concerned solely with the Technical Information CL in the Brand Owner + Partner (Customer + Supplier) network.

In the Technical Information Communication Loop, technical information is defined as the CAD-CAM drawings, technical standards, models described in math data, etc., that are necessary to transfer product information to the Supplier in order to receive the correct product (*quality*) at the correct time (*lead time*) at the correct cost (*price*). Technical information is sent from the Brand Owner to a Partner for implementation in the Partner's manufacturing process. Information about the results of the implementation in the Partner's manufacturing process is sent back by the Partner to the Brand Owner. Feedback information is then sent back by the Brand Owner to the Partner for further implementation, and then the results of this implementation are sent back to the Brand Owner. The technical information in the Technical Information Communication Loop continues to flow back and forth until the product manufactured by the Partner is approved by the Brand Owner. A Communication Loop always functions in a constant manner no matter where it exists between whatever units in whatever networks.

2.4 Competitive Power and Communication

Several key factors that contribute to corporate competitive power are influenced by the effectiveness of the communication between human beings as well as the communication between human beings and technical equipment at the company. The following key factors illustrate this interdependence between effective communication and success in becoming a corporate winner in business.

1. *Communication to the customer of the increased added value of a company's products.*

2. *Morale among personnel – whole-hearted commitment to achieving the best for the company.*
   - Clearly stated and clearly communicated goals and simplified targets
   - Facilitators (rather than managers) who can clearly formulate simplified targets and continuously inform personnel about the simplified targets
   - Possibility for personnel to request resources
   - Training in co-ordinator skills for all personnel, especially engineering personnel, so that everyone can clearly formulate the positive impact that the requested resources would have on achieving the targets.
   - Swift creation of positive relations between companies that work together
   - An integrated global policy for handling personnel

3. *Shortest time possible from idea to introduction on the market for new products.*
   - More components in common to the different products in order to achieve economy of scale
   - Rational frameworks, which decide how cost, price and profit are designed to ensure that the business partners will indeed want to work together for mutual benefit, rather than jealously watching each other with mutual suspicion
   - Shortest possible lead times
   - Correct quality
   - Lowest possible costs
   - Benchmarking studies which result in the adoption of new success-bringing equipment, systems, processes, materials or product features
   - Supply chain efficiency

4. *Effective communication in all operations in a company.*
   - Communication of the Brand Owner's Communication Policy, so that all departments work toward fulfilling the Policy.
   - The broadening of the number of contacts between employees at the Brand Owner and at the Partners to allow more persons to communicate in-house and externally. These contacts together form a "Communication Surface".
   - Negotiations carried out by the Purchasing Department for a new project include aspects of communication effectiveness (especially regarding the exchange of technical information) to maintain the project cost framework.

2.5 Economic Motivation for Assuring Effective Communication

Poor communication conditions have a dramatically negative effect on costs. This is true both for costs for new projects as well as costs for daily operations. The parameters that are interesting are *lead time, quality,* and *costs*. The value of any business activity can be assessed according to its effect on these parameters.

The following formulas and example demonstrate how cost and lead time are affected by communication conditions.

See the formulae below, where:

- l = Lead time
- e = Effectiveness in communication
- k = Mean value of project costs
- a = Total sum of project costs
- p = Calculated rate of interest for the company on working capital resources per day
- t = Reduction in lead time due to increased effectiveness in communication
- s = The *savings* in interest costs as a result of the reduction in lead time *due to increased effectiveness in communication.*

Suggested units for the formulae:

- l stated as *time in days*
- e stated as *time per parcel in days*
- k stated as *cost in SEK*
- a stated as *cost in SEK*
- p stated as *rate of interest per day*
- t stated as *time in days*
- s stated as *savings in interest costs stated in SEK*

Formula 1: $l = f(e,...)$

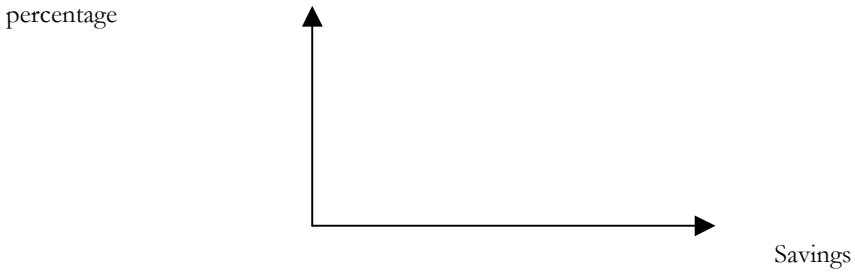
Formula 2: $a = f(l,...)$

Formula 3: $k = a / 2$

Formula 4: $s = k * p * t$

Thus, an example of the influence of effective communication on costs would be the following:

For launching a new car model, a total project cost of SEK 20,000,000,000 (~ USD 2.5 billion) means that k = 10,000,000,000 (~ USD 1.25 billion).



Formula 4: $s = k * p * t$

2.5.1 Example of Economic Motivation for Assuring Effective Communication

For launching a new car model, a total project cost of
SEK 20,000,000,000 (~ USD 2.5 billion) means that
k = 10,000,000,000 (~ USD 1.25 billion).

A project of this financial magnitude is normal when launching a new car model. At the beginning of the project, lead times are calculated and "gates" are set up. The lead times for automotive components that are critical for passing the "gates" are carefully and closely followed. The "critical time-line" that runs through the project from start to finish is based on such lead-time critical automotive components as the hood, the doors, the floor, etc. These are the traditional automotive components that require the most careful planning and follow-up in order to maintain the project schedule and make it through each "gate" on time.

However, towards the end of the new car project, a small automotive component, for example a bracket or a hinge that needs to be introduced or re-designed, can delay the entire project several weeks or even months. Effective external communication of technical information achieves the most significant savings in this situation since effective communication can mean the difference in a production delay of hours, days, weeks or months.

Today, for technical information on new or modified car part designs, the minimum time estimated for transfer by tape or disk is:

- Inside Sweden = 2 - 3 days
- Abroad = 1 - 3 weeks

Note that this refers *only* to the original transfer of the technical information. It does not include the time required to sort out and solve problems that may arise in the receipt and possible conversion of the technical information to a format that is readable by the Partner that will manufacture the part. It does not either include any time required to take action if there is a mistake in the technical information that is communicated. And it doesn't include the time required if the technical information is to be returned for further design changes.

At the end of a new car project, as the production date approaches and the new car model will be introduced at major press conferences, time is crucial to meeting these deadlines. Any savings in lead time is worth millions in tangible financial terms as well as regards intangible values such as "goodwill" and how potential customers perceive the Brand Owner in general.

Effective communication that functions smoothly and reliably will ensure that the minimum time for transfer of the technical information is reduced to:

- Inside Sweden = 1.5 - 2.0 hours
- Abroad = 1.5 - 2.0 hours

Concerning the actual financial gains, the calculated interest on working capital resources per day at 36% means that p = 0.001. The savings in interest costs as a result of a reduction in lead time of 10 days means that t = 10.

.

The application of Formula 4 yields a *savings in interest costs* of:

SEK 100,000,000 (~ USD 12.5 million).

This translates into a *savings per day* of SEK 10,000,000 (~ USD 1.25 million).

This savings was achieved because effective communication reduced the required lead time. In other words, this savings was achieved *because effective communication had previously been invested in and assured, consequently effective communication could immediately reduce the required lead time.*

3 STATE OF THE ART: EXTERNAL COMMUNICATION OF TECHNICAL INFORMATION

3.1 The Communication of Technical Information

A purchasing manager at a major automotive manufacturer said the following in the spring of 2000 regarding the communication of technical information: "Electronic Data Interchange is absolutely necessary today. There is no alternative. It costs money but it saves money at other points in the process." A project leader for a major automotive supplier said "The external communication of technical information is the heart of a project. We must be able to receive models in order to work with them so that we can send them back to our customers."

In general in recent years, the communication of technical information is *decreasing* in physical mass while it is *increasing* in its potential for correct quality, i.e. correct compliance with specification. In the past, technical information was communicated in drawings and as physical models.

Today, the electronic transfer of technical information is done by means of diskettes or by the Internet via the telephone lines. Electronic data interchange means that zeros and ones are transmitted as binary values and are transformed by the correct software into readable information.

Furthermore, the existence of a communication surface between the Brand Owner and the Partner means that more persons can communicate directly with their counterparts, for example engineers can communicate *directly* with each other regarding technical information required for the manufacture of production equipment, rather than *indirectly* through the purchasing staff. This direct communication can reduce lead time as well as time needed for any trouble-shooting and resolution of problems that may occur.

The technical hardware and software can be stipulated in the agreement between two companies, but the possibility and the empathy to communicate between the personnel of the two companies are decisive in the failure or success of getting products out into the market.

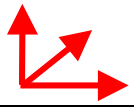
3.2 Milestones in Corporate Management and the External Communication of Technical Information

The state of the art today demonstrates the interrelationship between management trends and technological developments in the external communication of technical information. The table below indicates the main milestones in the last 30 years leading up to today.

MILESTONES

Milestones in Corporate Management	Date	Milestones in the External Communication of Technical Information
Management Vision: All CAD systems are based on a mutual database, so that all interchange between CAD systems is done in native format.	**2000**	♦ 2D/3D wireframe systems OK in EDI ♦ Free-form surfaces OK in EDI ♦ Solid modelling systems: 1) loss of quality 2) loss of data 3) longer lead-times 4) Immense loss of human and technical resources
♦ Benchmarking ♦ Inner Mental Training ♦ Lean Production ♦ Delivery Plans/EDI ♦ Core Operations/Outsourcing ♦ Management focus on: - Reduced Lead-times - Decreased Costs - Increased Quality	**1990-1999**	♦ CIM/EXTERnal Communication of Technical Information ♦ CAD-supplier systems ♦ Telecommunication/EDI ♦ STEP
♦ The MATCH Project ♦ Management by Sales ♦ Northwest Strategy ♦ Quality ISO 9000 ♦ Transaction Analysis ♦ Quality Assurance of Geometry	**1980-1989**	♦ IGES/VDAFS/SET ♦ Artificial Intelligence ♦ Volvo-Supplier demand ♦ Data Transfer by physical media
♦ Sensitivity ♦ Cheese Slicing ♦ Management by Walking around ♦ The Swedish Co-determination Act ♦	**1970-1979**	♦ NC machines ♦ CAD-Islands/Inhouse systems ♦ No Screen-Refresh
♦ Fayol ♦ Human Relations ♦ Trade Union Act	**… - 1969**	♦ Computers ♦ Mathematics ♦ Bezier

3.2.1 Implementation of Johansson Communication Tools

Management Decision	Date	Result in External Communication of Technical Information
Implementation of all or certain Johansson Communication Tools, for example: ➢ JCT Communication Surface ➢ JCT Communication Leadership Cycle ➢ JCT Communication Cube 	**2001 -**	Fail-safe external communication of technical information

4 COMMUNICATION AND CORPORATE LEADERSHIP

4.1 The JCT Leadership Communication Cycle

The JCT Leadership Communication Cycle has been presented previously in a paper for a conference on leadership for the Scandinavian International University.

4.1.1 The JCT Leadership Communication Cycle

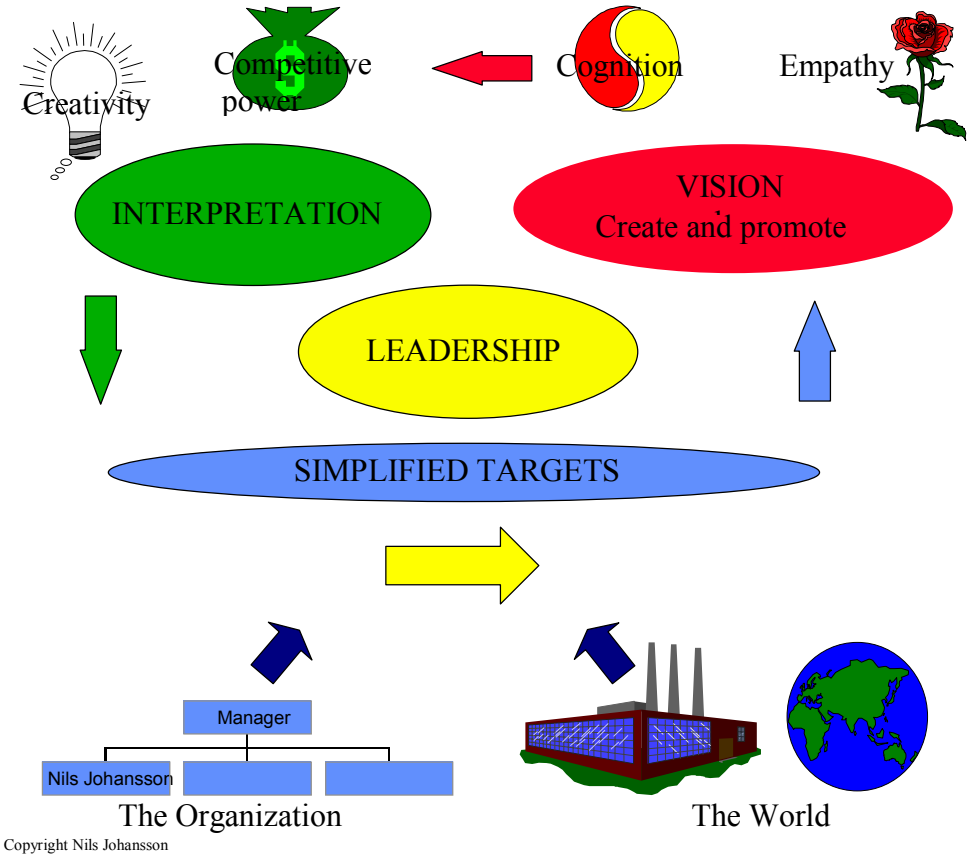


Figure 1 The JCT Leadership Communication Cycle

4.1.2 Explanation of the JCT Leadership Communication Cycle

The top management of a company, i.e. *the Leadership*, must ensure that the business operations survive. Those who lead a company create a vision and determine goals that will secure corporate survival. Managers often ask themselves what is the best way to gain inspiration to determine successful visions and goals.

The present is always a good point at which to start acquiring and analyzing information. In Norse mythology, the all-powerful god Oden sent his two ravens out every day to gather information about everything that was happening in *the World*. Today, corporate leaders acquire daily information both from sources in *the Organization* about human resources, equipment resources and communication resources, as well as from diverse sources out in the world. The leaders then create and promote the vision and goals, communicating these to the world and, equally importantly, communicating these throughout the Organization, to gain *Empathy* among the employees.

The *Vision* shows the direction to reach the goals. These goals are best communicated in the form of *Simplified Targets*. The initial simplified targets can be chosen either by studying the particular problem and establishing targets, or by gathering information from *the Organization* and/or *the World*, e.g. by means of a questionnaire. Simplified targets are easier to calculate, compare, and control. In terms of *Cognition*, the simplified targets are easier to communicate, recognize and understand. This makes it easier for everyone at all levels to feel *Empathy* and be committed to performing the work required to achieve the targets.

Leadership at any level, be it at the top management level or at the personal level uses *Creativity* to communicate and enthuse. All persons who work at any level, be it at the top management level or at the personal level, use *Creativity* to *Interpret* and carry out the necessary work, thus securing *Competitive Power* for the company.

As the targets are achieved, *a new reality is created*, in other words a new "present situation" will exist. New information will be acquired via global and organizational communication paths and then analyzed, and the *JCT Leadership Communication Cycle* will begin again. In fact, the Cycle is always beginning and ending and beginning again, always taking in new information, always creating and promoting a new *Vision*. The *Vision* secures *Empathy* and *Cognition* to win commitment from everyone so that everyone uses *Creativity* in their *Interpretation* of the work required to gain improved *Competitive Power*. The achievement of improved *Competitive Power* results in a new reality and a new present situation, and the Cycle begins again with new information and new simplified targets, and continues cycling.

4.1.3 Evaluation

In order to promote and safeguard the survival of the company, the results achieved in each Cycle must be evaluated and compared with the original Simplified Targets for that Cycle.

The JCT Leadership Communication Cycle represents the process of gathering information, communicating a vision, and securing the competitive power of company through the empathy, creativity and commitment of its employees.

4.1.3.1 The JCT Leadership Communication Cycle and other Johansson Communication Tools

The JCT Leadership Cycle can be used in establishing the effectiveness of the external communication of technical information. The different Johansson Communication Tools can be utilized at different stages in the Cycle:

- If the JCT Measuring Method is introduced at the *start* of a Cycle, the resulting JCT Key Ratios are used as the initial simplified targets. Then the Cycle is run through and the JCT Measuring Method is applied again. The resulting JCT Key Ratios can be compared with the original simplified targets, and a new JCT Leadership Cycle can be started. Or, the JCT Key Ratios can be studied independently to determine where human resources and/or economic resources should be allocated.
- The JCT Key Ratios can be used as input in the Communication Cube. This enables different persons in the company to visualize the actual relationship in the company between the different communication dimensions in order to determine an appropriate allocation of funds.
- If the JCT Measuring Method is introduced at the *end* of a Leadership Communication Cycle, the resulting JCT Key Ratios can then be compared with the original simplified targets. The JCT Key Ratios will show the status of the Simplified Targets and will indicate if the targets are correctly set to move the company forward toward the Vision.
- As input in the JCT Leadership Communication Cycle, information is gathered from the surrounding world. One way of gathering pertinent information is to implement a strategy of Benchmarking. This strategy is included in the JCT Measuring Method and the results are presented by the JCT Key Ratios in the JCT Communication Diagrams. Concerning the external communication of technical information, the JCT Communication Diagrams present the Partners' compiled assessment of the Brand Owner as well as the Partners' compiled assessment of a "best practice" company. Benchmarking is thereby used to evaluate the effectiveness of the Brand Owner's communication.

4.1.4 Recursiveness

The JCT Leadership Communication Cycle is recursive. Within the main Leadership Communication Cycle (the macro level), there are sub-Cycles running simultaneously at different levels (micro levels).

There is no limit to how many times and at how many levels the JCT Leadership Communication Cycle can run.

The JCT Leadership Communication Cycle can run on all levels from macro levels to micro levels:

- at the *organizational level*, in the communication of visions, strategies and targets by top management to all other levels.
- at the *departmental level*, by middle managers or department managers, to present departmental visions and to achieve departmental targets.

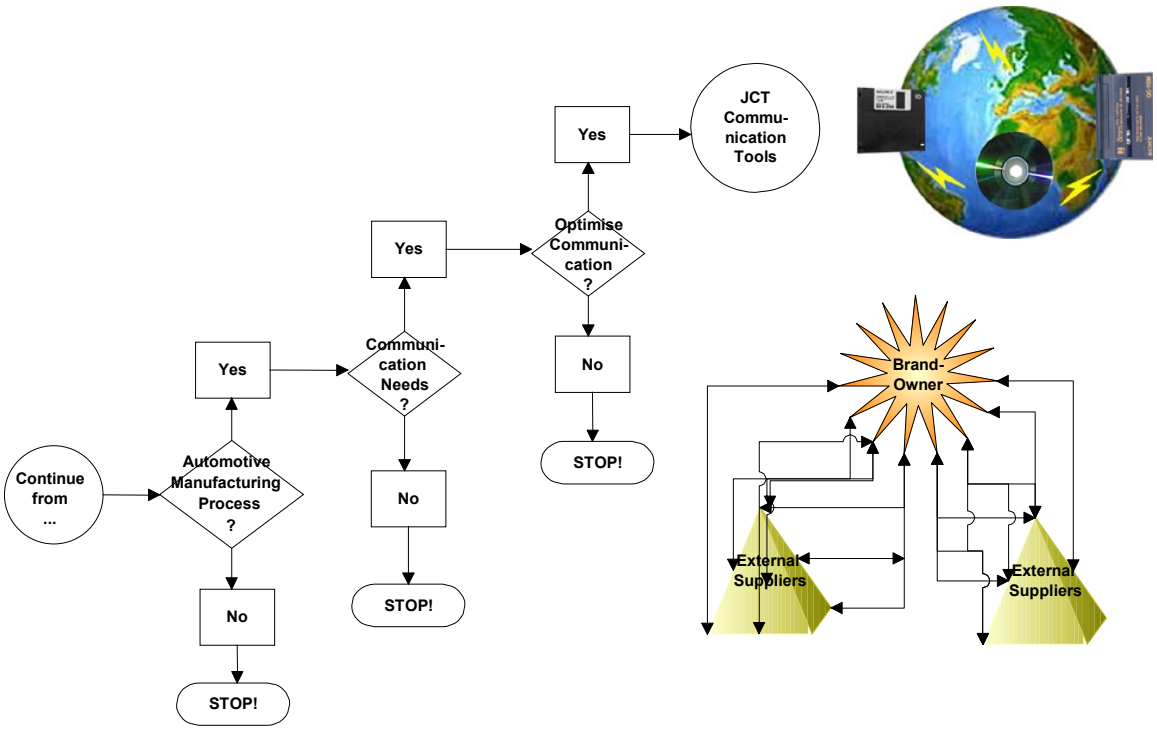
- at the *individual level*, where each individual employee acts as his/her own manager (leader) to interpret and carry out the required work tasks.

4.1.5 Output of the JCT Leadership Communication Cycle

The *output* of each JCT Leadership Communication Cycle, whether the Cycle is applied at the macro or micro levels, is always a step forward, and always creates a new "present situation", on the path toward meeting the simplified targets and fulfilling the targets. The use of key ratios ensures that the targets are simplified. This way, it is relatively easy to check the progress of the Cycle against the simplified targets as the Cycle advances. It is also easy to compare the actual result of each Cycle with the simplified targets in order to establish new simplified targets for the next JCT Leadership Communication Cycle.

4.1.6 The Decision Flow Chart

Regarding strategic financial decisions, see below : Summary of Economic Motivation for using Johansson Communication Tools.



4.2 The JCT Communication Surface

4.2.1 Communication Point or Communication Surface

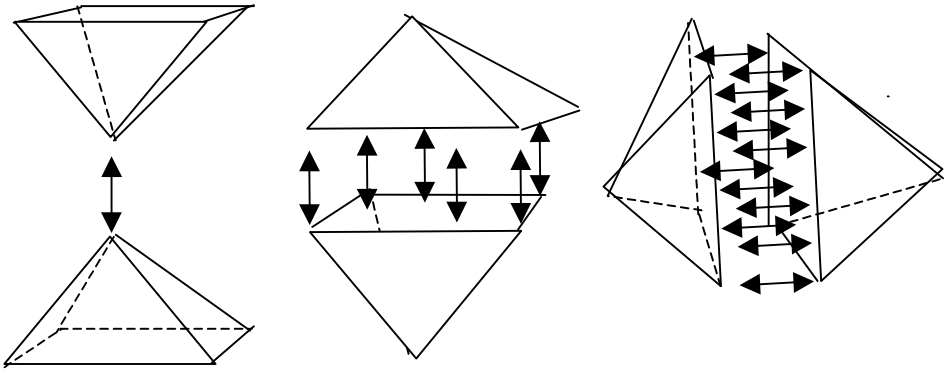
In the past, one contact person from the Brand Owner communicated with one contact person from the Partner. This put focus on one person's ability to communicate with one other person, usually in person, face to face or over the telephone. This situation can be represented as one "Communication Point" between the two companies.

Today, technology that permits the transfer of information by telefax and EDI (electronic data interchange) has enabled and encouraged communication between many persons at the Brand Owner and many persons at the Partner, *at all levels*. Today the opportunity to communicate exists within and between companies over an entire " JCT Communication Surface".

When a company strives to establish a communication surface, it encourages a situation where information can float or flow unhindered, like water. Persons who are interested *and have the required authorization* can get information even though it may not have initially been sent to them. This free information flow can enhance teamwork and cross-functional co-operation. It also encourages empathy, which in turn means that the JCT Communication Surface results in improved co-operation and teamwork.

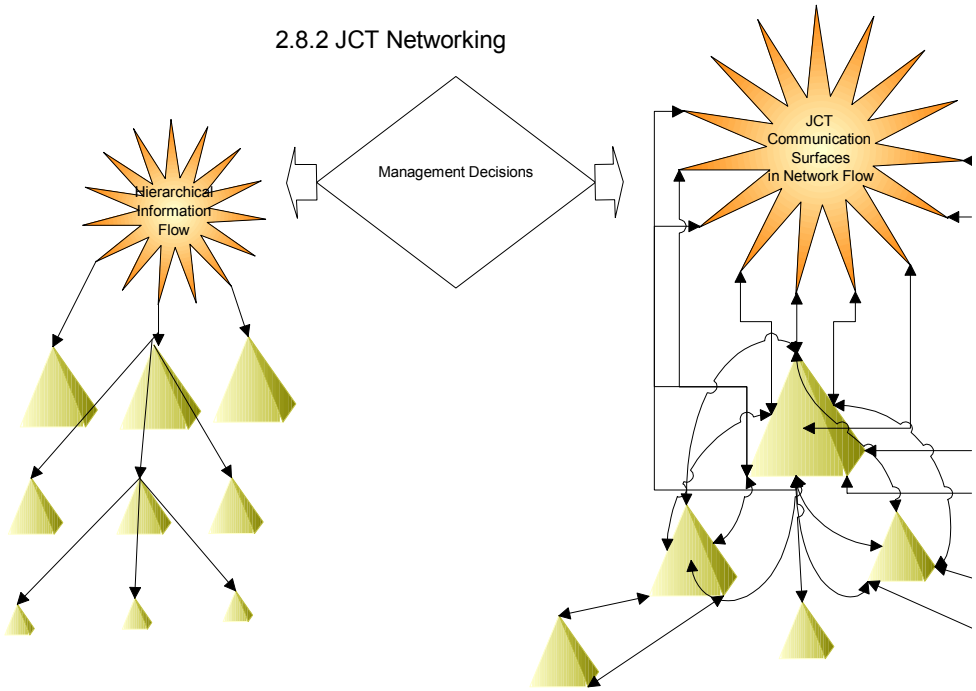
DEVELOPMENT TOWARD JCT COMMUNICATION SURFACE

Communication Point - Communication Surface - JCT Communication Surface



4.2.2 JCT Networking

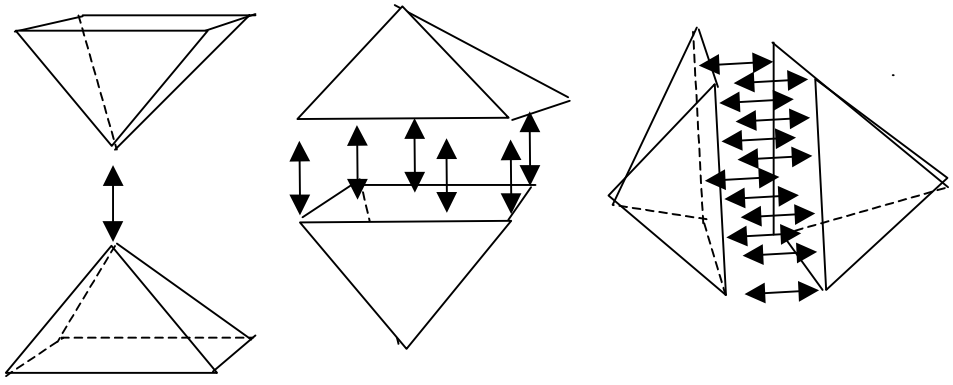
The existence of JCT Communication Surfaces facilitates the next stage in communication between Brand Owners and Suppliers. As mentioned above, this is an important field for further research. The figure below shows a basic representation of what could be called "JCT Networking". Better communication in JCT Networking will lead to higher quality, shorter lead times and lower costs.



4.2.3 JCT Communication Surface Development Example

At the time of the purchase by Ford Motor Company of Volvo Car Corporation, a communication link was developed between Tooling Cologne Europe (Ford Motor Company) and the Tool and Die Department at the Body Components Division in Olofström, Sweden (Volvo Car Components Corporation). The **first link** was a single link between the Purchasing representative from Volvo and the head of stamping and engineering at the Ford Cologne plant. This was soon augmented by an **additional link** between two persons, each one responsible for external communication of technical information at each company. The **JCT Communication Surface** was then created very rapidly once the management decision was taken to support this type of synchronized, multi-link communication relationship. The essential factor here was the creation of human communication links that served to bridge the difference between the two separate company cultures, especially with regard to technical specifications, product descriptions, and equipment requirements. The ultimate goal, which takes time and manual input to achieve, is direct automatic communication through the JCT Communication Surfaces of all technical information between the two companies. Work to achieve this goal is in progress today.

Communication Point - Communication Surface - JCT Communication Surface

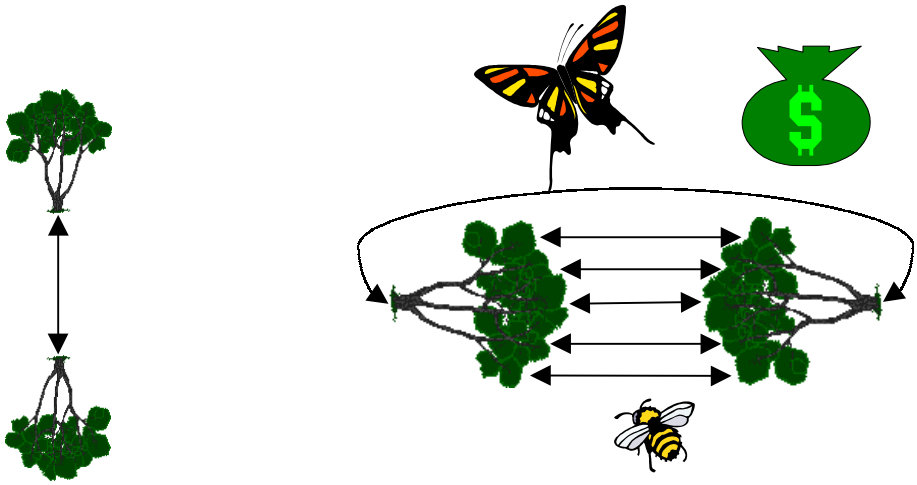


4.2.4 Symbolic Representation of JCT Communication Surface

The JCT Communication Surface can also be represented symbolically by a living, biological system. Here is a very simplified description, which is justified by the humanist approach applied in this research.

Each tree has an internal network but still needs to communicate externally. Many trees can communicate externally on one level by their root systems. However, in order to bear fruit and assure survival in coming generations, the trees need to establish other forms of external communication. Information databases in the form of pollen exist but the outside resources must be applied in airborne forms, e.g. wind, bees, butterflies and birds.

It is clear that, if the conditions (the sun, the rainfall and the temperature) of communication (pollination) are correctly allocated at the right time and for the right length of time, the trees will yield a great amount of fruit. Applied to a business case, this means that if the conditions (the hardware, the software and the human relationships) of communication (external communication fo technical information) are correctly allocated (by the management) at the right time and for the right length of time, the company will achieve effective communication which will yield higher quality, shorter lead times and lower costs.



5 CASE STUDY – A BRAND OWNER IN THE AUTOMOTIVE MANUFACTURING INDUSTRY

5.1 Historical Background

5.1.1 Early Years

The automotive industry was initially conceived by only a few people. For Volvo Car Corporation, Assar Gabrielsson visualized the manufacture of automobiles in Sweden while working as head of purchasing for SKF in France. SKF was at that time a major supplier to the French auto industry. Gabrielsson had in-depth knowledge of this branch. One of Gabrielsson's colleagues at SKF was Gustaf Larson, who had previously worked for the British auto industry. These were the two men behind the founding of Volvo Car Corporation. A third man, Edward Olsson, with experience from automobile and tractor manufacturing in the American company International Harvester, was first employed by Volvo when he was on vacation in Sweden. Edward Olsson was one of the few Swedes who at that time knew what an automobile manufacturing industry looked like. In this initial co-operation between these three men we can see the value of a global perspective, one in which industries in France, Britain, and the USA offered the basis for Benchmarking to create a world class industry in another country.

At the beginning of the automotive industrial era, the market was larger than the production capacity, ie demand was greater than supply. In order to guarantee the availability of the required resources, all necessary production resources were bought by the Brand Owner. An excellent example of this was Ford Motor Company, which bought the entire production chain, from mines and mining labour, forests and lumbering work all the way along the chain to the moment that the end product, the Ford automobile, rolled off the assembly line. Note that cars at this time contained many wooden parts.

At the beginning of the automobile manufacturing era, individual craftsmen manually adjusted each part to fit the adjacent parts in the automobile bodies. To realize serial production, however, parts had to be produced in a uniform manner to greatly reduce the time needed for manual adjustment. A Swedish inventor named Carl Edward Johansson, whose nickname was "Measurement Johansson", invented the Combination Gauge Blocks. These gauge blocks consisted of a number of precision blocks that fit together for measurement purposes. The Combination Gauge Blocks significantly reduced the number of blocks required for measuring. Measurement simply became a mathematical problem. Gradually a tolerance requirement of 1/1000 mm was possible thanks to a certain grinding technique. After these advanced measuring and grinding techniques were introduced in production, the individual auto parts could be serially produced with such precision that mass production of automobiles could begin in long production lines. For better or for worse from different points of view, these long serial production lines quickly replaced manual craftsmen.

5.1.2 Mass Production and Improved Quality

With the introduction of serial production, people and machines could be specialized. Compared with the long years required for training craftsmen, it now took much less time to train persons to become an effective cog in the wheel of production. A funny but very illustrative example of this was expressed in a Charlie Chaplin movie made at this time, where

the task to be done by a human being was reduced in complexity to tightening a single bolt. The reduced level of skills meant that automobile companies could recruit manpower directly off the street. New employees became productive after a very short period of training. The concept of piece-work, i.e. work paid for at a fixed rate per piece of finished work, became the basis for paying workers' wages and was also used as a means of motivating the workers to work harder and faster. Mass production became a fact. A good illustration of mass production is the well-known quote regarding production of the Model-T at Ford Motor Company, namely that "customers can choose whatever color they want as long as they choose black".

As the quality of automobile parts improved, it became possible for external suppliers to specialize in certain types of specific automobile parts. Some of these suppliers developed such expertise in manufacturing that it became more advantageous for the automobile companies to purchase parts from specialist suppliers than to develop and manufacture the parts themselves. In these cases the products were bought as pre-assembled sub-assemblies that could be directly mounted in the cars in the final assembly line. For example, Bosch and Hella became leading suppliers of headlights. The automobile producers began to realize that they could produce a car with better quality and content at a better price, by using world-leading suppliers from each component niche or competence niche.

Today, there is no automobile manufacturer that owns the entire chain as Ford Motor Company did in the beginning. The Brand Owner automobile manufacturer depends on close co-operation with its Partners to assemble a high quality end product that the target consumer will choose and enjoy and, even more importantly, choose again. This close co-operation depends in turn on increasingly sophisticated communication networks where not only communication but *effective communication* is an absolute necessity to rolling the *right product* off the assembly line and into the showroom at the *right time* and at the *right cost*.

5.1.3 The Volvo Stamping Plants in Olofström

The steel parts for the automobile body were first produced as a further development of the existing knowledge about how to stamp steel material in general. Automobile body parts for the first Volvo automobiles were produced by Alfa Laval. Alfa Laval had developed its competence in forming steel material through its manufacturing of machines and tools for the agricultural sector. A well-known example of a revolutionary Alfa Laval product from this period, stamped in steel, was the manually-driven Separator, used on farms to skim the cream from fresh milk. Alfa Laval know-how regarding the forming of steel sheet material was concentrated in Olofström in southern Sweden, in the company known as SSAB, the Swedish Steel Stamping Corporation. It was in their facilities that the parts for the body of the first Volvo automobile model, the famous "Jakob", were produced. Just like Ford in America where Ford had purchased all steps in the automobile manufacturing chain, Volvo Car Corporation purchased this steel stamping know-how in Olofström, and incorporated it as a division of Volvo under the name of **Volvo Olofström Plants**, the largest stamping plants in northern Europe.

Sheet metal forming technology at Volvo in Olofström developed from the initial techniques of using hammer-forms to press and hammer the metal into the correct shape as per wooden models to today's modern forming techniques based on the use of dies made of cast iron and/or steel. These dies are mounted in presses located one after another in press lines. As the sheet metal blank is transported down the press line, the dies cut, pierce, bend and form the metal blank into a particular automobile part. The parts are then bonded, welded, and/or

bolted together and transported by truck or train to another factory for final assembly. Volvo automobile parts that are stamped in the Olofström stamping plants are sent by train to the Volvo assembly plants in Gothenburg on the west coast of Sweden.

5.2 Optimizing Production

The process of stamping sheet metal requires many work stations and many persons. In order to optimize production several steps were taken:

1. Early production — Piece-work was introduced together with inspectors who carried out time-and-motion studies. These inspectors then calculated what each individual should receive in wages for each part.

2. Later production — MTM, "Methods Time Measurement" was introduced where the production activities were planned in detail in order to run as rapidly as possible.

3. Modern production — Transport of the part between the different work stations was automated.

   In connection with the implementation of automation technology, prototypes for automation equipment were developed at Volvo Olofström Plants that would later become the backbone of the patented DOPPIN SYSTEM of automation equipment for robots and press lines. The first DOPPIN automation equipment was designed by the Rönbeck brothers in Olofström. The DOPPIN SYSTEM today includes a great number of innovative standard and customized automation equipment. DOPPIN SYSTEM equipment has automated the production of many automobile manufacturers around the world.

4. Computerization — Computer technology was introduced in the design and manufacturing process of both the automobile itself as well as the equipment necessary to produce the automobile parts. Due to computer technology such as Computer Aided Design and Computer Aided Manufacturing (CAD/CAM) it has been possible to further increase the quality of the basic data for the manufacture of automobiles. Today, CAD/CAM enables engineers at the Brand Owner and the Partners to:

   1. Obtain extremely accurate master models of the automobiles.

   2. Obtain completely symmetrical master models through the use of mirroring functions in the computer.

   3. Transmit basic technical data at a higher level of precision than earlier. Electronic, computerized transfer of basic data has entirely eliminated or at least radically reduced the labour, materials and transport necessary in transferring basic data in the form of physical master models.

5. Robots — Robot technology was introduced.

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> The increase in capacity created by the implementation of computers and automation equipment also created the foundation for introducing robots with higher capacity and greater flexibility. Through the development and use of robots in automobile production, human beings could be spared the many monotonous and strenuous tasks in the manufacturing process, with a simultaneous increase in quality and decrease in costs.

The automotive industry gradually became better and still better at producing automobiles. Production exceeded market demand. In this situation the automotive industry increased its efforts to gain market share through more flexible capacity that enabled a customer to order the specific automobile that he/she wanted. Compare this situation with the first stages of automobile manufacturing when the normal customer had to buy the car that was the standard model, which represented the only possibility to produce automobiles in the early production lines. Today, options are available not only in the color of the automobile and type of seat covering but also regarding a large variety of accessories and extra equipment. The customer's choices are communicated through special information channels to the suppliers of the relevant products destined for the final assembly line, so that only cars that have been ordered by customers are produced. This is known as *production on demand*.

5.2.1 Production on demand

Production on demand represents a breakthrough from mass production based on the longest possible production series to production based on control by the customers. Japan became the forerunner in being able to efficiently stamp small batches of sheet metal parts. The production dies in the presses have to constantly be changed in order to stamp short production series in the same press line. The time required for changing dies in a press line had to be decreased from several hours to around ten minutes to obtain efficient production.

The evolution toward extremely rapid tool and die changes in a press line created an entirely new stamping technology in the form of *transfer presses*. In principle, a transfer press is a series of presses in a single unit that includes associated equipment. The sheet metal parts are transferred between the different work stations, which are integrated into a "single" press - a transfer press. The equipment required to transfer the stamped parts between the stations is included in the transfer press.

In a transfer press, all dies operate at the same height from the floor, which speeds up the production process. Another time-saving aspect of transfer presses is that die changes are prepared outside the transfer press itself. When the production run is finished, the "old" dies are rolled out on one side of the transfer press while the "new" dies are simultaneously rolled into the press from the other side.

Better quality has also been achieved by introducing the stamping technology based on the *Quintus press*. This press has increased the quality of prototype parts for new automobile models. In the Quintus press, dies made of the metal alloy kirksite are used. Kirksite dies can be milled and machined with high precision. The process has come a long way from the wooden models that were previously used in the automobile manufacturing process. Furthermore, kirksite is an alloy that can easily be melted down and recycled for use in new tools, an important environmental aspect.

5.2.2 Models of Components and Production Equipment

When the automobile industry was young it was natural to build the models for automobiles in wood. These models were then fit together to check that the automobile parts were correctly dimensioned. When it was later time to order a part, a copy of the wooden model was made, representing that specific part of the automobile. As the technology required for making the auto parts developed to satisfy tougher and tougher dimensional requirements, models were required not only for automobile parts but also for the equipment to stamp the parts. These physical models for auto components and manufacturing equipment, supplemented by drawings, were the *legal data* for ordering the manufacture of the part.

The accuracy of this legal data was greatly enhanced when models could be created in the computer. The data was stored in the computer in numerical form as *Math Data* and became the *legal basis* for the appearance and dimensions of the physical models for the automtive components and manufacturing equipment. Needless to say, effective communication of this data as the legal basis for the end product is extremely important to the survival of the Brand Owner automobile company and its Partners.

5.3 Digital Storage and Transfer of Math Data

Math data was initially stored and sent to Suppliers on magnetic 1/2" reel tapes as the bearer of the manufacturing information. These 1/2" reel tapes, so-called pizza tapes, were standard in the world of mainframe computers that existed in the 1960s and 1970s. This meant that the models in electronic/digital form could be sent by mail or by courier instead of by truck, boat or airplane. Before the use of these "pizza tapes", it was not uncommon that physical models in transport would undergo dimensional changes that were devastating to the accuracy of model. Two reasons for developing electronic forms of models are *lead time* and *dimensional accuracy* at the time of delivery. Tolerances for dimensional accuracy today are 0.001 mm (1/1000 mm) for the model, and 0.05 mm for milling.

More compact types of data transfer media have been developed such as floppy discs, diskettes, streamer tapes, etc. Today there is rapid progress toward still safer ways of transferring math data models by means of Electronic Data Interchange (EDI) over the Internet.

Developments in data transfer have reached the point where it is natural for automobile manufacturers to transmit automobile model data via telephone networks and communication superhighways to the Partners that are the best in the world in delivering a particular automotive part. One scenario for the future is where companies that co-operate with each other become more and more integrated with regard to all corporate information that can be stored in digital format. Information in digital format can be freely exchanged between the Brand Owners and Partners.

5.4 To Insource or To Outsource – That is the Question

Today, there is an excess production capacity in general at all steps in the *supply chain* in the automotive industry. The Brand Owners must find the optimum balance between insourcing, i.e. owning an entire industrial system and outsourcing, i.e. purchasing capacity. In a more sophisticated way, outsourcing could be described as cultivating the ability to co-operate with, develop with, communicate with and purchase from one or more Partners. After a Brand

Owner has trimmed away the operations that can be supplied by external Partners, the portion that then remains of the Brand Owner is known as its core business operations.

In order to position itself as a leading supplier in the world market, it is necessary for a supplier to have a capacity sufficiently large to enable production at high volume during a short period of time while retaining full use of machines and employees for other tasks in the meantime during a "slow" period.

5.4.1 Virtual Companies

One concept for handling this requirement is the *virtual company*. A virtual company is based on the network created by the Brand Owner and its Partners. The member companies of this virtual company may enter into a pact that is formulated to promote a win-win situation for all companies in the pact. The joint production capacity of this virtual company can then be utilized in an optimal manner. At the same time, the end-users (the automobile owners) deal with only one large company, the Brand Owner, who takes the entire responsibility in doing business with the end-user.

The member companies have the opportunity to develop according to the pact in a manner that enhances both their individual and their joint corporate competitive power, to the benefit both of the other pact members and the Brand Owner. Here again, *the existence of effective communication and the ability to analyze, measure, and improve communication* is essential to the success of the network that makes up the virtual company.

5.5 Effective Communication and the Decision to Insource or Outsource

5.5.1 To possess or not to possess

To possess certain business operations (to insource) or not to possess certain business operations (to outsource) is a crucial question for competitive power and corporate survival. Communication effectiveness and especially the effectiveness of the external communication of technical information between Brand Owner and Partners play an important role in determining competitive power. The existence of effective communication and the ability to analyze, measure, and improve communication is therefore a key factor in the Brand Owner's decision whether to insource or outsource.

5.5.2 The Ability to Communicate and Outsourcing

The ability to communicate is one of the factors that affect where the optimal boundary regarding outsourcing/insourcing can be located between the Brand Owner and the suppliers.

The choice to outsource or insource specific business operations depends on what a Brand Owner has decided is the best strategy to implement its economic resources in order to gain the ultimate competitive power. *This choice can be restricted by the inability to externally communicate technical information*. From this follows that increased ability to effectively communicate technical information to external partners enables more outsourcing *while maintaining control of the brand product*.

5.5.3 Communication and Outsourcing

The above discussion proves the following statements:

- *Effective communication enables successful outsourcing.*
- *Successful outsourcing requires effective communication.*

After communication effectiveness is achieved, outsourcing becomes *an option and an opportunity* that can be exercised/exploited by the Brand Owner or not, depending on the Brand Owner's financial strategies.

An example of the importance of the ability to communicate is the production of equipment at Partners' premises located in Spain, Japan, Sweden and Germany, for a Brand Owner automobile manufacturing company in Sweden. This equipment is intended to produce automobile components that must fit correctly together, with tolerances of only a few hundredths of millimeters. In this situation, there are several types of technical information that must be externally communicated between the Brand Owner and its Partners as the equipment is being manufactured in the separate locations. See the section "Types of Technical Information that Must Be Externally Communicated" in the Outsourcing Scenario below.

5.6 Outsourcing Scenario

The Brand Owner's search for the optimal limits concerning what operations to own and what operations not to own. This search for a balance between outsourcing/insourcing should lead to the ultimate competitive power for the Brand Owner. *This "optimal boundary" will shift as a function of the technical developments in communication.* Some of the aspects and communication issues to be considered as the search for this fluid optimal boundary constantly progresses are:

Aspect 1

Information and competence in research and development disappear from the Brand Owner compared with retaining an in-house Research and Development department.

Communication Issues in Aspect 1:

Communication Issue 1
The Brand Owner must ensure an extended information flow from Partners that are legally established as entities separate from the Brand Owner's core business operations, in order to safeguard the up-dating of information systems and registers that are vital to the Brand Owner's existence.

Communication Issue 2
The Brand Owner must determine what possibilities exist to achieve this information flow while also considering function and security.

Communication Issue 3
Security risks:
1. Data can disappear, e.g. in transport, storage and retrieval, poor archive function.

2. Data can be distorted, e.g in conversions between different CAD-systems.
3. Data can fall into the hands of competitors. Email is not secure. Compare email to information sent by postcard where all data are open to any reader.

Communication Issue 4
The Brand Owner must take into consideration the feasability of the Partners to acquire access to these systems as well as their potential for employing and training their own personnel to handle the up-dating activities that previously were carried out by the Brand Owner.

Aspect 2

The Partners develop their own networks within separate branches to co-ordinate the competence required to manufacture the *branch's contribution* to an entirely new, complete brand product, in order to achieve the lead times stipulated by the Brand Owners. For example, manufacturers of dies for stamping auto body components can co-ordinate their operations to deliver equipment to fulfil the Brand Owner's plans for launching a new model, thereby enhancing the Brand Owner's competitive power and ensuring the survival of the Partners.

Communication Issues in Aspect 2:

Communication Issue 4
The possibilities must be considered for the Partners to control and co-ordinate information by establishing their own internal communication networks within each branch of suppliers. These networks can be single networks composed of only two suppliers, or, these networks can be complex networks composed of two or more single networks.

Effective communication in these networks will lead to better customer service for the Brand Owner as well as more efficient capacity utilisation for the networking Partners.

This communication issue illustrates how effective communication will lead to better financial results and a "win-win" situation for <u>all</u> companies involved.

5.6.1 Types of Technical Information that Must Be Externally Communicated

A. Communication of technical information from Brand Owner to Partner

1. Drawings of the automobile parts or of the production equipment for manufacturing the automobile parts. These can be in paper format or digital, electronic format.

2. Models of the production equipment. These models are the basis for the manufacture of the production equipment. These can be physical models, usually in wood or styrofoam plastic, or in digital format. Digital CAD models are sometimes referred to today as Digital Shape Models (DSM).

3. Measuring Point descriptions. These descriptions contain the work sequence itself or information regarding the work sequence for programming a measuring machine to measure the equipment at specified points.

4. Feedback after quality assurance activities are implemented at the Brand Owner.

B. Communication of technical information from Partner to Brand Owner

1. The results of any measurement tests, carried out either manually or by a measuring machine. These measurement tests are done several times, which means that this technical information must be communicated at regular intervals back to the Brand Owner.

2. Electronic access to some Partner databases. An example would be a database containing technical information, for example, measurement test results.

5.6.2 A "Neural Network"

The above examples of technical information that must be externally communicated show that there are C*ommunication Loops* between the Brand Owner and the Partners. These Communication Loops are integral to a "neural network" that exists today between Brand Owner and Partners..

Communication Loops exist today, especially in the external communication of technical information. A "neural network" of communication loops exists also between the end-user (final customer) and the Brand Owner. The communication loop between the final end-user and VOLVO demonstrates that the car is an element of the communication loop! Human communication here refers to face-to-face meetings, direct marketing, customer service, and the grapevine between friends.

The core business operations of the Brand Owner may evolve to where the Brand Owner only possesses the legal right to the actual brand and requires enormous communication abilities. The Brand Owner, just like the human brain, would then control the information traffic and store the information, while communicating with all other development and production operations being performed at the premises of the Partners.

5.7 Summary Figure of Chapter 5

Figure 5.7.1 schematically illustrates the information presented in Chapter 5.

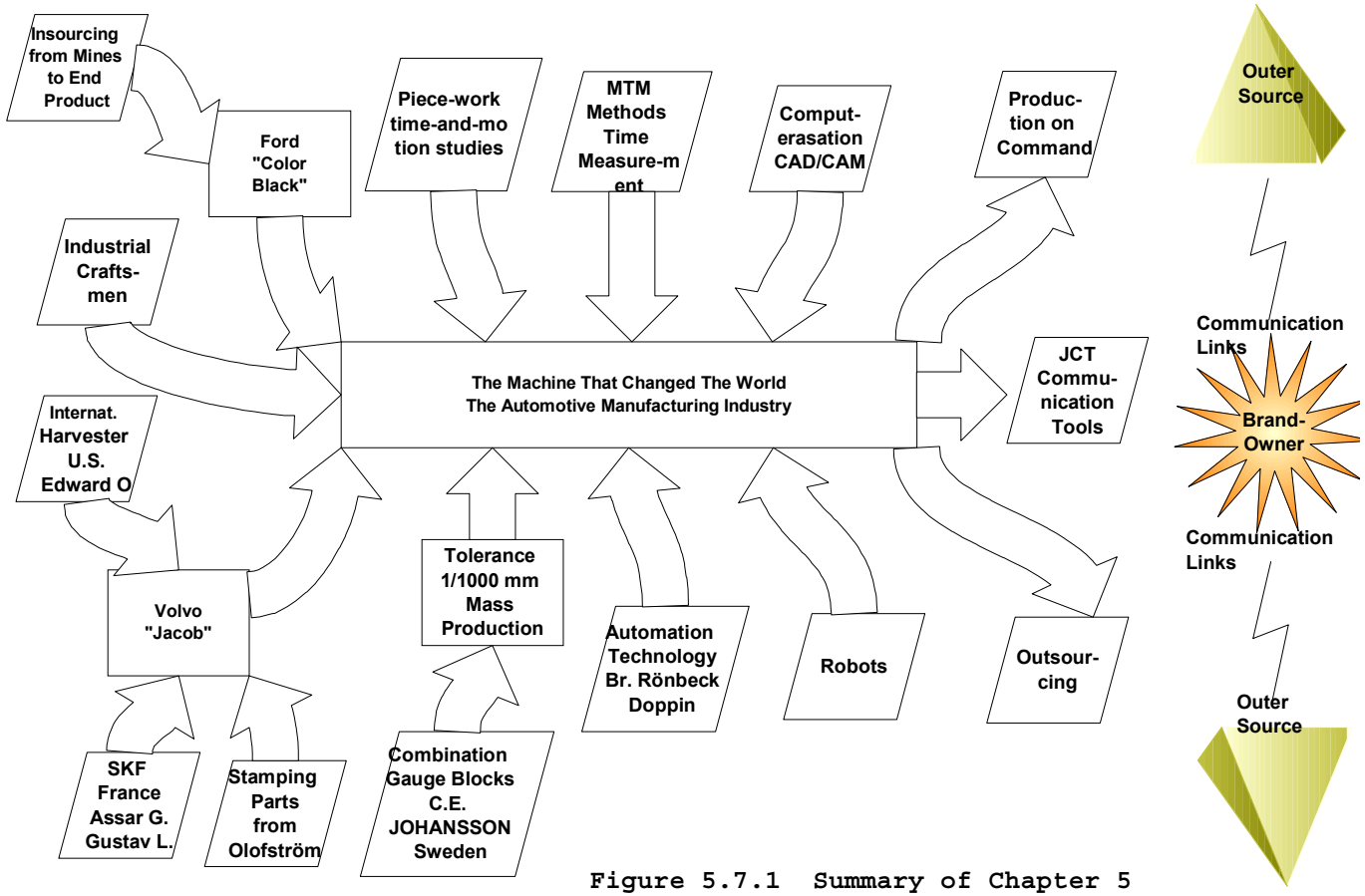

Figure 5.7.1 Summary of Chapter 5

6 The Investigation

In this investigation, the Brand Owner is Volvo Car Components Corporation, Body Components Division, located in Olofström, Sweden, abbreviated BCD. The Suppliers are, as previously done in this paper, referred to as PARTNERS. Also, just as in the above discussion in this investigation, a PARTNER is simply a company with which BCD communicates.

The investigation measures nine different parameters, i.e. three each in the three dimensions of the JCT Communication Cube. The three dimensions are Human Communicators, Transfer Media and Changes in the Transfer Conditions. For a description of the Communication Cube, see Section 6.4. A questionnaire was created to measure the parameters. A copy of the questionnaire that BCD sent to its PARTNERS is found in Section 13.3 Questionnaire. The main purpose of the investigation was to create a measuring method that could be used to calculate key ratios that would indicate a company's communication effectiveness for each parameter.

The investigation was carried out during the period 1996 – 1998.

6.1 Choice of Participants in the Investigation

The Purchasing Department of the Brand Owner (BCD) chose the Suppliers (Partners) to be included in the investigation. These Partners were all members of the Brand Owner's sphere of interest (automobile manufacturing) and were listed in the Partner File of the Volvo Car Corporation. This file is a database containing companies with whom Volvo exchanges technical information. The answers from the Partners were used as the basis for computing the measuring method.

The questions in the questionnaire in the section named "COMMENT" were answered in text form. These answers, formulated in the Partner's own words, are intended to be used by the Brand Owner as suggestions for possible improvements. These suggestions provide ideas and inspiration to the engineers at the Brand Owner about how business operations can be developed and refined in order to improve communication effectiveness.

The questionnaire was addressed to the CAE (Computer Aided Engineering) contact person at each Partner. The CAE contact person is responsible for the support system concerned with handling the technical flow of information, involving support for both software and hardware. The Volvo support system is called *External Communication of Technical Information*, and is abbreviated EXTER.

The Partners in this investigation were limited to those Partners for whom BCD is responsible for ensuring that EXTER is always kept up-to-date.

6.2 Implementation of the Results of the Investigation

1. Investigate problems and opportunities regarding EXTERNAL COMMUNICATION OF TECHNICAL INFORMATION between BCD and PARTNERS, in order to determine, by means of key ratios, which parameters are optimal for investment.
2. Present investment program for improving EXTERNAL COMMUNICATION OF TECHNICAL INFORMATION based on the resulting key ratios.
3. Implement the investments according to priority approved by management.
4. Go to Step 1 interactively over a three-year period.

6.3 Communication Dimensions as the Basis for the Questionnaire

Chapter 2 presents the assertion that communication has three dimensions, an impression dimension, an information dimension, and a change dimension. When these dimensions are applied to the external communication of technical information, they can be seen respectively as a dimension concerning **human communicators**, a dimension concerning the **transfer media** (software and hardware) used to transfer the technical information, and a dimension concerning **changes in the conditions for transferring** the technical information.

These three communication dimensions constitute a cube, i.e. a communication cube. The dimensions of the cube form the basis for the questions in the questionnaire for this investigation. The cube is an important tool for the visual presentation of the status of the existing communication effectiveness in a company at any one time and is therefore named the JCT Communication Cube.

6.4 The JCT Communication Cube

The JCT Communication Cube has three dimensions:
1. Human Communicators
2. Transfer Media
3. Changes in the Transfer Conditions

The JCT Communication Cube can be used to describe all types of communication but the application in this investigation is for the communication effectiveness of the external communication of technical information.

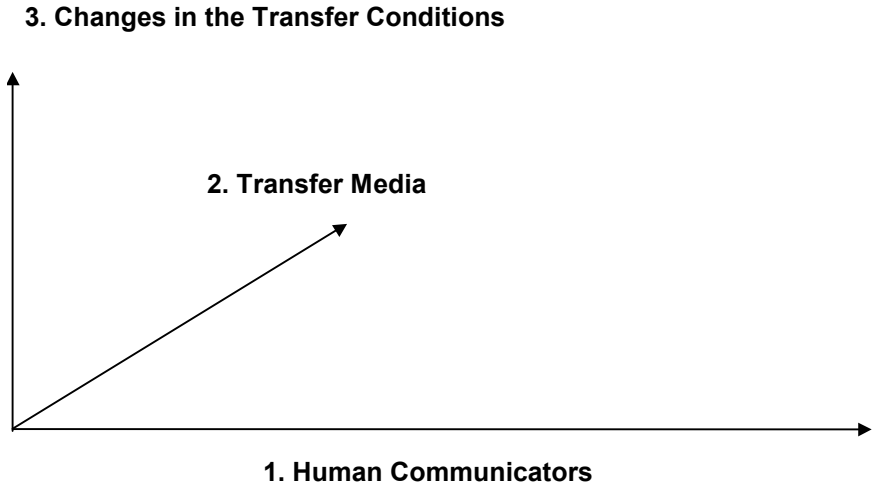

Figure 6.4.1 The Three Dimensions of the JCT Communication Cube

In order to *communicate technical information externally,* there must first exist a communication-bearing object, e.g. computer, floppy disk, or physical model, which can be called the **Transfer Media**. A human being, i.e. a **Human Communicator**, is also needed, who "informs" the Transfer Media what the information is to look like. In order to decipher the information after it has been transferred, the receiver of the information needs to know how the information has been stored for transfer. One way of ensuring successful transfer is to draw up an agreement concerning the Transfer Media and the format for storage. When changes are made that affect the agreement, i.e. **Changes in the Transfer Conditions**, the Human Communicators involved must up-date the agreement, in consultation with each other.

The three dimensions interact. Furthermore, each dimension is more complex than an initial impression may reveal. *Transfer Media* can comprise more than one alternative selection of hardware or software. *Human Communicators* can number more than one in the Communication Loop.

Changes in the Transfer Conditions nowadays usually entail large amounts of money and thorough expertise.

The Communication Cube is extremely useful when analysing requirements and determining resource allocation. It enables managers to determine how to allocate resources among the three dimension to obtain optimal external communication of technical information.

Each dimension represents a cube of its own that presents the situation for that dimension. The total communication ability of a company is represented by the main Communication Cube.

The philosophical foundations of the JCT Communication Cube are evident in that the Cube integrates the human element, the technical element and the element of passing time.

6.5 Three Parameters for Each Dimension in the JCT Communication Cube

The investigation considered three parameters in each of the three dimensions of the JCT Communication Cube, which means that nine parameters in total were investigated. The three dimensions and the three parameters for each dimension (3 x 3 = 9 dimensions) are as follows:

1. HUMAN COMMUNICATORS

1.1 Possibility of finding the right person at the PARTNER company to help investigate and agree about the Communication Agreement for CAD/CAM data

1.2 Possibility of carrying out a quality test of the transfer conditions before the project starts

1.3 Repeatability of the routine for successful transfer of the technical information during the whole project

2. TRANSFER MEDIA

2.1 Possibility of investing in the right hardware and software at the PARTNER for successful transfer of CAD/CAM data with the Brand Owner

2.2 Possibility of getting expert assistance in-house or externally, concerning the transfer of technical information.

2.3 Expectations regarding the success of future improvements in the different types of transfer media

3. CHANGES IN THE TRANSFER CONDITIONS

3.1 Effectiveness of informing the Brand Owner about changes that can affect the Communication Agreement for CAD/CAM data

3.2 Effectiveness of confirmation from Brand Owner of a change reported by PARTNER

3.3 Possibility to carry out a quality test after implementation of changes that have affected the Communication Agreement for CAD/CAM data

6.5.1.1 The Two Assessments for Each Parameter

1. HUMAN COMMUNICATORS

1.1 *Possibility of finding the right person at the PARTNER company to help investigate and agree about the Communication Agreement for CAD/CAM data*
1.1.1 PARTNER'S assessment of BRAND OWNER
1.1.2 PARTNER'S assessment of its own best practice partner (BENCHMARK)

1.2 *Possibility of carrying out a quality test of the transfer conditions before the project starts*
1.2.1 PARTNER'S assessment of BRAND OWNER
1.2.2 PARTNER'S assessment of its own best practice partner (BENCHMARK)

1.3 *Repeatability of the routine for successful transfer of the technical information during the whole project*
1.3.1 PARTNER'S assessment of BRAND OWNER
1.3.2 PARTNER'S assessment of its own best practice partner (BENCHMARK)

2. TRANSFER MEDIA

2.1 *Possibility of investing in the right hardware and software at the PARTNER for successful transfer of CAD/CAM data with the Brand Owner*
2.1.1 PARTNER'S assessment of its possibility to invest in the necessary existing transfer media
2.1.2 Assessment of Benchmark = constant value of 100% *

2.2 *Possibility of getting expert assistance in-house or externally, concerning the transfer of technical information.*
2.2.1 PARTNER'S assessment of its access to competent personnel
2.2.2 Assessment of Benchmark = constant value of 100% *

2.3 *Expectations regarding the success of future improvements in the different types of transfer media*
2.3.1 PARTNER'S expectations regarding the success of improvements in future transfer media
2.3.2 Assessment of Benchmark = constant value of 100% *

***** The value for this assessment is always 100%, since the respondent Partner would not have access to the information needed to correctly assess the Benchmark company. The ultimate value of the assessment is 100% since you would then have all the funds you wanted.

3. CHANGES IN THE TRANSFER CONDITIONS

3.1 *Effectiveness of informing the Brand Owner about changes that can affect the Communication Agreement for CAD/CAM data*
3.1.1 PARTNER'S assessment of itself in relation to the BRAND OWNER
3.1.2 PARTNER'S assessment of itself in relation to its own best practice partner (BENCHMARK)

3.2 *Effectiveness of confirmation from Brand Owner of a change reported by PARTNER*
3.2.1 PARTNER'S assessment of BRAND OWNER
3.2.2 PARTNER'S assessment of its own best practice partner (BENCHMARK)

3.3 *Possibility to carry out a quality test after implementation of changes that have affected the Communication Agreement for CAD/CAM data*
3.3.1 PARTNER'S assessment of BRAND OWNER
3.3.2 PARTNER'S assessment of its own best practice partner (BENCHMARK)

6.5.1.2 Comments on the Assessments in each Dimension

Dimension 1
For the three parameters in Dimension 1, the company that demonstrates the best practice according to the PARTNER's communication process is the "Benchmark". In other words, the Benchmark represents the ideal company with which the PARTNER co-operates.

Dimension 2
For the three parameters in Dimension 2, the "Benchmark" assessment is always 100%. This means that the respondent can be 100% satisfied with communication equipment that is not necessarily the most expensive or most advanced equipment. For the answer to be 100%, the communication equipment simply needs to fulfil the communication requirements of the Brand Owner.

Dimension 3
Just as in Dimension 1 above, the three parameters in Dimension 3 include assessments by the PARTNER regarding the "Benchmark" for that Partner. In other words, the Benchmark represents the ideal company with which the PARTNER co-operates.

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6.5.2 Assessment Answer Identification Number System

Question number	Position 1 = *Communication Dimension*	Position 2 = *Parameter to be measured*	Position 3 = *Assessment concerns*	Assessment Identification Number
	1 = Human Communicators	1 = Right person 2 = Quality test 3 = Repeatability	1 = Brand Owner 2 = Benchmark	
1.1.1	1	1	1	111
1.1.2	1	1	2	112
1.2.1	1	2	1	121
1.2.2	1	2	2	122
1.3.1	1	3	1	131
1.3.2	1	3	2	132
	2 = Transfer Media	1 = Hardware or software 2 = Personnel 3 = Future systems	1 = Brand Owner 2 = Benchmark	
2.1.1	2	1	1	211
2.1.2 *	2	1	2	212 *
2.2.1	2	2	1	221
2.2.2 *	2	2	2	222 *
2.3.1	2	3	1	231
2.3.2 *	2	3	2	232 *
	3 = Changes in the Transfer Conditions	1 = Notification 2 = Up-dating 3 = Quality test	1 = Brand Owner 2 = Benchmark	
3.1.1	3	1	1	311
3.1.2	3	1	2	312
3.2.1	3	2	1	321
3.2.2	3	2	2	322
3.3.1	3	3	1	311
3.3.2	3	3	2	312

* The three assessments 212, 222 and 232 are defined as having the constant value of 100%, since the respondent Partner would not have access to the information required to indicate a precise value as an answer about the Benchmark company.

6.6 Obstacles to Effective Communication

6.6.1 Examples of Existing Obstacles to Effective Communication

The following examples are taken from reality and are related to individual parameters in the JCT Communication Cube. Most managers and communication contact persons or communication technicians will recognize these as situations, which can and do exist today in any company. These examples represent universal obstacles to smooth and effective communication.

1.1 An actual CAD/CAM Agreement does not exist regarding investigated and agreed parameters
1.2 The routine that prescribes the quality test is not followed
1.3 The outcome of a process is dependent on only one person for troubleshooting and restoration.

2.1 Inability, due to lack of expertise or lack of investment funds, to buy the hardware/software that exists.
2.2 Personnel lack competence that is necessary to run software/hardware
2.3 STEP, Odette and Internet function in practice

3.1 Changes, e.g. new CAD system or CAD release, have not been reported.
3.2 Confirmation is seldom sent to PARTNER
3.3 Lead time pressure from Brand Owner due to project time frame does not allow time for a quality test

6.7 Summary of the Investigation Process

See Figure 6.6.2.1 Summary flow chart on the following page that schematically describes the information presented in Chapter 6.

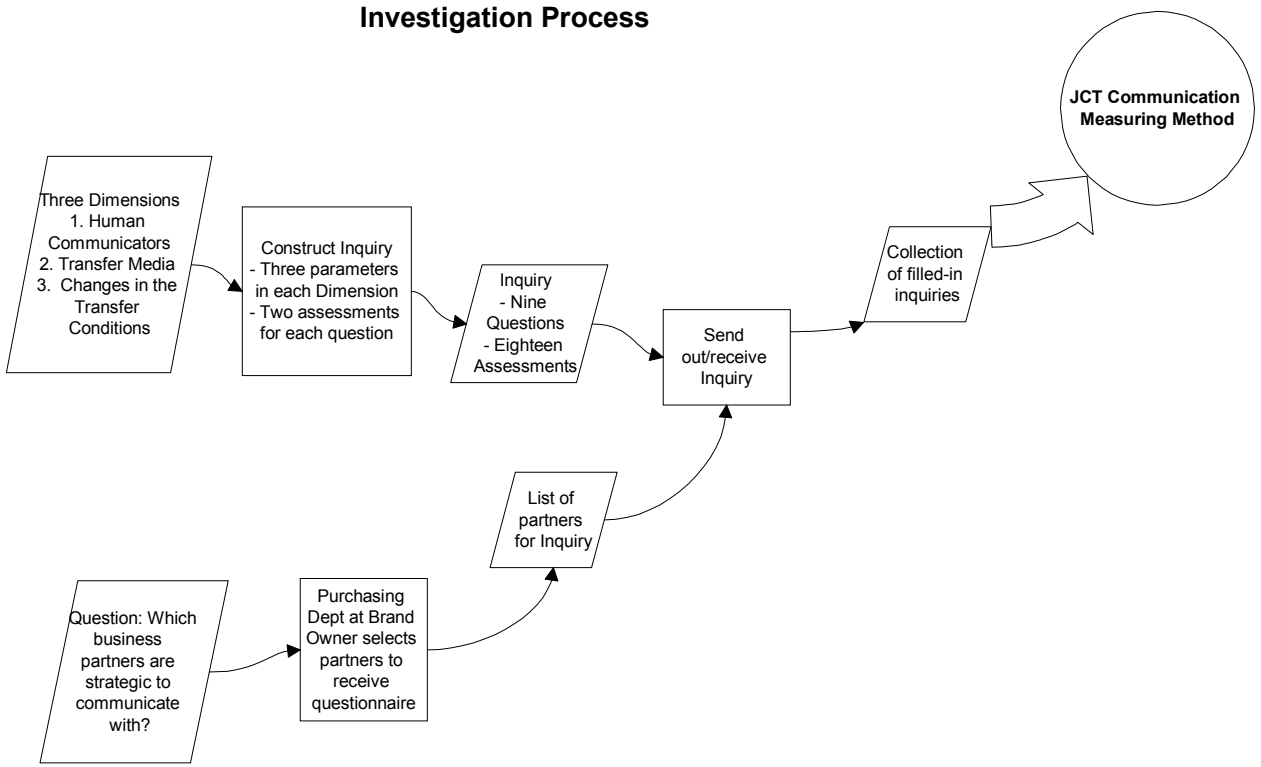


Figure 6.7.1 Summary flow chart of Chapter 6

7 The JCT Communication Measuring Method

In this investigation, the JCT Communication Measuring Method measures the communication effectiveness of the external communication of technical information. The purpose of the Method is:

1. To supply measurement data that will create a clear and easily understandable picture of communication effectiveness of the Brand Owner and the Benchmark as seen through a Partner's eyes.

2. To enable calculation of a key ratio for each of the eighteen assessments in the Questionnaire based on the nine dimensions in the JCT Communication Cube.

Key Ratios
The JCT Key Ratios permit managers to quickly gain insight into how a company is positioned compared with the global competition. The key ratios are always measurable and are therefore especially appropriate for use as simplified targets in the JCT Leadership Communication Cycle. Managers at the Brand Owner and its Partners can use the key ratios to make decisions to correctly allocate the resources in order to achieve the targets throughout the business operations of the Brand Owner and its Partners.

7.1.1 The Procedure

First, the questionnaire is sent out in A4 paper format to the person responsible for technical information (CAD-CAE, etc.) at selected suppliers. These suppliers are referred to as PARTNERS below. As stated above, in this investigation a PARTNER is defined simply as a company that a Brand Owner communicates with, and has no other meaning. The questionnaire contains assessments for the PARTNER to mark and requests for answers in the PARTNER's own words. The assessments in the returned questionnaires are handled according to statistical methods. A calculation model is used to reduce the results for each assessment to one single number, a Key Ratio indicating the communication effectiveness for each assessment. Two assessments per parameter result in two Key Ratios per parameter. The Key Ratios are presented below in the form of tables and diagrams. The diagrams especially point out any difference between the PARTNER's assessment of the communication effectiveness of the Brand Owner and of the Benchmark.

7.1.1.1 Step 1: Sorting the answers into intervals

The respondent PARTNER marks each answer on a scale of 0 and 100. This value represents the degree of satisfaction with the situation at present (present = at the time the questionnaire is answered). An answer of 100 represents 100% satisfaction.

Each answer is then placed into a Satisfaction Interval from 1 to 10. Thus, 0-9% is placed in Interval 1; 10-19% in Interval 2; and so on, up to 90-100% in Interval 10. For example, an answer of 54% is placed in Interval 6, an answer of 90% is placed in Interval 10, etc., as follows:

Table 7:1 Basis for Sorting the Responses

Actual answer in %	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99
Interval	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**

This procedure permits us to handle each answer individually, which affords the advantage that all answers, even those from surveys that are returned incomplete, can be processed. In the third round of this investigation, 55 surveys were sent to the Brand Owner's PARTNERS. Of these, the answers of 21 returned surveys were usable.

7.1.1.2 Step 2: Accumulated Satisfied Assessments

Determining the percentage of satisfied assessments in each interval and higher intervals:

After the assessments are sorted into satisfaction intervals, the next step is to determine the percentage of assessments for each parameter that have been sorted into a particular interval or a higher interval.

We can follow Assessment 131 through the Measuring Method procedure.

Assessment 131

1.3 Repeatability of the routine for successful transfer of the technical information during the whole project

1.3.1 PARTNER'S assessment of BRAND OWNER

The answers returned for Assessment 131 show the following:

100% of Partners answer that they are satisfied at least to a degree of 0% (Interval 1). 100% of Partners answer that they are satisfied at least to a degree of 10% (Interval 2). 100% of Partners answer that they are satisfied at least to a degree of 20% (Interval 3). 100% of Partners answer that they are satisfied at least to a degree of 30% (Interval 4). 100% of Partners answer that they are satisfied at least to a degree of 40% (Interval 5). 83% of Partners answer that they are satisfied at least to a degree of 50% (Interval 6). 61% of Partners answer that they are satisfied at least to a degree of 60% (Interval 7). 61% of Partners answer that they are satisfied at least to a degree of 70% (Interval 8). 56% of Partners answer that they are satisfied at least to a degree of 80% (Interval 9). 39% of Partners answer that they are satisfied at least to a degree of 90% (Interval 10).

Assessment 131 can be stated in a table as follows:

Table 7:2 Sorting Example for Assessment 131

Actual answer	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99
Interval	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Assess-ment ID number										
131	100	100	100	100	100	83	61	61	56	39

The answers can now be given the name JCT Satisfaction Values and can be stated for ALL the Assessments in a table. See Table 7:3 JCT Satisfaction Values.

Table 7:3 JCT Satisfaction Values

Table 7:3 shows the JCT Satisfaction Values for all assessments sorted into satisfaction intervals.

Actual answer in %	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99
Interval	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Assess-ment ID number			**JCT Satisfaction Values**							
111	100	100	100	100	100	100	83	72	55	27
112	100	100	100	100	100	100	94	83	72	72
121	100	100	100	100	100	100	100	94	55	28
122	100	100	100	100	100	100	100	100	61	39
131	100	100	100	100	100	83	61	61	56	39
132	100	100	100	100	100	83	72	72	61	50
211	100	100	94	89	89	89	67	44	39	17
212 *	100	100	100	100	100	100	100	100	100	100
221	100	100	100	100	94	94	83	67	50	22
222 *	100	100	100	100	100	100	100	100	100	100
231	100	100	100	94	78	78	67	61	33	28
232 *	100	100	100	100	100	100	100	100	100	100
311	100	100	100	100	100	100	89	89	83	67
312	100	100	100	100	100	100	89	89	83	67
321	100	100	100	100	100	94	83	83	72	44
322	100	100	100	100	100	94	89	89	72	44
331	100	100	100	94	89	89	78	67	44	44
332	100	100	100	94	89	89	83	73	44	44

* The three assessments 212, 222 and 232 are defined as having the constant satisfaction value of 100%, since the respondent Partner would not have access to the information required to indicate a precise value as an answer about the Benchmark company.

7.1.2 Calculating the JCT Key Ratios for each parameter

The next step is to calculate the JCT KEY RATIO for each of the two assessments in each parameter. This is done by using the following general formula:

Formula 7-A $K_{pqr} = \sum_{i=1}^{10} y_i$

where:

K = KEY RATIO for each parameter as shown in Table 7:3 above.

p = the digit in position 1 in the parameter identification number; possible digits for p are 1 or 2 or 3.

q = the digit in position 2 in the parameter identification number; possible digits for q are 1 or 2 or 3.

r = the digit in position 3 in the parameter identification number; possible digits for r are 1 or 2.

y_i = the value in each interval where **index i** represents the particular interval for a particular parameter pqr ,

Example:

The KEY RATIO for Assessment 131 is calculated as follows: $K_{131} = \sum_{i=1}^{10} y_i$ or $K_{131} = 800$

Actual answer in %	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	**Key Ratio**
Inter-val	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	
Assess-ment ID number											
y_i	Y_1	Y_2	Y_3	Y_4	Y_5	Y_6	Y_7	Y_8	Y_9	Y_{10}	
131	100	100	100	100	100	83	61	61	56	39	800

The JCT Key Ratios for all eighteen assessments in the nine parameters are stated in Table 7:4 JCT Key Ratios.

It is important that the assessments can be stated in pairs. This permits evaluation of the Brand Owner in relation to world class, i.e. the Benchmark.

Assessments that are made in pairs in this investigation are the following:
(111,112), (121,122), (131,132), (311,312), (321,322), (331,332).

Assessments 211, 221, and 231 can be compared with 100%, which here corresponds to the highest possible result. This is why the "pair" assessments 212, 222 and 232 are always stated as 100%.

Table 7:4 JCT Key Ratios

Table 7:4 shows the JCT Key Ratios for all eighteen assessments in the nine parameters.

Actual answer in %	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	**Key Ratio**	**Assessment ID number**
Inter-val	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**		
Assess-ment ID num-ber												
111	100	100	100	100	100	100	83	72	55	27	**837**	**111**
112	100	100	100	100	100	100	94	83	72	72	**921**	**112**
121	100	100	100	100	100	100	100	94	55	28	**877**	**121**
122	100	100	100	100	100	100	100	100	61	39	**900**	**122**
131	100	100	100	100	100	83	61	61	56	39	**800**	**131**
132	100	100	100	100	100	83	72	72	61	50	**838**	**132**
211	100	100	94	89	89	89	67	44	39	17	**728**	**211**
212 *	100	100	100	100	100	100	100	100	100	100	**1000**	**212***
221	100	100	100	100	94	94	83	67	50	22	**810**	**221**
222 *	100	100	100	100	100	100	100	100	100	100	**1000**	**222***
231	100	100	100	94	78	78	67	61	33	28	**739**	**231**
232 *	100	100	100	100	100	100	100	100	100	100	**1000**	**232***
311	100	100	100	100	100	100	89	89	83	67	**928**	**311**
312	100	100	100	100	100	100	89	89	83	67	**928**	**312**
321	100	100	100	100	100	94	83	83	72	44	**876**	**321**
322	100	100	100	100	100	94	89	89	72	44	**888**	**322**
331	100	100	100	94	89	89	78	67	44	44	**805**	**331**
332	100	100	100	94	89	89	83	73	44	44	**816**	**332**

* The three assessments 212, 222 and 232 are defined as having the constant satisfaction value of 100%, since the respondent Partner would not have access to the information required to indicate a precise value as an answer about the Benchmark company.

7.2 Two Applications of the JCT Communication Key Ratios

The JCT Communication Key Ratios can be applied in two ways:

1) Comparison between Brand Owner and Benchmark (using a method of simple subtraction). This is illustrated best by showing the JCT Communication Key Ratio pairs in a JCT Communication Diagram.

2) Illustration of current status quo in communication effectiveness (using multiplication formulae). This is best illustrated by reducing and entering the JCT Key Ratios in the JCT Communication Cube.

7.2.1 Comparison between Brand Owner and Benchmark (subtraction method)

Simple subtraction yields the growth potential in effectiveness points. We can take Assessment 131 again and subtract it from the Benchmark, here called Assessment 132. This operation yields 838 – 800 = 38 effectiveness points. Here is an example of where a discussion is necessary to determine what action(s) could be implemented to improve the communication effectiveness, i.e. to ensure powerful growth. This is a relatively simple way of using the Key Ratios. It points out the magnitude of possible problems but yields a rather imprecise picture of the problem areas that need addressing.

7.2.2 Illustration of current status quo in communication effectiveness (multiplication method)

Multiplication using the following formula provides a better evaluation of improvement potential, as well as realistic basic data to assist managers in determining management strategies to ensure improvement in relevant areas.

Formula 7-A $\sum_{q=1}^{3}(pq2 - pq1)$

Formula 7-A indicates the improvement potential for <u>one</u> particular business operation represented by <u>one</u> of the three dimensions, either Human Communicators, Transfer Media or Changes in Transfer Conditions.

Formula 7-B $\sum_{p=1}^{3}\sum_{q=1}^{3}(pq2 - pq1)$

Formula 7-B indicates the <u>total</u> improvement potential for business operations represented by <u>all</u> three dimensions, Human Communicators, Transfer Media and Changes in Transfer Conditions.

7.3 Application 1: JCT Key Ratios presented in JCT Communication Diagrams

7.3.1 The JCT Communication Diagram

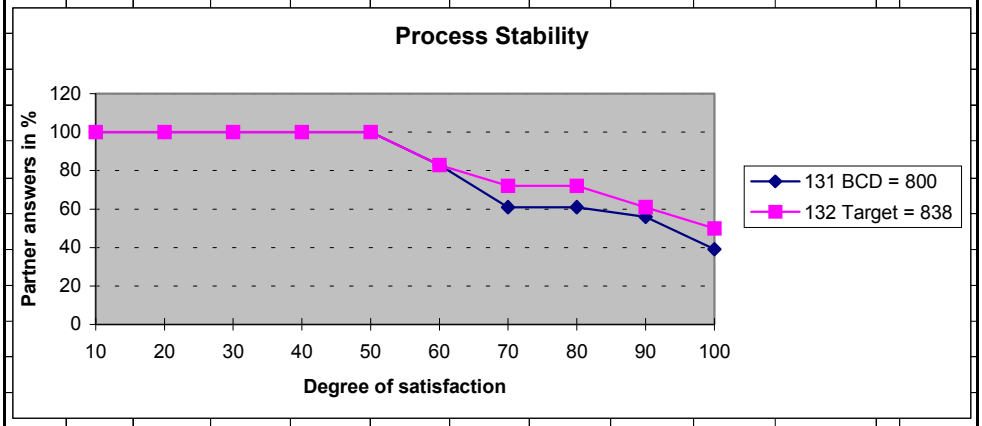
As stated above, the JCT Communication Diagram is an excellent tool for presenting measurement results (JCT Key Ratios) based on an analysis of communication effectiveness. The JCT Diagram shows clearly the magnitude of the difference between the Brand Owner's performance in communication effectiveness compared with a Benchmark, i.e. another company that the Brand Owner's Partner considers to be best in communication effectiveness. The JCT Communication Diagram Example below shows how the results for Parameter 1.3: *Repeatability of the routine for successful transfer of the technical information during the whole project* in the "Human Communicators" Dimension can be presented in a JCT Communication Diagram.

NOTE:
In all JCT Communication Diagrams presented below, "BCD" is the BRAND OWNER and "Target" is the BENCHMARK.

7.3.1.1 JCT Communication Diagram Example

JCT Communication Diagram for Parameter 1.3, Assessments 131 and 132

131	100	100	100	100	100	83	61	61	56	39		800
132	100	100	100	100	100	83	72	72	61	50		838



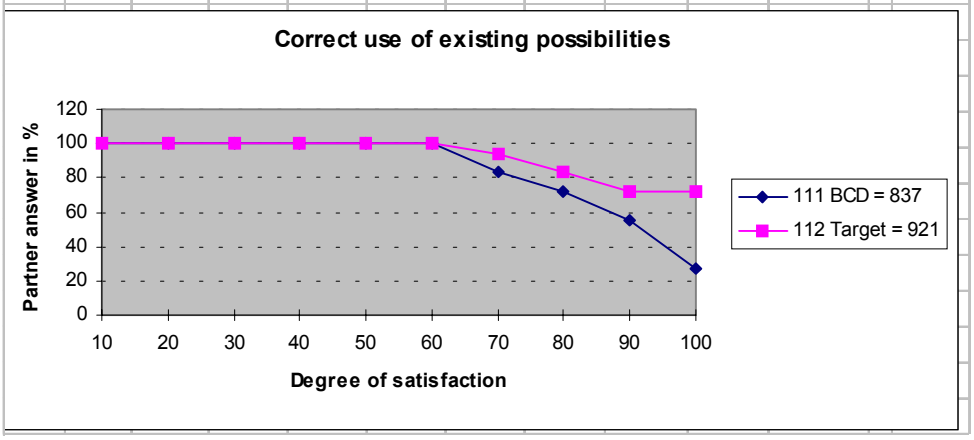
7.3.2 JCT Communication Diagrams based on the 1998 Questionnaire

The following JCT Communication Diagrams are based on the assessments collected by the questionnaire sent out in February 1998. The analysis was finished in October 1998. The resulting JCT Communication Key Ratios have been paired for each parameter and are presented in JCT Communication Diagrams here.

JCT Communication Diagram 7-1

Parameter 1.1, Assessments 111 and 112

111	100	100	100	100	100	100	83	72	55	27		837
112	100	100	100	100	100	100	94	83	72	72		921



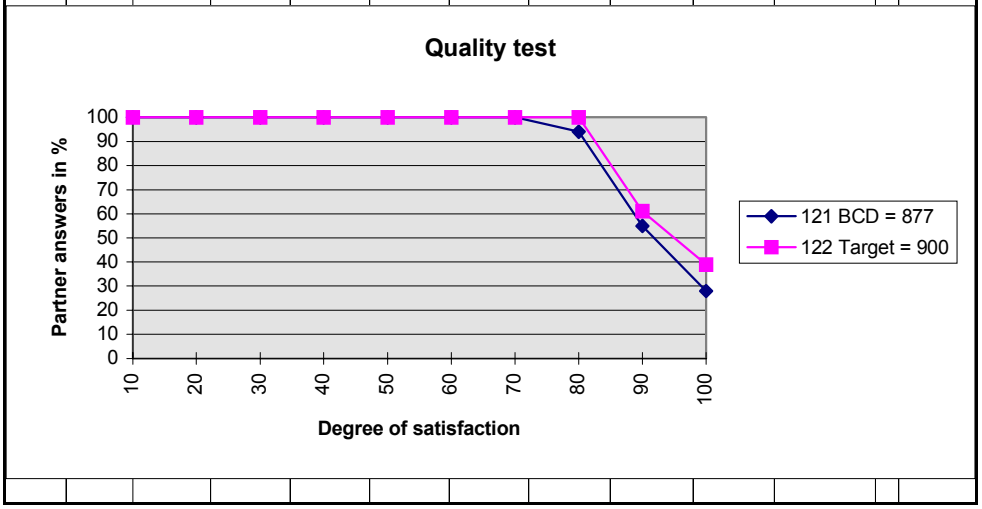
JCT Communication Diagram 7-1

JCT Communication Diagram 7-2

Parameter 1.2, Assessments 121 and 122

Assessments 121 - 122 refer to the possibility of performing a quality test of the communication in advance, before the actual automobile project necessitates real communication between the Brand Owner and the Partner. The results indicate that there is a potential for improvement of 123 effectiveness points. The Brand Owner is 23 effectiveness points below world class, i.e. being the best partner for all its Partners.

121	100	100	100	100	100	100	100	94	55	28		877
122	100	100	100	100	100	100	100	100	61	39		900



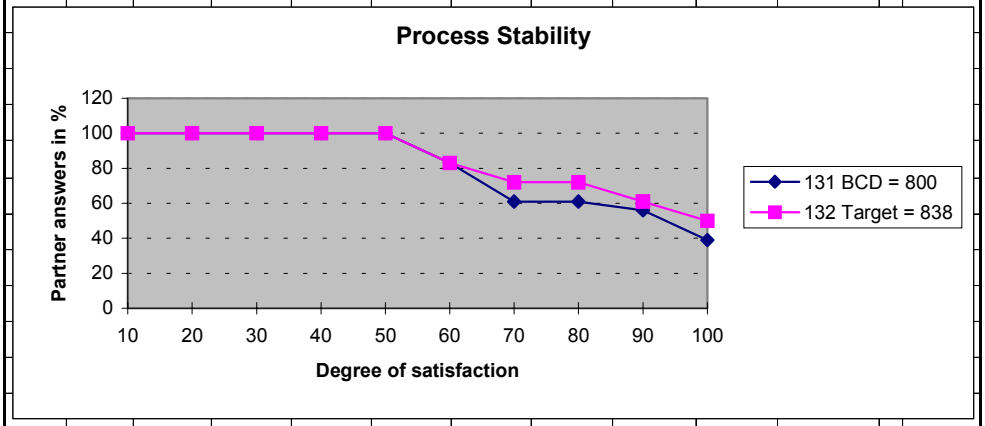
JCT Communication Diagram 7-2

JCT Communication Diagram 7-3

Parameter 1.3, Assessments 131 and 132

Assessments 131 - 132 show the quality of smooth transmission and reading of CAD data according to the established routines. The analysis shows that this can be improved by a total of 200 effectiveness points. BCD has 38 points to go before reaching the goal of being the best communication Partner.

131	100	100	100	100	100	83	61	61	56	39		800
132	100	100	100	100	100	83	72	72	61	50		838



JCT Communication Diagram 7-3

JCT Communication Diagram 7-4

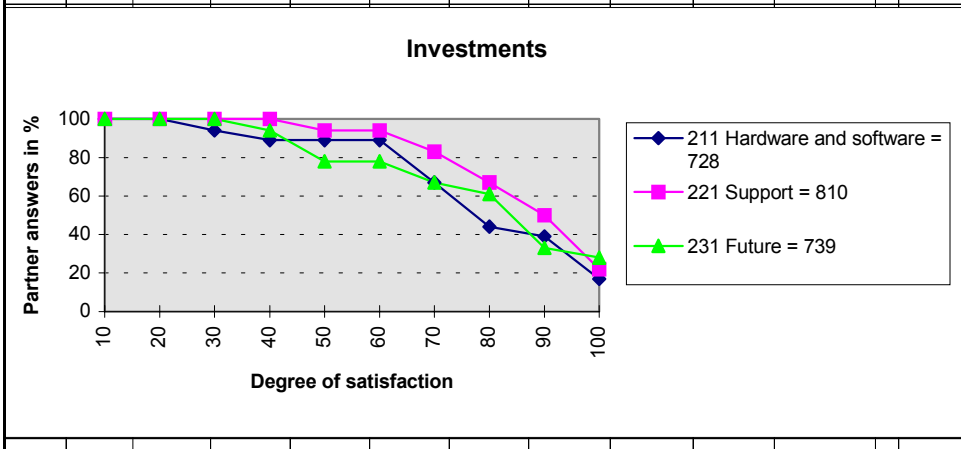
Parameter 2.1, 2.2, and 2.3; Assessments 211, 221 and 231

Parameter 2.1 concerns the possibility for Partners to invest in the best hardware and software available on the market. The curve here shows that there is an improvement potential of 272 effectiveness points.
Parameter 2.2 concerns the possibility to receive support to obtain the maximum use of the equipment that was invested in. For this parameter there is a potential of improvement of 190 effective points.
Parameter 2.3 concerns the vision that communication will improve when the communication tools now under development are ready for productive application in reality. The results show that the belief is that, after the improvements in progress today are fully implemented, 261 quality points will remain to reach world class.

Benchmark Assessments for these Parameters
Assessments 211, 221 and 231 have as their respective "Benchmark" assessments the three Assessments 212, 222 and 232. It is essential to remember that these "Benchmark" assessments are defined as having the constant satisfaction value of 100%, since the respondent Partner would not have access to the information required to indicate a precise value as an answer about the Benchmark company.

NOTE: It is important to keep in mind that lower satisfaction values for these parameters are probably a very good result, since lower values may be an indication that the respondent Partner wants to improve/develop communication effectiveness.

211	100	100	94	89	89	89	67	44	39	17		728
221	100	100	100	100	94	94	83	67	50	22		810
231	100	100	100	94	78	78	67	61	33	28		739



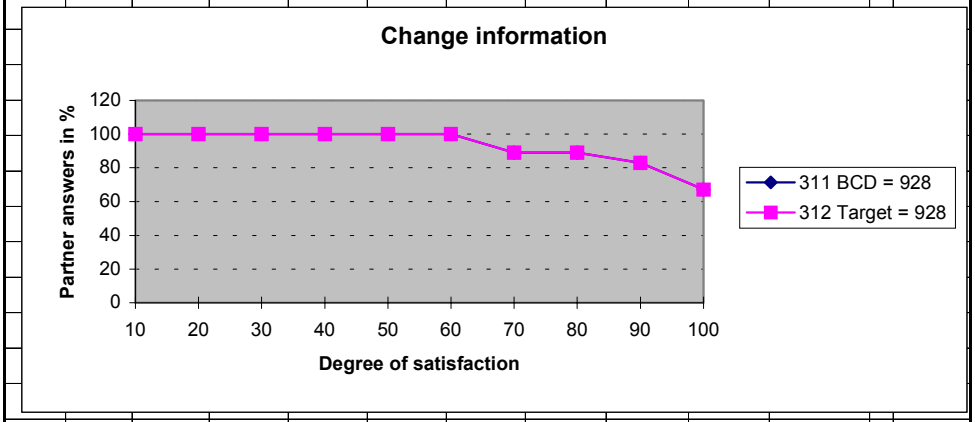
JCT Communication Diagram 7-4

JCT Communication Diagram 7-5

Parameter 3.1, Assessments 311 and 312

Assessments 311 - 312 **concerns the degree of satisfaction with always being informed about changes in the Communication agreement**. There is a total potential here to improve by 72 effectiveness points. BCD has here been judged as the best partner of all partners e.g. world class at this time.

311	100	100	100	100	100	100	89	89	83	67		928
312	100	100	100	100	100	100	89	89	83	67		928

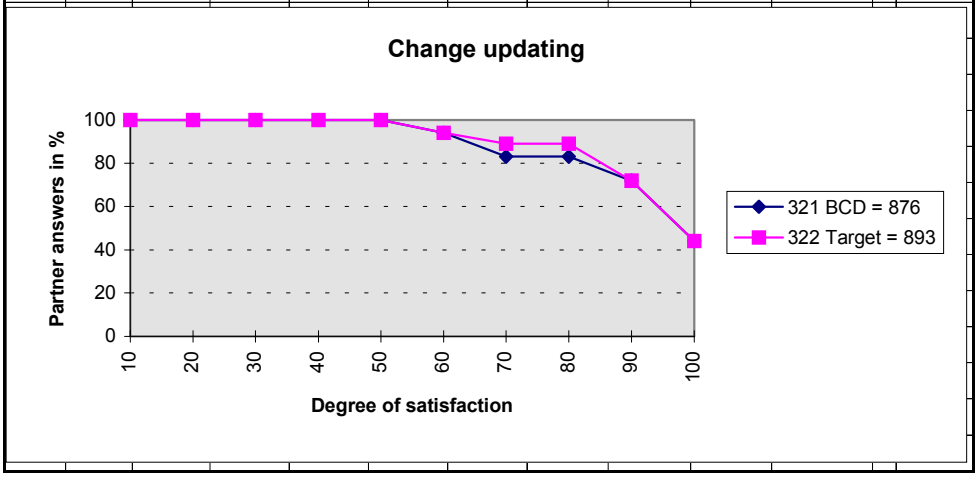


JCT Communication Diagram 7-5

JCT Communication Diagram 7-5JCT Communication Diagram 7-6
Parameter 3.2, Assessments 321 and 322

Assessments 321 - 322 concern the degree of satisfaction with how changes in the Communication Agreement have been introduced and with how the Partner has been informed of changes. In this case there is a total potential for improvement of 124 effectiveness points. BCD here has 12 effectiveness points to reach the level of being the best partner.

321	100	100	100	100	100	94	83	83	72	44		876
322	100	100	100	100	100	94	89	89	72	44		888



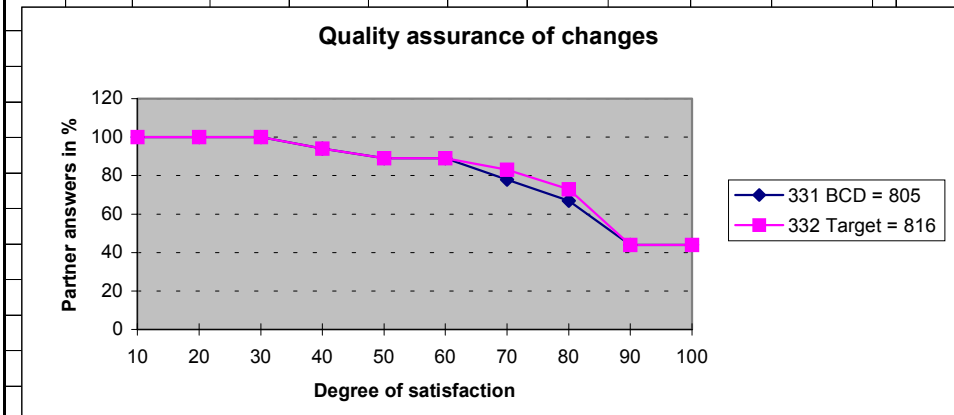
JCT Communication Diagram 7-6

JCT Communication Diagram 7-7

Parameter 3.3, Assessments 331 and 332

Assessments 331 - 332 refer to the degree of satisfaction that any changes in communication conditions have been quality tested i.e. quality assured after introduction. The improvement potential here is 195 effectiveness points. BCD has 11 effectiveness points to becoming the best partner.

331	100	100	100	94	89	89	78	67	44	44		805
332	100	100	100	94	89	89	83	73	44	44		816



JCT Communication Diagram 7-7

7.3.3 JCT Communication Diagram and Competitive Power

An important ingredient in the JCT Communication Diagram is the indication of a Benchmark by a Brand Owner's partners. This provides the Brand Owner with information about where it stands on the path to world class performance concerning communication effectiveness.

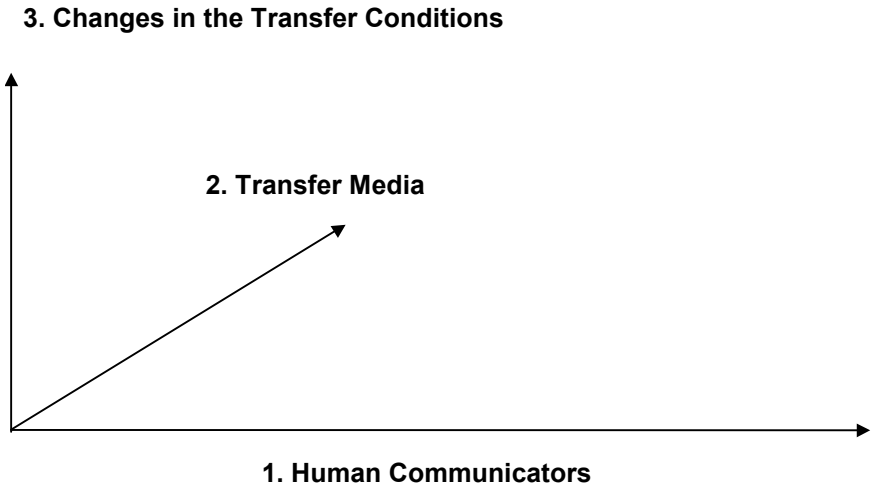
Since effective communication is an essential factor in a company's competitive power, the JCT Communication Diagram provides important data about the Brand Owner's competitive power.

7.4 Application 2: JCT Key Ratios entered in the JCT Communication Cube

7.4.1 Normalizing the Key Ratios through reducing by 10x10x10

The JCT Communication Cube is extremely useful as a tool for presenting a specific picture of the three communication dimensions in total as well as of each separate communication dimension.

7.4.1.1 Dimension Reduction Formulae for Communication Cube



DIMENSION 1

$$f_1 = 1000 * \left(\prod_{j=1}^{3} w_{1j} \bullet (K_{1j1} / 1000) \right)$$

where $1 = \sum_{j=1}^{3} w_{1j}$

DIMENSION 2

$$f_2 = 1000 * \left(\prod_{j=1}^{3} w_{2j} \bullet (K_{2j1} / 1000) \right)$$

where $1 = \sum_{j=1}^{3} w_{2j}$

DIMENSION 3

$$f_3 = 1000 * \left(\prod_{j=1}^{3} w_{3j} \bullet (K_{3j1} / 1000) \right)$$

where $1 = \sum_{j=1}^{3} w_{3j}$

COMMUNICATION CUBE VOLUME

$$f_c = 1000 * \left(\prod_{i=1}^{3} w_i \bullet (f_i / 1000) \right)$$

where $1 = \sum_{i=1}^{3} w_i$

7.4.2 JCT Communication Cube Example

Dimension 1:
Human Communicators

Key Ratio	Assessment ID
837	111
921	112
877	121
900	122
800	131
838	132

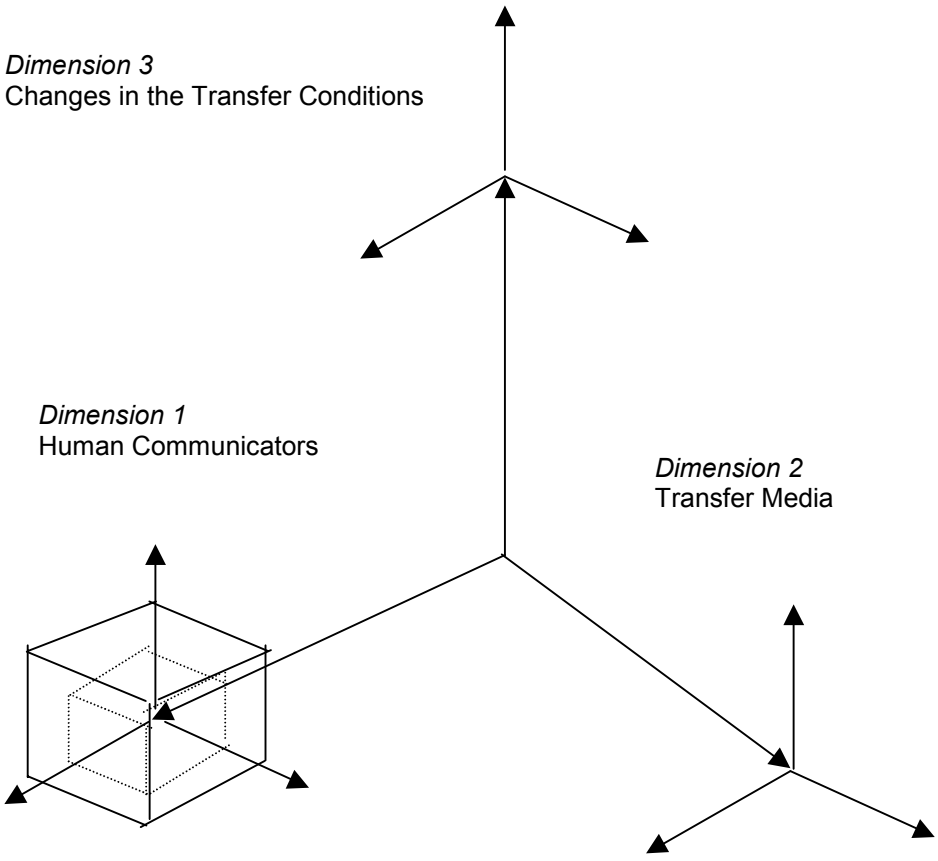
Dimension 2:
Transfer Media

Key Ratio	Assessment ID
728	211
1000	212
810	221
1000	222
739	231
1000	232

Dimension 3:
Changes in the Transfer Conditions

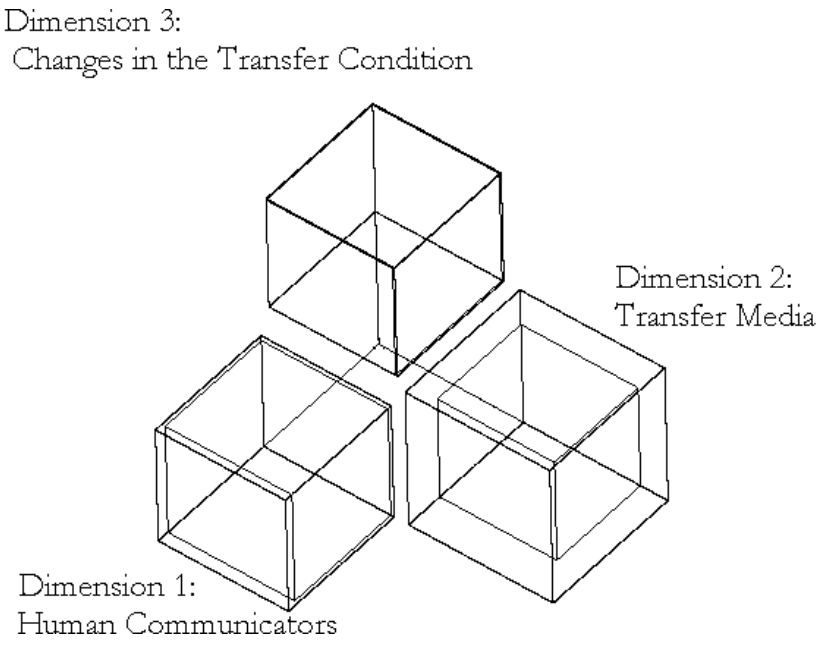
Key Ratio	Assessment ID
928	311
928	312
876	321
888	322
805	331
816	332

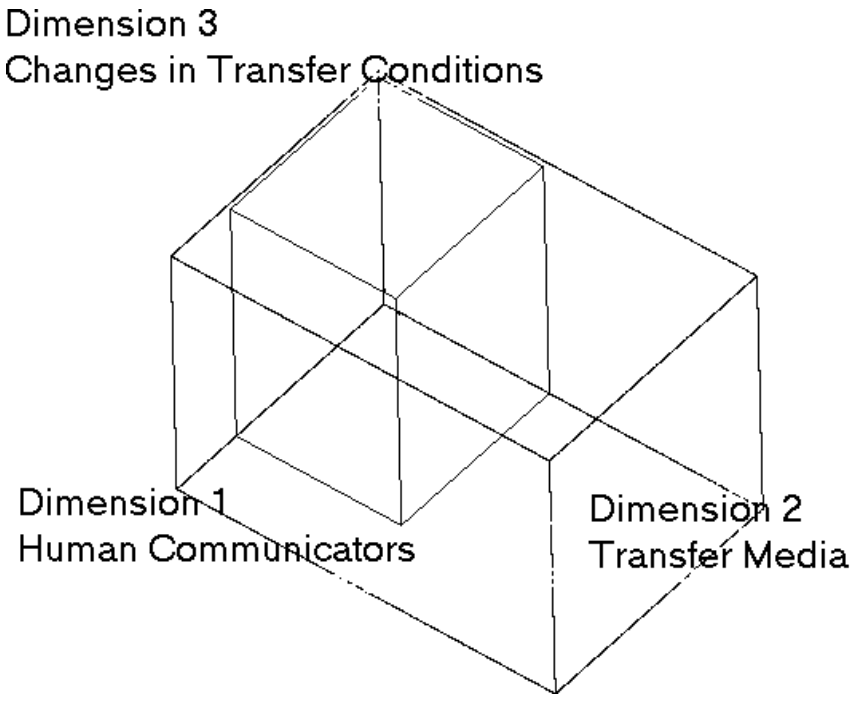
Note that even though only *Dimension 1* is visualized in the figure below, any of the three dimensions can be visualized as a cube inside the main Communication Cube:



As stated above, the Communication Cube is extremely useful when analysing requirements and determining resource allocation. It enables managers to determine how to allocate resources among the three dimension to obtain optimal external communication of technical information. Using the JCT Communication Cube creates a mutual platform for management of technology and management of money.

In the figure below, three "Dimension Cubes" are obtained because the Communication Cube is calculated for each dimension. These three Dimension Cubes can then be studied separately in more detail.





The integration of the three separate Dimension Cubes creates the total JCT Communication Cube for the values of the Key Ratios in the example above.

7.5 Application 3: JCT Key Ratios as Input to Determine Communication Growth Potential

The values that are used as input to determine communication Growth Potential are found in Table 7:4 JCT Key Ratios for all eighteen Assessments in the nine Parameters. Please refer to Table 7:4 when reading the following.

7.5.1 Calculations for obtaining the Communication Growth Potential

7.5.1.1 Examples

Dimension 1, Parameter 1.1:
Take the Key Ratio for the Benchmark Assessment, i.e. Assessment ID number 112, and divide that by the Key Ratio for the Brand Owner, i.e. Assessment ID number 111. This will provide the value for the Growth Potential for Parameter 1.1.

Dimension 1, Parameter 1.2:
Take the Key Ratio for the Benchmark Assessment, i.e. Assessment ID number 122, and divide that by the Key Ratio for the Brand Owner, i.e. Assessment ID number 121. This will provide the value for the Growth Potential for Parameter 1.2.

Dimension 1, Parameter 1.3:
Take the Key Ratio for the Benchmark Assessment, i.e. Assessment ID number 132, and divide that by the Key Ratio for the Brand Owner, i.e. Assessment ID number 131. This will provide the value for the Growth Potential for Parameter 1.3.

The results of the three separate calculations are then multiplied to obtain the Growth Potential for the whole dimension, in this case Dimension 1.

7.5.1.2 General Formulae

Each Specific Parameter
For each specific parameter, where D stands för Dimenstion identification and P for Parameter identification, the formula for Growth Potential is as follows: DP2/DP1.

Each Specific Dimension
The general formula for calculating the Growth Potential for each Dimension (D) is calculated as follows: (D12/D11)*(D22/D21)*(D32/D31).

Ex for Dimension 1 : (112/111)*(122/121)*(132/131)

Ex for Dimension 2 : (212/211)*(222/221)*(232/231)

Ex for Dimension 3 : (312/311)*(322/321)*(332/331)

For the Communication Cube
The Growth Potential for all Dimensions in the Communication Cube is calculated as follows:
[((112/111)*(122/121)*(132/131)) * ((212/211)*(222/221)*(232/231)) *
((312/311)*(322/321)*(332/331))]

7.5.1.3 Presentation of Results

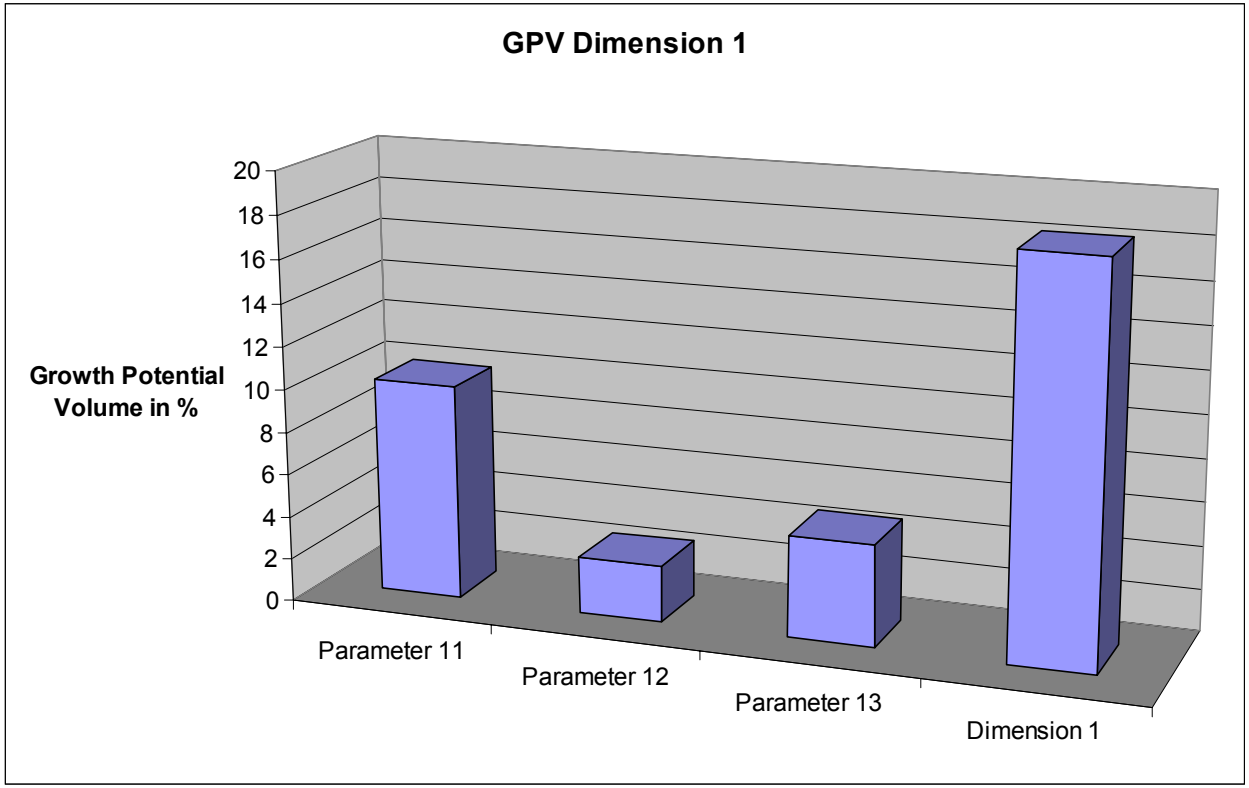
When a Growth Potential (G) is represented in the Growth Potential Graph it is transformed into a percentage as follows: (G-1)*100.

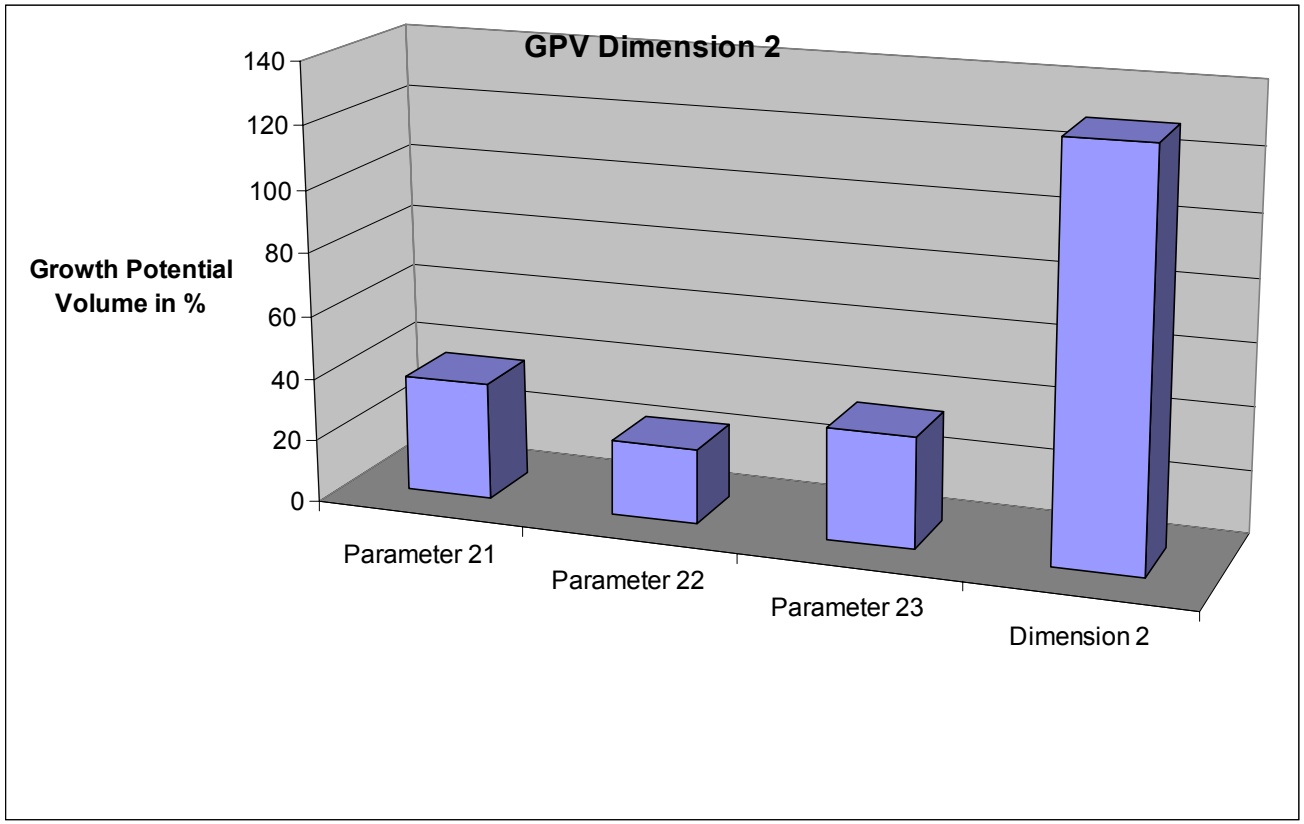
7.6 Examples of Growth Potential Volume Graphs

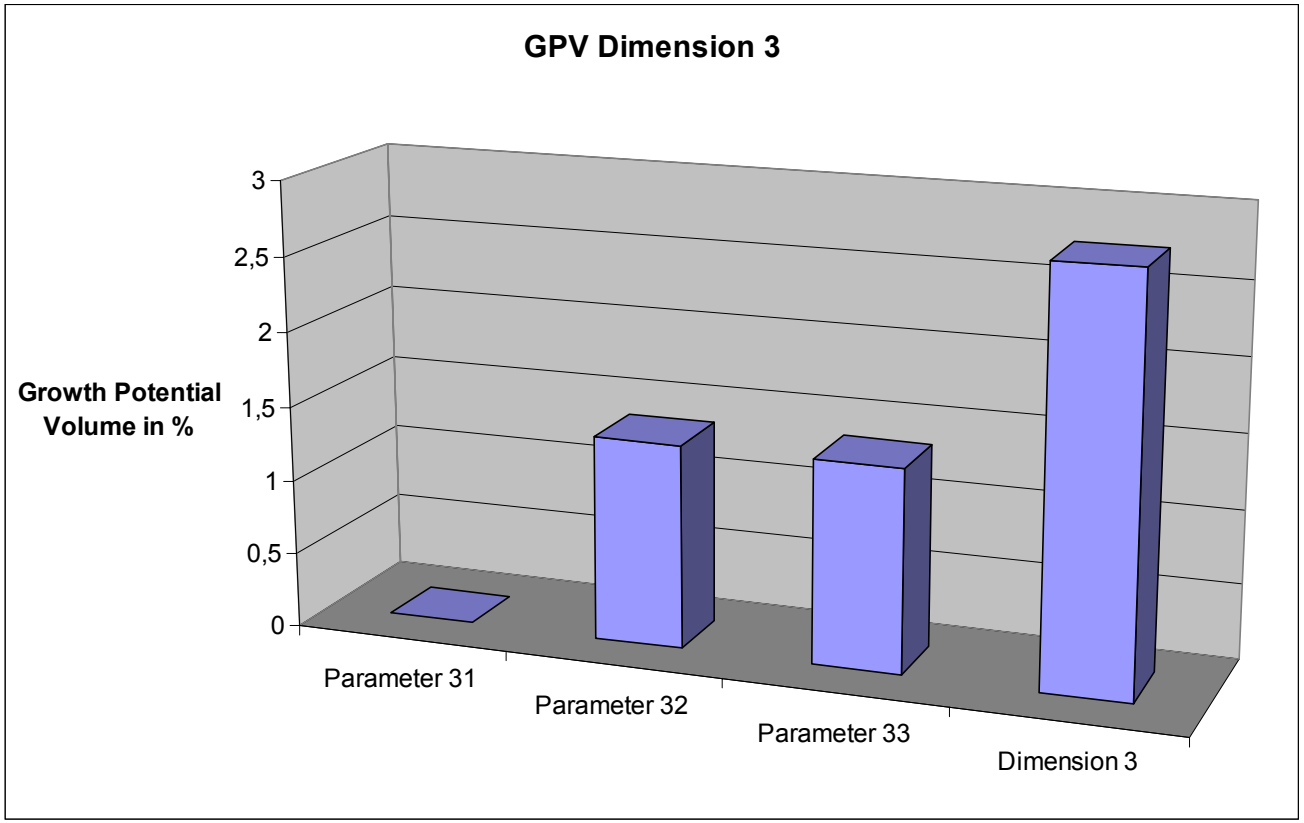
See the Growth Potential Graphs on the following pages which are based on the values in Table 7:4 JCT Key Ratios.

7.7 Summary Charts of JCT Communication Measuring Method

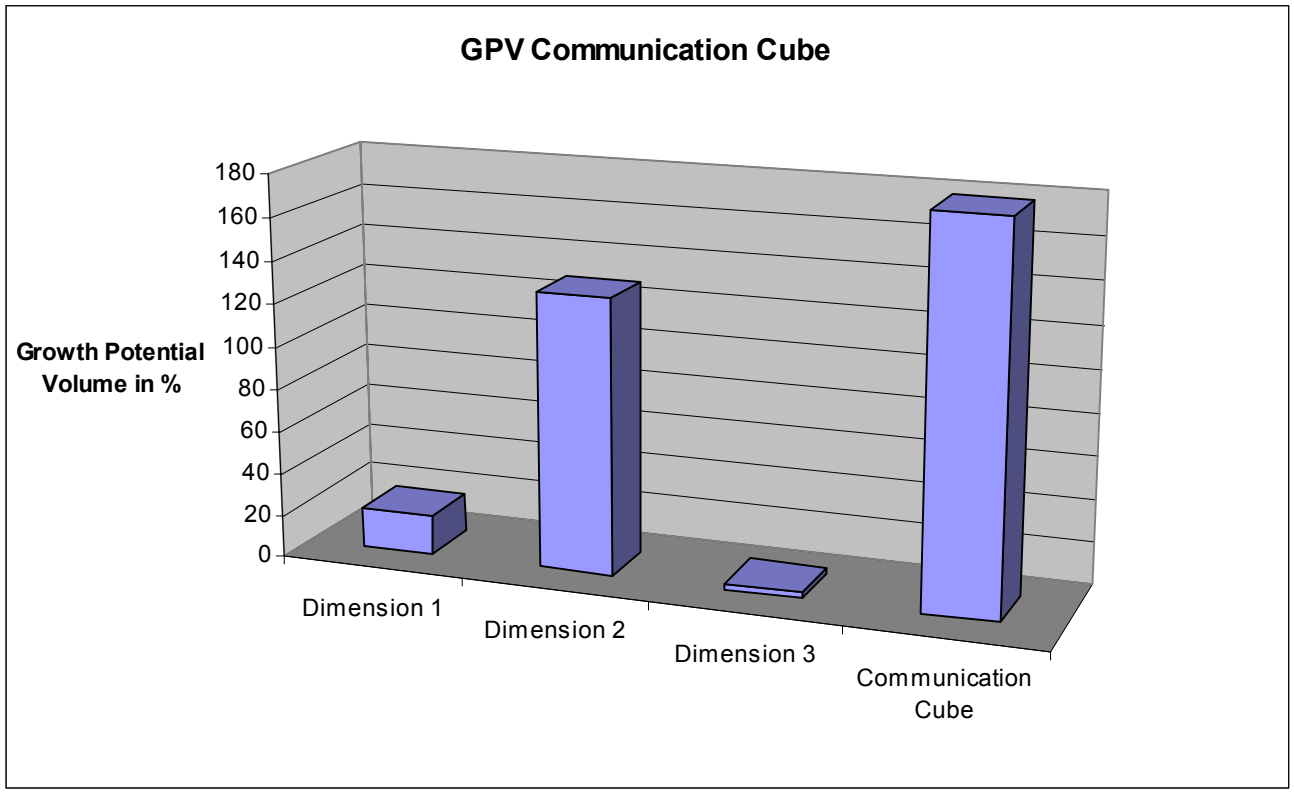
For a summary of Chapter 7 in schematic form , see the two summary charts below after the Growth Potential Graphs.


GPV Dimension 1
Growth Potential Volume in %
20
18
16
14
12
10
8
6
4
2
0
Parameter 11
Parameter 12
Parameter 13
Dimension 1

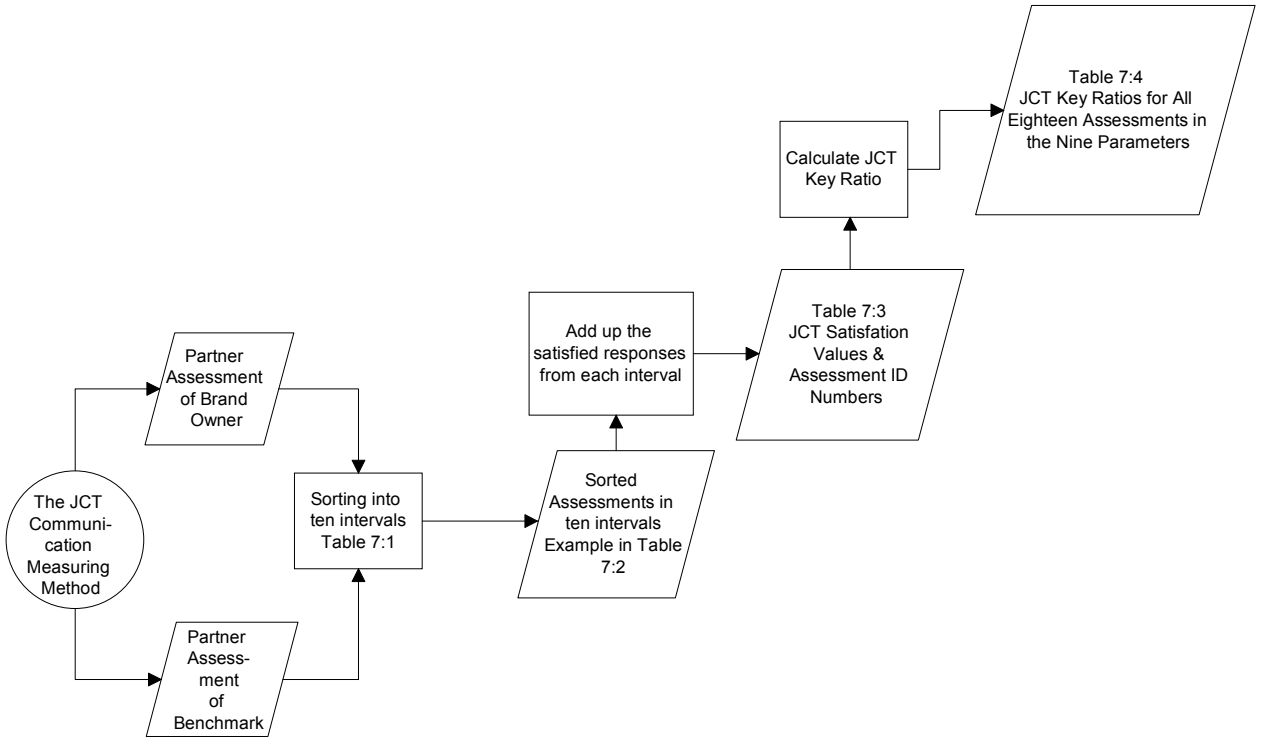

GPV Dimension 2
Growth Potential Volume in %
140
120
100
80
60
40
20
0
Parameter 21
Parameter 22
Parameter 23
Dimension 2


GPV Dimension 3
Growth Potential Volume in %
3
2,5
2
1,5
1
0,5
0
Parameter 31
Parameter 32
Parameter 33
Dimension 3

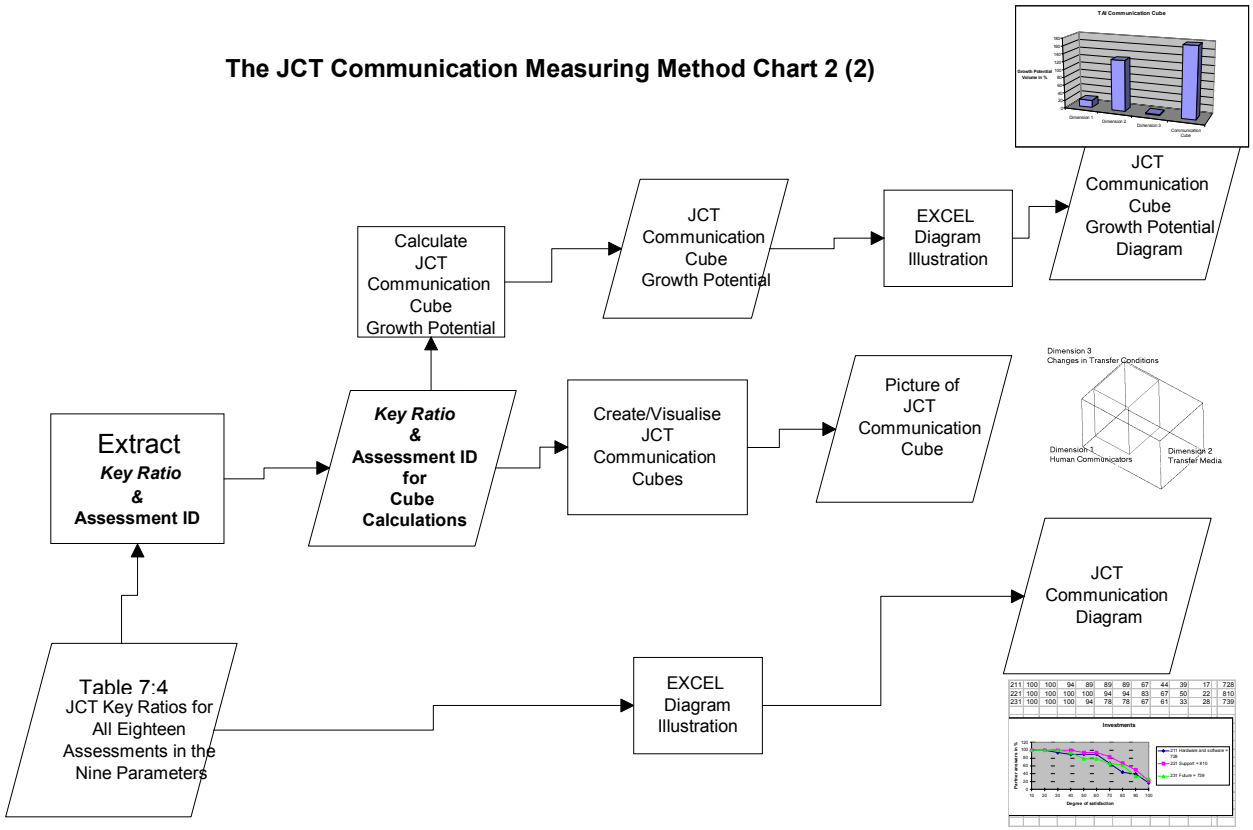
Graphic representation of the Growth Potential Value for the whole Communication Cube. Compare with the graphic representations shown in the three figures in Section 7.4.2.



The JCT Communication Measuring Method Chart 1 (2)



The JCT Communication Measuring Method Chart 2 (2)



8 Case Studies

8.1 Introduction

The Case Studies presented below illustrate how the different Johansson Communication Tools described above can be applied. The case studies here describe real-life applications of The JCT Leadership Communication Cycle, the JCT Communication Cube and the JCT Communication Surface.

8.1.1 Five Case Studies of the Application of Johansson Communication Tools

8.1.1.1 CASE STUDY 1

Task: To satisfy Brand Owner demands concerning reduced lead times in a new car project by arranging Electronic Data Interchange (EDI) for the external communication of technical information to German suppliers.

Problem: Electronic Data Interchange (EDI) requires human communicators and appropriate transfer media. The development of human communicators and strategic transfer media was a priority objective but there was *no empathy* in the specific organization responsible for realizing this objective.

Objective: To create empathy and willingness to allocate the necessary financial resources at the different Suppliers in order to arrange EDI in accordance with the Brand Owner requirements.

Solution:
The communication questionnaire was sent out to the German Suppliers The questions that could be answered in free text, i.e. in the responding companies' own words, showed that there was a major preference on the part of the Brand Owner's Partners that the Brand Owner should establish some kind of Electronic Data Interchange (EDI) solution with a lower price tag than the existing EDI solutions so that small companies could also have access to EDI.

Human Communicators
1. The *Communication Surface* in-house at one of Suppliers was expanded.
2. The *Communication Surface* was expanded between Brand Owner and Suppliers.
3. Investment: German language training for communication expert at Brand Owner.

Strategic Transfer Media
1. Suppliers purchased communication hardware and software that was customized for the EDI requirements of the Brand Owner.

Results:
Within twelve months the following results were realized.

Human Communicators

1. The expanded *Communication Surface* in-house at one of the Suppliers was extremely rewarding and plans exist for further expansion.
2. The expanded *Communication Surface* between the Brand Owner and the Suppliers resulted in increased closer co-operation and empathy.
3. Investment in German language training for the communication expert at the Brand Owner opened up new communication avenues that also resulted in a qualitative increase in the expanded Communication Surface. This language competence also resulted in knowledge of the potential of the existing German EDI systems.

Strategic Transfer Media

1. EDI between the Suppliers and the Brand Owner began functioning in an effective manner in time to deliver major benefits for the new car project.

8.1.1.2 CASE STUDY 2

Task: To satisfy Brand Owner demands concerning reduced lead times in a new car project, by arranging Electronic Data Interchange (EDI) for the external communication of technical information to suppliers. These suppliers were already approved for the new car project so it was essential that an EDI system be installed as soon as possible (within 12 months) to be of any use in reducing lead times in the new car project. The majority of these suppliers were Spanish.

Problem: In-house at the Brand Owner there was both empathy and competence to expand the external communication of technical information by EDI to more suppliers. However, the suppliers were not allocating sufficient resources to fulfil the Brand Owner's EDI requirements. The problem was intensified due to the lack of a mutual language between the contact persons

Objective: To create empathy and willingness to allocate the necessary financial resources at the different suppliers in order to arrange EDI in accordance with the Brand Owner requirements.

Solution:

Human Communicators

1. Expand the *Communication Surface* between the Brand Owner and the Suppliers.
2. Expand the *Communication Surface* by setting up a communication link between the Brand Owner and an EDI specialist company who
   a) sells the appropriate hardware and software
   b) can speak English and Spanish and has agents on site in Spain.

Strategic Transfer Media

1. The Suppliers purchases communication hardware and software customized for the EDI requirements of the Brand Owner.

Results:

Within two months the following results were realized:

Human Communicators

1. The expanded *Communication Surface* between the Brand Owner and the Suppliers resulted in increased closer co-operation and empathy.
2. The EDI specialist company installed the required hardware and *software thereby succeeding in reducing the lead time for installing the required EDI system.*

Strategic Transfer Media

1. EDI between the Suppliers and the Brand Owner began functioning in an effective manner in time to deliver major benefits for the new automobile project.

This worked out well, i.e. the lead time for installation of a functioning communication system in accordance with the Brand Owner's EDI specification was reduced to 20 % of the time it would have taken if each company had done the programming *independently*. Consequently, the Brand Owner obtained the EDI-installation in time to gain benefits and reduce the lead time in the current automobile project. The lead time to install a new communication system decreased from one year to two months and enabled the Brand Owner to use this EDI-connection during the current automobile project.

8.1.1.3 CASE STUDY 3

Task: To arrange for each Partner an EDI-solution that is in accordance with the Brand Owner's EDI requirements.

Problem: The chosen EDI-solution that fulfilled the Brand Owner's EDI requirements was too expensive for small and medium-sized Partners.

Objective: To find a cheaper solution for these Partners that also fulfils the requirements.

Solution: *The Brand Owner increases the Communication Surface between the Brand Owner and a company that delivers communication hardware/software.*

The increased communication surface will create better insight into both the Brand Owner's EDI requirements and the potential market composed of the many small and medium-sized Partners of the Brand Owner. In this way the communication hardware/software company can offer special customized hardware/software at special prices, or special prices for entry-level hardware/software.

Results: The Brand Owner successfully connects more Partners to its EDI network in accordance with its EDI requirements.

The communication hardware/software company increases its market share and becomes more aware of customer needs.

8.1.1.4 CASE STUDY 4

Task: To make a foreign software that fulfilled the Brand Owner's EDI requirements available for the Brand Owner's domestic Partners.

Problem: The foreign software supplier wanted to form an alliance with an agent in the target country (Sweden) to avoid costly investments in marketing materials and instruction materials in the Swedish language as well as to keep its own travel expenses to Sweden at a minimum.

Objective: To find a Swedish company that had the competence and distribution resources to act as an agent to market, install, and maintain the software of the foreign software supplier.

Solution: *The Brand Owner, in order to ensure its own Competitive Power as per the JCT Leadership Communication Cycle, assists in establishing a Communication Surface between the foreign software supplier and a potential agent in Sweden.*

Results: The Brand Owner ensures its competitive power and the competitive power of its Partners through implementation of the correct EDI-solution.

New competence in communication software was introduced in Sweden, thereby increasing the competitive power of Swedish industry in general.

8.1.1.5 CASE STUDY 5

Task: To harmonize the EDI requirements between two Brand Owners. In this case, close and extensive communication is necessary because the two Brand Owners are both suppliers and customers to each other in different areas.

Problem: The two Brand Owners have established different EDI requirements which causes technical communication problems, leading to irritation and unacceptable allocation of communication costs for one of the Brand Owners. There is also a degree of reluctance between the two companies' communication technicians in their human communication.

Objective: To establish a technical solution that is approved by both Brand Owners and that will encourage better human communication.

Solution/Results in Five Rounds
Solution:
Round 1:
a) Expand the Communication Surface
- increase the number of human communicators.
- increase the language competence of the communicators.
- establish a single entry node at one division of Brand Owner A to facilitate communication for that division of Brand Owner A.

b) Improve all three parameters in the Human Communicator dimension of the JCT Communication Cube

Result 1: Other departments at Brand Owner B discovered the potential of communicating with Brand Owner A.

Round 2:
a) Expand the Communication Surface in-house at Brand Owner A

b) Expand the Communication Surface between the two Brand Owners by setting up a communication link via a satellite station

Result 2: Brand Owner A decides to invest in a central solution.

Round 3:	Brand Owner B participates in a meeting on site at Brand Owner A.
Result 3:	Two Communication Surfaces were expanded, one was expanded in-house at Brand Owner A and one between Brand Owner A and Brand Owner B.
Round 4:	Brand Owner A participates in a meeting on site at Brand Owner B.
Result 4:	An agreement was reached concerning routines for transmission and conversion of the technical information. The agreement was written in two languages in order to ensure empathy from both the employees of Brand Owners. See below in next section for a copy of the actual agreement.
Proposed Round 5:	Expand the Communication Surface between the communication technicians in both Brand Owners, by distributing a list with the names, telephone and fax numbers, and e-mail addresses.
Expected Result 5:	Joint discussions and testing of communication processes at a more detailed technical level.
Proposed Round 6:	Expand the Communication Surface by using an EDI specialist company who has detailed knowledge of the EDI systems of both Brand Owners.
Expected Result 6:	Productive EDI communication between of the Brand Owners.

Actual agreement reached in Case Study 5:
Note: Brand Owner 1 referred to as BO1; Brand Owner 2 referred to as BO2.

French version:

Olofström le 30 avril 1999.

Proposition faite base de mes note lors de notre réunion de 15
avril 1999 a BO2.

Proposition d´un accord sur la solution des échanges de données CAO par télétransmission entre BO2 et BO1.

1/ BO2 doit créer la fiche ENGDAT pour l´envoi automatique de donnéesà l´utilisateur final,c.-à.-d. BO1. D´autre part,lorsque BO2 reçoit une ficheENGDAT, cette fiche doit être convertie en ABSTRACT pour qu´elle arriveà la propre boîte à lettres.

2/Quand BO2 a placé des fiches dans la boîte à lettres de BO1, une télécopie est envoyée à BO1. BO1 doit faire une invitation à émettre à la boîte à lettres " BO1" au serveur de BO2, et, par là, BO1 obtiendra les fiches.

3/ BO2 doit payer les redevances téléphoniques quand BO1 reçoit des fichesenvoyées par BO2.

English version:

A proposal of an agreement concerning a solution of External Communication of Technical Information between BO2 and BO1.

1. BO2 is to create the ENGDAT-file for the automatic sending of data to the enduser, i.e. BO1. On the other hand, when BO2 receives an ENGDAT-file, this file is to be converted into ABSTRACT for it to reach the appropriate mailbox

2. When BO2 has placed files in the BO1 mailbox, a fax is sent to BO1. BO1 is to make an invitation to send (polling) to the BO1 mailbox on the BO2 server, and, thereby, BO1 obtains the files.

3. BO2 is to pay the telephone charges when BO1 receives files sent by BO2.

Nils Johansson
Échanges de données CAO
External Communication of Technical Information

9 Economic Motivation for Johansson Communication Tools

9.1 The Management of Money and the Management of Technology

Johansson Communication Tools are management tools. The tools allow both the managers of money and the managers of technology to see where the potential for improvement in communication effectiveness lies and to determine what the costs and required actions are to exploit that potential as favourably as possible.

Some improvements do not need to cost so much. Of the three dimensions: 1) Human Communicators, 2) Transfer Media, and 3) Changes in the Transfer Conditions, improvements in the dimension "Human Communicators" can be made without involving too much money in relation to the excellent gains achieved.

9.1.1 Summary of Economic Motivation for Implementing Johansson Communication Tools

Johansson Communication Tools are potent management tools that can secure effective external communication of technical information. Using the tools when making strategic decisions will enable managers to accurately perceive strengths and weaknesses in communication, thereby enabling them to correctly allocate resources to improve communication effectiveness and reduce lead times and costs.

An area of crucial importance to managers is the question of whether to insource or outsource. The analysis, measurement and improvement of corporate communication effectiveness is of vital importance in this question. However, the communication effectiveness of the Brand Owner or the Partner is not always included in discussions regarding the decision to insource or outsource. This is extremely unfortunate since the level and quality of communication effectiveness can be the reason behind the success or failure of insourced/outsourced operations.

Communication effectiveness, particularly regarding the external communication of technical information, must be measured, analyzed and taken into consideration at the earliest stages of management discussions and negotiations concerning insourcing/outsourcing. Measurement, analysis, and presentation of communication effectiveness is possible through the use of the JCT Communication Measuring Method, JCT Communication Key Ratios and JCT Communication Diagrams.

The JCT Leadership Communication Cycle indicates the importance of establishing and maintaining effective communication. The Cycle clearly illustrates both how effective communication is a management responsibility and how effective communication contributes to continuously renewed competitive power.

The JCT Communication Surface symbolizes the ideal contact network between two co-operating companies. A communication surface with several communication paths between the two companies instead of a single communication path between one point in each company is an important concept of successful communication effectiveness.

The JCT Communication Cube is a means of presentation of the real communication conditions and the potential for improvement. The JCT Communication Cube presents this information is a way that can be immediately understood.

Most important of all, the Johansson Communication Tools save money and promote co-operation since they can be easily used by persons who normally do not "speak the same language" in a company, namely the persons who are responsible for the management of money and the persons who are responsible for the management of technology/competence. The Johansson Communication Tools are intended to give these two corporate staffs better opportunities and a stronger platform from which they can integrate their respective competence. This will bring greater benefits to the Brand Owner and its Partners, and ultimately, the final customer. The information about communication effectiveness, which is collected from the organization and the surrounding world, is measured, analyzed, and presented by the Johansson Communication Tools, and finally transformed by the Johansson Communication Tools into financial information to enable clear-sighted management of money and resources to ensure corporate survival.

10 Recommendations for Improving Communication Effectiveness

- Introduce and implement the Johansson Communication Tools.
  - The tools can be used both by top level management in strategic decisions of the management of money, and by communication technicians who are responsible for the management of technology.
  - The tools provide a platform for discussion and they encourage co-operation

- Include communication stipulations in the negotiations and especially in the contract itself.
  - This saves money for the Brand Owner.
  - This can result in new contracts.
  - This assures long-term solutions for *both* Brand Owner and Partners that minimize costs.
  - This assures supply chain efficiency.

- Understand the importance of Benchmarking to communication effectiveness

- Think proactively. The proverb "A stitch in time saves nine" takes on a financial meaning when it concerns communication. Johansson Communication Tools that are implemented in time can save USD 1.25 million per day!

- Introduce a company-wide Communication Policy, similar in concept to a company-wide Quality Policy, known to every employee. See below for examples of how to use the JCT Communication Cube to create a Communication Policy.

11 Communication Objectives and Communication Policy

11.1 Example 1: Communication Objectives

The Communication Objectives proposed here are based on the three communication dimensions of the JCT Communication Cube and the three parameters of each dimension (nine parameters in total). These dimensions and parameters correspond to the assessments that a Brand Owner can request of its Partners.
Dimension 1: Human Communicators, Dimension 2: Transfer Media, and
Dimension 3: Changes in the Transfer Conditions

Dimension 1: Human Communicators

1 We shall optimise the communication surface between our company and customers/suppliers to achieve an optimum communication interface.

1.1 We shall communicate our Communication Policy to our suppliers to obtain a valid "Communication Agreement for External Communication of Technical Information" that is in accordance with our Policy. We shall strive to implement long-term communication solutions for our suppliers.

1.2 We shall send the correct data, with the correct identification and correct data quality, at the correct time.

1.3 We shall fulfil our customers' communication requirements.

Dimension 2: Transfer Media

2 We shall optimise the communication hardware and software to achieve an optimum communication interface.

2.1 We shall buy existing hardware and software necessary to fulfil the communication requirements of our business projects.

2.2 We shall have access to human resources with the right competence to fully utilise our hardware and software.

2.3 We shall closely follow the development of new hardware and software to always be prepared to adopt new hardware and/or software when it is the right time to do so.

Dimension 3: Changes in the Transfer Conditions

3 We shall maintain and develop our competence to enable co-operation with customers and suppliers to improve the communication process.

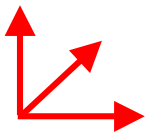
3.1 We shall inform our suppliers about future changes in our communication routines, hardware and/or software as soon as possible to ensure smooth transition.

3.2 We shall always immediately update our communication process when we get information about changes that have been introduced at our customers/suppliers.

3.3 We shall always carry out a communication test after changes have been introduced at our company or at our customers/suppliers.

11.2 Example 2: Corporate Communication Policy

COMMUNICATION POLICY



1. We shall be flexible so that we can fulfill the communication requirements of our customers.

2. We shall find long-term communication solutions for our suppliers based on global standards.

3. We shall maintain and develop our competence to enable co-operation with customers and suppliers to improve the communication process.

4. We shall expand the communication surface between our company and customers/suppliers to achieve an optimum communication interface.

5. All communication shall
   - contain the correct data in the correct quality
   - be carried out with the correct hardware/software
   - be sent at the correct time

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13 Appendices

13.1 The Johansson Communication Tools Toolbox

1. JCT Communication Leadership Cycle

- A graphical presentation of how corporate leadership can successfully promote a joint vision and interpretation in order to achieve the corporate objectives by means of first fulfilling the established simplified targets.

2. JCT Communication Surface

- A strategic interface consisting of numerous contact points between persons with the corresponding responsibilities or competence
- Demonstrates the importance of many effective communication channels between the right persons for each transmission of information.

3. JCT Communication Cube

- Enables determination of the volumes
- Provides clear visual presentation
- Can be used by both management of money and management of technology

The three basic dimensions of the JCT Communication Cube:

1. Human Communicators
2. Transfer Media
3. Changes in the Transfer Conditions over time

4. JCT Communication Measuring Method

- A method based on the use of questionnaires and calculation of key ratios to measure communication effectiveness and to determine where to make investments to improve communication effectiveness.

5. JCT Communication Key Ratios

- Provide management with quick insight into how a company is positioned compared with the global competition.
- Can be used as simplified targets in JCT Communication Leadership Cycle.

6. JCT Communication Diagram

- Graphical representation of Partner's experience of Brand Owner and Benchmark in each of the nine parameters in the JCT Communication Cube.
- Indicates parameter ID numbers, percentages concerning Partner's answers and calculated JCT Key Ratios.

7. JCT Communication Growth Potential Graph

- A graph that shows the gap, representing improvement potential, between the existing position of a company and the position of the company considered to be the benchmark with regard to best practice in communication.

13.2 The JCT Communication Measuring Method

13.2.1 Summary of the Procedure

1. Send out the JCT Communication Questionnaire to selected Partners (See Appendix "Questionnaire").

2. Collect the assessments from the Partners (two assessments per parameter = 18 assessments) in accordance with the questionnaire.

3. Sort the assessments into intervals.

4. Calculate the satisfaction indicated by the Partners *up to* each interval boundary. This means that for each interval, all the answers that indicate satisfaction at least up to that interval boundary are included. If the satisfaction $\geq$ the interval, then add 1 to the sum for that interval.

5. Calculate the percentage of assessments that are satisfied *in each interval and higher*. (See below Table *JCT Satisfaction Values for All Assessments Sorted into Satisfaction Intervals*.)

6. Calculate (by addition operations) the JCT Communication Key Ratios using Formula 1.

7. Present the resulting percentages and Key Ratios for all parameters in table form. (See below Table *JCT Key Ratios for All Eighteen Assessments in the Nine Parameters*.)

8. To facilitate presentation of Benchmarking information, enter the same resulting percentages and Key Ratios into JCT Communication Diagrams.

9. Reduce the resulting percentages and JCT Communication Key Ratios by normalization (10 x 10 x 10) and enter results in the JCT Communication Cube.

10. Use the JCT Communication Cube to show the strengths and weaknesses of the business operations with regard to the three communication dimensions.

11. Use all the Johansson Communication Tools as the basis for a discussion forum for communication technicians and financial managers regarding effective communication, resource allocation, and competitive power.

13.2.2 Table 7:3

JCT Satisfaction Values for All Assessments Sorted into Satisfaction Intervals

Actual answer in %	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99
Interval	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Assess-ment ID number			**JCT Satisfaction Values**							
111	100	100	100	100	100	100	83	72	55	27
112	100	100	100	100	100	100	94	83	72	72
121	100	100	100	100	100	100	100	94	55	28
122	100	100	100	100	100	100	100	100	61	39
131	100	100	100	100	100	83	61	61	56	39
132	100	100	100	100	100	83	72	72	61	50
211	100	100	94	89	89	89	67	44	39	17
212 *	100	100	100	100	100	100	100	100	100	100
221	100	100	100	100	94	94	83	67	50	22
222 *	100	100	100	100	100	100	100	100	100	100
231	100	100	100	94	78	78	67	61	33	28
232 *	100	100	100	100	100	100	100	100	100	100
311	100	100	100	100	100	100	89	89	83	67
312	100	100	100	100	100	100	89	89	83	67
321	100	100	100	100	100	94	83	83	72	44
322	100	100	100	100	100	94	89	89	72	44
331	100	100	100	94	89	89	78	67	44	44
332	100	100	100	94	89	89	83	73	44	44

* The three assessments 212, 222 and 232 are defined as having the constant satisfaction value of 100%, since the respondent Partner would not have access to the information required to indicate a precise value as an answer about the Benchmark company.

13.2.3 Table 7:4

JCT Key Ratios for All Eighteen Assessments in the Nine Parameters

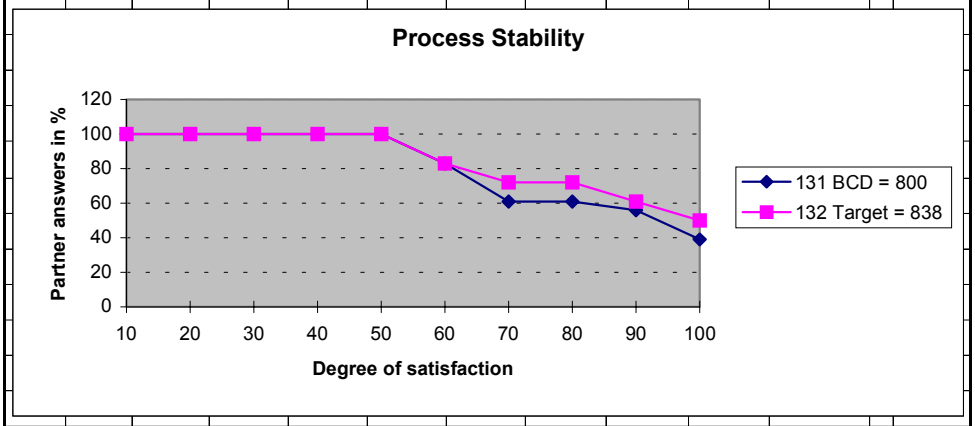
Actual answer in %	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	**Key Ratio**	**Assessment ID number**
Inter-val	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**		
Assess-ment ID num-ber												
111	100	100	100	100	100	100	83	72	55	27	**837**	**111**
112	100	100	100	100	100	100	94	83	72	72	**921**	**112**
121	100	100	100	100	100	100	100	94	55	28	**877**	**121**
122	100	100	100	100	100	100	100	100	61	39	**900**	**122**
131	100	100	100	100	100	83	61	61	56	39	**800**	**131**
132	100	100	100	100	100	83	72	72	61	50	**838**	**132**
211	100	100	94	89	89	89	67	44	39	17	**728**	**211**
212 *	100	100	100	100	100	100	100	100	100	100	**1000**	**212***
221	100	100	100	100	94	94	83	67	50	22	**810**	**221**
222 *	100	100	100	100	100	100	100	100	100	100	**1000**	**222***
231	100	100	100	94	78	78	67	61	33	28	**739**	**231**
232 *	100	100	100	100	100	100	100	100	100	100	**1000**	**232***
311	100	100	100	100	100	100	89	89	83	67	**928**	**311**
312	100	100	100	100	100	100	89	89	83	67	**928**	**312**
321	100	100	100	100	100	94	83	83	72	44	**876**	**321**
322	100	100	100	100	100	94	89	89	72	44	**888**	**322**
331	100	100	100	94	89	89	78	67	44	44	**805**	**331**
332	100	100	100	94	89	89	83	73	44	44	**816**	**332**

* The three assessments 212, 222 and 232 are defined as having the constant satisfaction value of 100%, since the respondent Partner would not have access to the information required to indicate a precise value as an answer about the Benchmark company.

13.2.4 JCT Communication Diagram (Example)

JCT Communication Diagram for Parameter 1.3, Assessments 131 and 132

131	100	100	100	100	100	83	61	61	56	39		800
132	100	100	100	100	100	83	72	72	61	50		838



The JCT Communication Diagram is a diagram that graphically shows the Partner's experience of the Brand Owner and the Benchmark in each of the nine parameters in the JCT Communication Cube. The JCT Communication Diagram indicates the parameter ID numbers for this pair, the percentages concerning the Partner answers and the calculated key ratios.

13.3 The Questionnaire

The following questionnaire was sent to Partners (in this case, Suppliers).

Lund University
Department of Production
and Materials Engineering

Scandinavian International
University

Volvo Car Components Corporation
Body Component Division (BCD)

Olofstroem, Sweden

Attention: The person responsible for CAD/CAM

Olofstroem, Sweden
1998 February

Subject: Analysis of problems and possibilities concerning COMMUNICATION of TECHNICAL INFORMATION between Volvo Car Components Corporation, Body Components Division and its PARTNERS.

Purpose: Positive influence of the bottom line result for the car project parameters LEAD TIME, QUALITY and COST

Method: Inquiry with secrecy guaranteed is made with the assistance of Lund Institute of Technology and CAE-contact persons from COMMUNICATION AGREEMENT FOR CAD/CAM-DATA.

I would appreciate your help with this investigation by you filling in this inquiry and sending it in the reply envelope, which has your secrecy code number on it.

We will of course send the results of the investigation back to you when the results are available. The results of the investigation 1997 are available at the Internet address: **http://giorgos.mtov.lth.se/vov**

In response to the proposal in the previous investigation, we have searched for and found a company that can provide software and hardware for Electronic Data Interchange with Volvo for ISDN/ODETTE with full ENGdat at a reasonable introduction price.

If you have any questions about the inquiry or your CAD/CAM-data communication with BCD-Olofstroem, you are welcome to call or fax me.

Best regards,	Address:
Nils Johansson	VOLVO CAR CORPORATION
Researcher for Lund Institute of Technology	OLOFSTROEM PLANTS
and Scandinavian International University.	Production Engineering
Responsible for CAD/CAM-data communication	SE-293 80 OLOFSTROEM
at Volvo Car Components Corporation,	SWEDEN
Body Components Division, Olofstroem Plants	Tel:+46 454 94166 Fax:+46 454 42472

Lund University
Department of Production
and Materials Engineering

Scandinavian International
University

Author: Nils Johansson
Nissatorpsvägen 20-3
290 60 KYRKHULT, SWEDEN

Title: CAD/CAM/CAE and CONCURRENT ENGINEERING

Abstract:
Evaluate how COMMUNICATION of TECHNICAL INFORMATION between Volvo Car Components Corporation, Body Components Division, Olofstroem Plants (BCD) and its PARTNERS can develop.

Supervisors: PhD (Engineering) Lars-Göran Pärletun
PhD (Engineering) Giorgos Nikoleris
PhD Lars-Eric Uneståhl

Target group for investigation: CAD/CAM/CAE CONTACT PERSONS at PARTNERS of BCD

Investigation method: Inquiry with guarantee of secrecy.
Inquiry language: Swedish, English and German.

Inquiries sent from: Lund Institute of Technology

Final results reported in English.

Subject: Analysis of problems and possibilities concerning COMMUNICATION OF TECHNICAL INFORMATION between BCD and its PARTNERS .

Purpose: Positive influence of the following car project parameters: LEAD TIME, QUALITY and COST, through developing the COMMUNICATION OF TECHNICAL INFORMATION between BCD and its PARTNERS.

Method: Inquiry to be answered by CAD/CAM/CAE contact persons chosen from the PARTNER-register in Volvo Car Components Corporation'scommunication system.
Only partners that BCD is responsible for have been selected.

Steps:

1. Make inquiry to gather information for analysis of problems and possibilities focusing on EXTERNAL COMMUNICATION OF TECHNICAL INFORMATION between BCD and its PARTNERS. Analyze information.
2. Determine and present investment program to obtain optimal development of EXTERNAL COMMUNICATION OF TECHNICAL INFORMATION
3. Implement improvements according to priority established by management.
4. Go to Step 1 interactively each year during a period of three years.

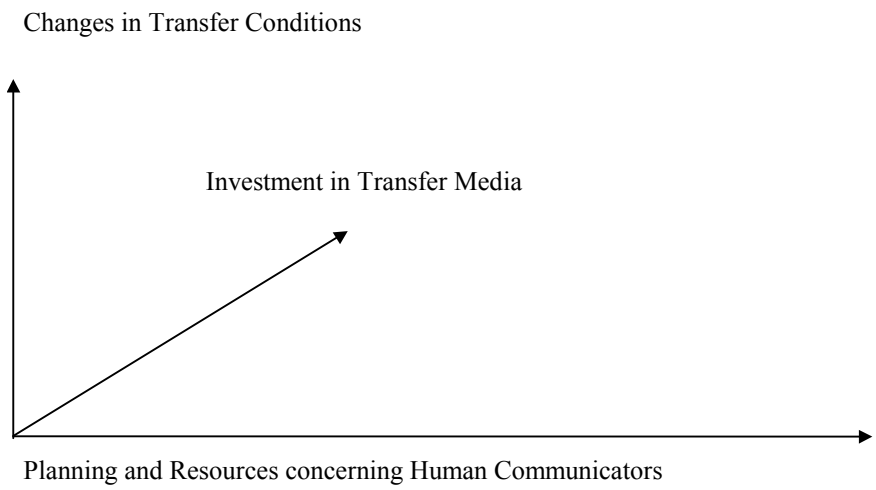


Figure 1 Dimensions which the investigation will measure

The investigation will measure three parameters in each of the following three dimensions.

1 Planning and resources concerning Human Communicators

1.1 Problem in using the existing possibilities in the correct way. Example:Making an investigation that results in ”COMMUNICATION AGREEMENT FOR CAD/CAM DATA”.

1.2 Problem with quality test. Example: Quality test is not performed according to the routine prescribed.

1.3 Problem with variability in the communication process. Example: The data is received in a format that is not the format prescribed in the ”COMMUNICATION AGREEMENT for CAD/CAM DATA".

2 Investment in Transfer Media

2.1 Problem to invest in the support that exists on the market. Example: Unable for some reason to buy existing hardware or software.

2.2 Lack of competent personnel for installing and running required hardware and software. Example: Lack of competent personnel to get required hardware to work properly.

2.3 Development/testing of data interchange. Example: STEP, communication by public network and Odette in reality.

3 Changes in Transfer Conditions during ongoing projects

3.1 Changes introduced without prior information. Example: Changing of CAD-system or version without prior information.

3.2 No time to update changes.

3.3 No time for quality test of implemented changes.

QUESTIONS for analysis of EXTERNAL COMMUNICATION of TECHNICAL INFORMATION

For the scale 0 - 100, please mark your answer with an X.

1.1 I easily find the persons at the PARTNER-company that helps me to investigate and agree about Communication agreement for CAD/CAM-data

No, of course not Yes, sure

0 10 20 30 40 50 60 70 80 90 100

Answer regarding VOLVO Car

No, of course not Yes, sure

0 10 20 30 40 50 60 70 80 90 100

Best practice PARTNER : _____
Answer regarding your best-practice PARTNER

1.2. Through quality testing of CAD/CAM-DATA, I am confident before the project starts that data interchange with PARTNERs functions correctly.

No, of course not Yes, sure

0 10 20 30 40 50 60 70 80 90 100

Answer regarding VOLVO Car

No, of course not Yes, sure

0 10 20 30 40 50 60 70 80 90 100

Best practice PARTNER : _____
Answer regarding your best-practice PARTNER

1.3. My experience is that conversion of CAD/CAM data from PARTNERs functions perfectly thanks to agreed routines.

No, of course not Yes, sure

0 10 20 30 40 50 60 70 80 90 100

Answer regarding VOLVO Car

No, of course not Yes, sure

0 10 20 30 40 50 60 70 80 90 100

Best practice PARTNER : _____
Answer regarding your best-practice PARTNER

COMMENT:
Volvo could improve their CAD/CAM data exchange through:

2.1 I have the possibility to invest in the best hardware and software on the market to get the best CAD/CAM-data communication I want.

No, of course not Yes, sure

0 10 20 30 40 50 60 70 80 90 100

2.2 I always have the support I need from CAD-specialists to get maximum use of the available equipment.

No, of course not Yes, sure

0 10 20 30 40 50 60 70 80 90 100

2.3 I could have managed the CAD/CAM-data exchange if I had been able to use the hardware and software that is under development (e.g. STEP)

No, of course not Yes, sure

0 10 20 30 40 50 60 70 80 90 100

COMMENT:
Volvo could improve their CAD/CAM-DATA-exchange through:

3.1 I have always informed our PARTNER about changes that can affect the "Communication Agreement of CAD/CAM data ".

No, of course not Yes, sure

0 10 20 30 40 50 60 70 80 90 100

Answer regarding VOLVO Car

No, of course not Yes, sure

0 10 20 30 40 50 60 70 80 90 100

Best practice PARTNER : _____
Answer regarding your best-practice PARTNER

3.2 I have always immediately after a reported change received a new "Communication Agreement for CAD/CAM-data".

No, of course not Yes, sure

0 10 20 30 40 50 60 70 80 90 100

Answer regarding VOLVO Car

No, of course not Yes, sure

0 10 20 30 40 50 60 70 80 90 100

Best practice PARTNER : _____
Answer regarding your best-practice PARTNER

3.3 When there have been changes in the "Communication Agreement for CAD/CAM-data" I always have the possibility to carry out a quality test.

No, of course not Yes, sure

0 10 20 30 40 50 60 70 80 90 100

Answer regarding VOLVO Car

No, of course not Yes, sure

0 10 20 30 40 50 60 70 80 90 100

Best practice PARTNER : _____
Answer regarding your best-practice PARTNER

COMMENT:
Volvo could improve their CAD/CAM-DATA-exchange through:

13.4 Milestones in Management and in the External Communication of Technical Information

Milestones in Corporate Management	Date	Milestones in the External Communication of Technical Information
Management Vision: All CAD systems are based on a mutual database, so that all interchange between CAD systems is done in native format.	**2000**	♦ 2D/3D wireframe systems OK in EDI ♦ Free-form surfaces OK in EDI ♦ Solid modelling systems: 1) loss of quality 2) loss of data 3) longer lead-times 4) Immense loss of human and technical resources
♦ Benchmarking ♦ Inner Mental Training ♦ Lean Production ♦ Delivery Plans/EDI ♦ Core Operations/Outsourcing ♦ Management focus on: - Reduced Lead-times - Decreased Costs - Increased Quality	**1990-1999**	♦ CIM/EXTERnal Communication of Technical Information ♦ CAD-supplier systems ♦ Telecommunication/EDI ♦ STEP
♦ The MATCH Project ♦ Management by Sales ♦ Northwest Strategy ♦ Quality ISO 9000 ♦ Transaction Analysis ♦ Quality Assurance of Geometry	**1980-1989**	♦ IGES/VDAFS/SET ♦ Artificial Intelligence ♦ Volvo-Supplier demand ♦ Data Transfer by physical media
♦ Sensitivity ♦ Cheese Slicing ♦ Management by Walking around ♦ The Swedish Co-determination Act	**1970-1979**	♦ NC machines ♦ CAD-Islands/Inhouse systems ♦ No Screen-Refresh
♦ Fayol ♦ Human Relations ♦ Trade Union Act	**… - 1969**	♦ Computers ♦ Mathematics ♦ Bezier

13.5 Worksheet for implementing Johansson Communication Tools

External Communication of Technical Information