

---

**Development of an  
Analysis Methodology  
for  
Functional Communication**

**Rémi BACHELET M.Sc. AMS  
August 1992**

---

**Development of an Analysis Methodology  
for Functional Communication at  
INSTRON  
The packing Department and its environment**

With reference to INSTRON Ltd.,  
High Wycombe, BUCKINGHAMSHIRE

**Rémi BACHELET**

Dissertation submitted as part of the Master of Science in  
Advanced Manufacturing Systems under the  
supervision of Mr. Jean-Noel Ezingard

Department of manufacturing and Engineering Systems  
Brunel University

August 1992

---

## Summary

Over the last century, Manufacturing and Office functions have been organised as a series of specialised departments. As products and activities have become more complex, the need has been felt to add an increasing number of communication links to coordinate the activity of these centres.

Nowadays, it is increasingly recognised that the effectiveness of the coordination function is the main limiting factor in the growth of productivity.

The aim of this dissertation is to contribute to the analysis and design of the coordination function by developing an Analysis Methodology for Functional Communication. We define Communication as "The process of organising", and the term "Functional Communication" pertains to the processing of work-related information by organisational networks within the company.

As no specific literature exists on Functional Communication, the dissertation advocates a multidisciplinary approach to the problem; Elements from Manufacturing Systems Design, as well as from Industrial Organisations and Management Sciences are exploited.

After a presentation of the sponsoring company and a description of the project definition phase, an Industrial Product Design method, Value Analysis, is adapted to characterise the Functional Information needs of the main functions of the Packing department., which has been used as a case study.

Systems analysis provides the framework for this approach.

In the next chapter, some basic elements of Communication Networks Theory are featured and the Mintzberg theory of coordination is portrayed in order to characterize the mechanisms for coordination in the organisational network.

A detailed study is also undertaken of the appropriateness of the communication links (the media) vis-à-vis the nature of the information conveyed. Information requirements are depicted in terms of uncertainty and equivocality reduction. Additional data collection is undertaken through a questionnaire, which design is also detailed.

While the first steps of the study feature a "static approach", centred on the information needs of the Packing function, the following chapter emphasize a dynamic approach focused on the study of a Circuit (Spares Orders Processing) of which Packing is but one element. The adoption of this perspective, inspired

---

by Shigeo Shingo Non-Stock Production thinking brings forth major developments in the study. Data Flow analysis and Paper Flow charting are the main tools used in this last chapter, along with a dynamic approach to the communication network.

Finally, the whole Analysis Methodology for Functional Communication is reviewed and conclusions are drawn on the strong points and weaknesses of the proposed approach.

---

## **Foreword**

This dissertation is submitted upon completion of an M.Sc. in Advanced Manufacturing Systems in the department of Manufacturing and Engineering Systems at Brunel University of West London.

This report will also conclude my final year of study at the Ecole Centrale de Lille (Institut industriel du Nord) which I have undertaken abroad thanks to the ERASMUS European exchange Scheme.

## **Acknowledgements**

I would like to thank my academic supervisor, Jean Noel Ezingard for his kind guidance. My industrial supervisors were Louise Walker-Robson, Commercial Manager and Ian Hyde, Production Manager who I would like to thank for the time he devoted to discussing problems and issues with me.

From the Packing department, I would like to thank Dave Sutton, Nigel Busby Eddy Tinkler and Ivor Payne; From Shipping, Palna Antoine, Andy Angus and Mike Cooke.

My final thanks go to Pat Taylor, for her invaluable & untiring help.

---

## Table of contents

!!autonumout.....	1
A general presentation of Instron.....	2
How does Instron compete ?.....	2
Instron Ltd at High Wycombe.....	5
Some of the main processes at Instron.....	7
Machine orders.....	7
Accessories and spares.....	8
The packing department.....	9
!!autonumout.....	11
A review of potential subjects.....	12
The reporting structure.....	12
Decentralisation of packing.....	12
Interface between departments.....	13
An overview of the project.....	13
Project context.....	13
Project need.....	14
Study objectives.....	14
!!autonumout.....	16
Division of work and the need for coordination.....	17
Communication as an element of Coordination.....	19
A definition of Functional Communication.....	21
How to study Functional Communication?.....	23
!!autonumout.....	26
Principles of the analysis.....	27
Systems analysis.....	27
Value analysis.....	29
Analysis.....	31
Machine packing & loading.....	31
Crate management.....	32
Stocks handling.....	34
Accessories packing & loading.....	35
Conclusion.....	36
!!autonumout.....	37
Communication network theory.....	38
Communication networks: a definition.....	38
Network structure and problem-solving.....	38
Coordination within the network.....	40
Medium and message nature.....	41
Formal communications network.....	44
Organisational structure.....	44
The Functional Communication network around packing.....	44
Conclusion.....	51
!!autonumout.....	53
Introduction to the study.....	54
Data Flow Analysis.....	54

---

Paper flow diagram.....	55
Network Analysis.....	56
Conclusion.....	57
!!autonumout.....	60
A review of the methodology.....	1
The Functional Analysis.....	3
The network Analysis.....	3
The circuit Analysis.....	4
A study of the cellularisation of spares order processing.....	5

---

## **REFERENCES**

## **BIBLIOGRAPHY**

### **APPENDIX 1:**

Instron's corporate objectives

### **APPENDIX 2:**

Original project definition

### **APPENDIX 3:**

Functional communication at Instron

Design of the questionnaire issued to the personnel of shipping and packing

### **APPENDIX 4:**

Spares and accessories Orders: Data Flow diagram and key

### **APPENDIX 5:**

The spares and accessories circuit: Paper Flow diagrams I and II and Key



---

## List of Figures

!!autonumout.....	1
A general presentation of Instron.....	2
How does Instron compete ?.....	2
Instron Ltd at High Wycombe.....	5
Some of the main processes at Instron.....	7
Machine orders.....	7
Accessories and spares.....	8
The packing department.....	9
!!autonumout.....	11
A review of potential subjects.....	12
The reporting structure.....	12
Decentralisation of packing.....	12
Interface between departments.....	13
An overview of the project.....	13
Project context.....	13
Project need.....	14
Study objectives.....	14
!!autonumout.....	16
Division of work and the need for coordination.....	17
Communication as an element of Coordination.....	19
A definition of Functional Communication.....	21
How to study Functional Communication?.....	23
!!autonumout.....	26
Principles of the analysis.....	27
Systems analysis.....	27
Value analysis.....	29
Analysis.....	31
Machine packing & loading.....	31
Crate management.....	32
Stocks handling.....	34
Accessories packing & loading.....	35
Conclusion.....	36
!!autonumout.....	37
Communication network theory.....	38
Communication networks: a definition.....	38
Network structure and problem-solving.....	38
Coordination within the network.....	40
Medium and message nature.....	41
Formal communications network.....	44
Organisational structure.....	44
The Functional Communication network around packing.....	44
Conclusion.....	51
!!autonumout.....	53
Introduction to the study.....	54
Data Flow Analysis.....	54
Paper flow diagram.....	55
Network Analysis.....	56
Conclusion.....	57
!!autonumout.....	60
A review of the methodology.....	1
The Functional Analysis.....	3
The network Analysis.....	3

---

---

The circuit Analysis.....	4
A study of the cellularisation of spares order processing.....	5

---

# 1 Project background

*This chapter introduces the company; After a historical presentation, the markets and the products of Instron are detailed.*

*The High Wycombe site is then introduced and a basic vision of the processes of Machine manufacturing and accessories order is given in order to set the scene for the case study.*

*The packing department is then replaced in its immediate context.*

---

## **2 A general presentation of Instron**

Instron is the world leading manufacturer of materials testing machines. Instron Electromechanical machines are designed to evaluate the strength-related properties of materials in tension, compression, torsion and bending. The Servohydraulic machines can also perform these tests but have the additional capability to submit the materials to vibrations or fatigue cycles.

The original company, Instron Corporation, was created in 1947 by two professors at the MIT, George Burr and Harold Hindman. Today, the same two families still own the company and were able to defend it against a takeover bid last year. And indeed, the company is extremely tempting for raiders, as the value of the land it owns around Canton is higher than all the rest of its assets!

Instron is quoted on the Dow Jones: Sales and balances figures have to be published at the end of every quarter. This is not without consequences on the company itself and is at the source of the dreaded Hockeystick effect; Compared to the average activity level, the internal activity in the company is slow at the beginning of the quarter and increase exponentially to reach a peak at the end of the quarter.

Instron is a multinational; the company has subsidiaries and agents all over the world in a total of 22 countries therefore it is present on virtually all world markets.

## **3 How does Instron compete ?**

---

The original Instron machines were developed to test parachute cords, but today their list of application is nearly infinite. From orthodontic appliances design to Velcro fasteners quality control and ceramics high temperature testing.

Instron's corporate objectives are detailed in appendix 1. This mission's statement stipulates how Instron will maintain its world leadership:

- a) By being technically responsive to customer's needs.
- b) By maintaining the highest quality standards.
- c) By the provision of a better customer service.

These priorities are particularly adapted to Instron markets which are based on batch or one-shot rather than mass production. The customer's expectations are also of paramount importance because of the wide variety of applications. Instron has a strong "niche marketing" strategy in special applications, but also seeks to compete on the cheaper end of the market with small static machines.

The main customers are Industry (72% of sales), followed by Governments (15.5%) and Education (12.5%)

The product mix for Instron is as follow:

- Servohydraulic floor models (23.3% of sales)
- Electromechanical table and floor models (69.7% of sales)
- Structural test systems (7% of sales)

Product type	Price	Volume	Order winning Criteria	Order Qualifying Criteria
ElectroMechanical	£5-20k High		Price	Same Table capability as

According to the criteria defined by Race and Slack (1990) the competitive criteria on these products could be depicted as follow (next figure):

0: Main types of machines produced at High Wycombe competitors

Electromechanical Floor	£20-40k	Medium	Price/product	Product Quality - Customer service
Servo-hydraulic Floor	£20-75k	Medium	Product differentiation	Product Quality - Customer service
Structural test systems	£50k + Low		Ability to perform task	Corporate image

Corporate sales per year total approximately \$110-130 million.

The present strategic position of Instron on the market could be evaluated as follow:

#### STRENGTHS

In the market place the main strength of Instron products is product

differentiation (Thanks to the modular design of its machines, the company is able to offer very broad customisation for its products), Quality (Instron machines are renowned for their durability and there is a market for secondhand machines) and the services offered to the customer (mainly training).

#### WEAKNESSES

As we have seen in the previous paragraph, Instron strives to achieve a competitive advantage on the ground of product differentiation, quality and service. However, it

---

cannot compete on price, sometimes because the machines are over-sophisticated (on the lower end of the market), sometimes because Instron cost base is simply too high ! Many overhead costs are associated with R&D (7% of sales), and the international service network (the ratio of indirect/direct labour is 3.5 / 1, which is quite high).

#### OPPORTUNITIES

The present recession has not affected Instron very much last year, moreover the company is in a healthy financial situation and could take advantage of the recession to buy one of its competitors.

#### THREATS

Instron's markets have arrived to maturity, which means that they do not grow any more and competition for market shares is increasingly hard, although the market shares themselves tend to remain stable (note that buying a competitor is the best way of expanding one's market share when the market is mature).

The main competitor of Instron is the American MTS, which is leader for Servohydraulic machines on some markets.

#### **4 Instron Ltd at High Wycombe**

Instron has had a European headquarters and manufacturing facility in the UK since 1961 and has been on its present site in high Wycombe since 1968. This site is responsible for all the world outside Americas, the Pacific Rim and China. The High Wycombe offices are situated on the Cressex industrial estate, which has recently been expanded by the construction of a new 3000m<sup>2</sup> extension, opened in april '90.

---

## 0: Simplified organisational chart of the High Wycombe Site

Instron Limited is responsible for approximately 40% of corporate turnover and profits and is fully involved in corporate development programs.

Historically, the UK facility has manufactured the same range of products as the US, but there is currently a shift of manufacturing strategy towards

focused manufacturing; In order to realise "economies of Scope" some models are produced only by one of the two factories. The High Wycombe plant produces some 750 machines a year, including static test machines and servohydraulic machines, that can be used in fatigue testing. It also build a significant number of structural test rigs for large components testing.

Apart from the UK operation, there are sales and services facilities in Belgium, France, Italy, Sweden and Spain. There is also a recently-acquired subsidiary located near Bristol which manufactures high technology temperature cabinets, Severn Furnaces Ltd.

Approximately 390 of the company 950 employees are located on the High Wycombe site. A simplified organisational chart could be sketched as follow (figure 2). The structure of the company is composed of a series of functional departments.



---

## 5 Some of the main processes at Instron

### 6 Machine orders

0: The "T plant" organisation

The internal structure of the factory can be described as a "T plant" (figure 3), which means that parts are made to forecast and assembly and packing are made to order. Modularity being very important

(40% of the products sold have some amount of customisation) the number of standard catalogue references reaches 1800. This results in enormous cost (£3.5 millions in stocks), hence the importance of the move toward focused manufacturing. When an order is received, it is entered on the mainframe by Order Entry (Commercial department), the order then is vetted by an expert system so that to check if there is no error and if all the modules are compatible, if there is a doubt the system produces a list of questions. A Bill of Material is then edited by the MRP II system with the detail of all the assemblies and subassemblies down to each individual item. As soon as production is triggered, an order acknowledgement is sent to the customer. A scheduling sheet details the date of availability of these items, and whether they must be manually scheduled or have been automatically processed.

A routing sheet follows the machine as it is assembled, starting with the frame, the subassemblies and the final assembly. The subassemblies are tested individually before going to stores. They are pulled out of the stores when needed and the final assembly is tested, goes through Quality Control and, at to last Packing and Shipping.

---

When the machine is packed, it is considered to be out by production whether it has left the premises or not !

The production lead time is 10 days to 3 months for an Electromechanical (static) machine and can range from 4 weeks up to 10 months for a big Servohydraulic (dynamic) machine.

### **7 Accessories and spares**

Customers often upgrade their machine by ordering accessories, while they order spares when they have to operate a repair. These two types of orders can nevertheless be handled by the same procedures. The sale of accessories and spare parts represents roughly 10% of the total sales. However, Customer Service being a priority for the company it is considered a very important area. Moreover, as could be expected, the margin is much higher on the spares than on the machines orders.

A Fast Spares department has been created by marketing in 1989. This department is specialized in answering urgent customer demands; when the required item is in stock or anywhere in the factory, it is immediately sent by courier to the customer. Thus delivery lead time for fast spares is 24 hours.

An order cannot be processed by Fast Spares when it is not available off the shelf, when special testing is required or when there are special contract details, like a letter of credit. In such a case, the order is just sent through the usual long route detailed in chapter VI. The lead time for big accessories can range between 10 days to 3 months.

The creation of Fast Spares has successfully reduced the lead time for priority orders, at the expense of a certain animosity between this department and the other production sectors; Until recently, Fast Spares used to be directly under the supervising of marketing and problems often arose when Fast Spares had to take away a part which was sometimes scheduled elsewhere.

Since July 1992, fast spares must respond to Material Control (which in turn belongs to the Manufacturing department) instead of Marketing. As Material Control is also responsible for Planning and Stores, the move is likely to ease the existing rivalry.

---

Fast spares is also the starting point for most orders; if the order cannot be handled by the department, it goes to order entry and follows the usual route described in this chapter VI.

### **8 The packing department**

The packing department, which will be used as a case study in this dissertation is the last department in the production line. It is in charge of packing everything that leaves the shopfloor (save fast spares). When finished and controlled by Quality, machines are transferred to the packing room. By this time a crate must be available to pack the machine. The type of crate does not only depend on the machine type, but also on the way it is shipped (e.g. most machines must be laid down if they are to travel by air) and on the destination country (e.g. machines going to South East Asia receive special attention for protection against humidity). Normal spares and accessories also arrive to packing through the Stores or the Tidy ship (Quality Control and Testing) area.

The shipping department starts editing shipping and export documents after the machine has been packed and returns them, along with the address to print on the crate to the packing department. Packing is in charge of storing the machine during this time and of loading the lorry that takes it away.

The relations between packing and the surrounding departments can be summarized as follow:

---

At the end of the quarter both the packing and shipping departments become the most sensitive areas in production; Many machines are rushed out of the production cells because they have to appear on the quarter's sales. Any major problem occurring in one of the two departments can become devastating. A breakdown of the computer invoicing system in the last week of the quarter would affect approximately one-third of this period's sales! This point will have to be reminded when we analyse the communication network at quarter's end.

---

## 9 Project brief

*Defining the scope of a project is a very delicate phase.*

*In this chapter, the reasons why this subject was chosen to tackle the packing-shipping problem are rapidly explored, along with an overview of alternative projects.*

*The project brief, defining the outlines of the study and the main points to be tackled follows.*

---

## **10 A review of potential subjects**

The first weeks of the project had to be devoted to gain a basic understanding of the functioning of the two departments and their environment. The first week was spent learning the procedures in some departments working with packing and shipping: Tidy Ship, Systems Integration, Hydraulics and the Stores. The choice of these four departments was made because their activity came just before ("upstream") of packing. Systems integration comes at the end of the manufacture of the Static machines, Tidy Ship is the last quality control before the spares are sent to the customer and Stores sometimes send parts directly to packing. Once the activities of packing had been replaced in their context, the next weeks were spent going "downstream": first to packing, then to shipping.

Much time during these first weeks was also devoted to talking to workers and employees about their problems and what they felt could be improved in their work. Discussions with my industrial supervisors were also instrumental in defining potential project topics.

The original project presentation (appendix 2) defines the main activities of shipping and packing and ends with the delineation of three main areas of interest which were selected as potential dissertation topics:

## **11 The reporting structure**

One of the problems of the management, mainly with packing, was the provision of accurate information on the activities of packing. In many respects, packing seemed to be a kind of "Black hole" in production: sometimes, the departments just seemed inactive, but packers still had to work overtime hours in the evening. At other times the departments was simply overloaded and up to ten more workers had to work in the department. At the end of the quarter the department had would become a bottleneck for the whole factory unless it worked Saturdays and Sundays.

## **12 Decentralisation of packing**

---

Another interesting challenge for the future was the prospect of a different organisation of the packing department: the idea of implementing a cellular organisation in Instron had long been discussed and some of the production departments were in the process of being integrated into production cells. As the move proved to be quite successful, the prospect of moving at the end of the production cells was increasingly thought about.

### **13 Interface between departments**

The last cause of concern was Communication. Great losses of time would sometimes arise when a machine was forgotten instead of being loaded in the right lorry or when a urgent machine arrived unexpectedly. According to packing there was also a coordination problem as the transport companies lorries tended to arrive before the shipping documents were ready.

Finally, this last subject was kept because it seemed to be the most decisive to the company. It would also be a challenging test case for the methodology proposed.

### **14 An overview of the project**

#### **15 Project context**

During the last ten years, Instron's shipment pattern has dramatically evolved:

- The total number of shipments has been multiplied by 250%
  
- The percent share of UK/export machines shipments has shifted  
from 22% / 78% in 81  
to 5% / 95% in 91
  
- A fast spares department was created in december '90.

---

Alongside this, there has been a reduction in personnel in the two departments: the shipping personnel has been reduced from 5 to 3. The packing personnel has also been reduced (from 5 to 4, including one packer doing mainly spares) but can rise up to 10-15 at quarter's end.

These reductions arose mainly from the use of the mainframe and stand alone computers in shipping, while faster packing methods were adopted in the packing area.

On the other hand, the organisation of shipping and packing has remained quite stable over the years, shipping being under the responsibility of the commercial manager and packing under the production manager; both the packing and the shipping managers have remained the same over the last ten years.

#### **16 Project need**

Most of the problems in packing and interfacing departments occur because the appropriate information, although in the company, has not been transmitted to the individual that needed it.

It is also claimed that time is wasted walking between departments in order to check and obtain information that might be conveyed more efficiently through other channels.

The departments might also suffer from excessive paperwork and administrative recording.

#### **17 Study objectives**



---

These objectives have been defined at the beginning of the project. They provide the framework for the dissertation, although all the project-related activities will not necessarily be included within the dissertation itself.

1. Determine what the information needs of packing are.
2. Model the present functional communication network.
3. Model and rationalize the administrative system.
4. Make recommendations bearing on all three points.

The study will be conducted in two ways: a "static" study will be made dealing only with packing and the closest departments, with an emphasis on shipping. The second approach will be more dynamic and cross-functional, it will be conducted by looking at an entire circuit, namely the spares and accessories orders.

This approach is the best way of investigating how administration can be simplified. Moreover, the shift in point of view might prove worthwhile for the analysis.

The next chapter will explain what we mean by functional communication and the methods used for the analysis.

---

## 18 Communication and coordination

*This chapter links work organisation and communication; It is argued that while specialisation and division of work are necessary for competing on the market, they bring forth a problem that was not as critical in craftsmanship production: Coordination.*

*The link between communication and coordination is then established. Finally a definition of the object of the study, Functional Communication, is undertaken.*

---

**19 Division of work and the need for coordination**

---

Division of labour has been made famous for the first time in the 1770's by Adam Smith,

0: Comparing work organisation: The craftsman and the factory

although it is likely that this concept was implemented far before.

The following figure summarizes two basic types of work organisation: From the craftsman, who does the whole job of buying the materials for production, to the more elaborate process of production with a manager coordinating the work of various specialists. The later form of organisation is likely to provide a better output per man assuming the demand is large enough: Compared to the craftsman job, which is broad in coverage, the use of specialists will involve less loss of time in transferring from one activity to the next (or setup time) and will make operator skill easier to develop (among other things).

0: The number of communication links grow geometrically with departments number increasing arithmetically

However, when it is decided to subdivide the activities associated with some goal among two or more specialists, a specific set of relationships is created: The total operation, having been divided into parts, must be

reintegrated into a meaningful whole. This means that:

- a) Functions must be carried out in the correct order
- b) Work must not be duplicated
- c) Operations should be carried out at the appropriate time.

It is in this reintegration that coordination becomes important. Short or long-term coordination remains the main job of the management.

---

As illustrated above, the relationship between the number of specialised units and the number of

0 : Relation between division of work and the need for coordination
---

communication links is not linear: the complexity of the coordination task will grow geometrically with the number of specialized departments. If tremendous benefits have been gained through the use of mass production techniques, certain benefits of the old system have been lost: most of the efficiency gained through simplicity and standardisation was lost because of the coordination problems induced by creating complex networks of departments.

A final remark could be made on the subject of division of work and coordination; our conclusion on the growing complexity of interactions is based on two assumptions:

- a) It is necessary that all departments are linked to each other: In practice some departments (like finance and wiring, for example) might have little need for constant coordination. This would, to a certain extent, reduce the growth of complexity.
- b) Very often, the need for tight interdepartmental coordination arise when work has to be processed sequentially (i.e. the input of one department is the output of another).

**20 Communication as an element of Coordination**

---

According to Litterer ('73) there are two basic elements to Coordination: *Programs* and *Communication*.

*Programs* are commonly incorporated within work procedures and can be defined as "a formalized descriptions of behaviour". Most procedures insure that routine work is carried out in a coordinative fashion. But programs alone are not enough for providing coordination because they are insufficient to meet changing or complex situations. These problems can only be solved through the provision of communication.

*Communication* has been characterised in a variety of ways; in this chapter, we will simply define it as "The process of organising". In other words, communication is the process that enable people to co-orient their behaviour (Kreps 1990).

In an organisation, communication is conveniently split in three types: *Downward communication*, which is directed from the manager to the employee; *Upward communication* flows up the hierarchy from employees to manager; *Horizontal communication* is shown as circulating between employees. Each of these types of communication can be characterized as follow:

*Downward communication:* Much of the communication occurring in this way is of directive nature and follows hierarchical patterns as it flows from superior to subordinate. Katz and Kahn (1966) assign five basic purposes to downward communication:

1. To provide specific tasks directives (or job instructions).
2. To provide information which produces an understanding of the task in relation to other in the organization.
3. To provide procedures and practices (thus setting *programs*).
4. To provide feedback to the subordinate regarding his performances
5. To induce motivation

---

Directive communication is mainly oral or written, although written directives often receive the greatest attention; examples of these are quality procedures, safety regulations, job descriptions, memos and so on... An almost infinite number of documents direct organisational life in this way. It can become quite complex when many lines of management are involved.

*Upward communication* is also termed "feedback". The provision of information regarding production volumes to top management is an example of upward communication. As such it is closely linked to control. The advent of computer technology has made it possible to present the manager with an almost overwhelming amount of data.

Upward communication can also go through the interpersonal channel - some managers have an "open door" or a "suggestion box" policy which are intended to supplement reports. Wofford and al. ('77) suggest that it is doubtful that many managers care about the upward interpersonal communication channel because they are too concerned about the downward channel or else feel that the documented upward channel will tell them all they need to know.

*Horizontal or lateral communication* takes place between people of the same hierarchical rank. At the bottom level of the hierarchy it consists mainly in operational information. It is conveyed by administrative documents like work orders or routing sheets

## **21 A definition of Functional Communication**

---

Let us now define the object of our study: *Functional communication* comprises the communication needed for carrying out routine or job-related tasks in the company. Functional communication can be transmitted through a variety of media. However, direct face-to-face interpersonal exchanges, phone calls, computer enquiries and forms are used 95% of the time.

Functional communication is mainly manipulated by employees as part of their daily work. Consequently, it can be either upward, downward or horizontal, but is most often related to the latter. It plays a vital role in coordination and tends to take place directly between individuals located along the flow of work. But the best way to distinguish functional communication from all the other forms of communication is its constant relation to short-term, shopfloor or administrative operational work; It is not exceptional enough to justify a supervisors meeting, but it is important enough to send employees and workers look for the missing information around the company.

When it is coordination-oriented, the passing on of Functional Communication must be done so that:

- 1) The workers who benefit from the information in a critical or urgent way receive the information immediately.
- 2) Those that do not need the information and will not benefit from it at all do not receive it.
- 3) Those who will benefit from it are provided with the information before it is required in an urgent way.

The reader will also note that in the course of this dissertation, we will focus our study on the transactions going on between departments, or intradepartmental communication, as opposed to interdepartmental transactions. Communication with the world external to the company is not considered, except when transactions take place at regular intervals: e. g. when it is impossible to ignore the relationships between the packing department and Wycombe Timber, who is the main source for crates, as they take place twice a day on average.



---

## **22 How to study Functional Communication?**

Having decided of the subject of our study and defined it, we now have to decide what methods we will use to address and analyse it.

How to represent functional communication flows? How to know if an organisational system is appropriate for a given set of procedures ? Is it better to use written forms or are face-to-face communications more effective to convey the information ?

Organisational Communication, which is a branch of Industrial Organisation describes the circuit of information in terms of communication network, but if networks are appropriate to describe quantitatively the information flows, they cannot help seeing what are necessary and what are not. The audit method called paper flow analysis can be of help in that but how to understand why mistakes still occur when the right paper is in the right place ? Organisational information processing can give an idea why but cannot describe what are the functions we want to fulfil in the end.

In other words, there is no specific literature on Functional Communication covering all the various aspects of the topic. That is why the author has decided to pick up the elements of his study from a variety of fields so that to put together a coherent Analysis Methodology.

The organisation of the fields of study used in this Functional Communication Analysis could be sketched as follow (an idea of the links between these domains is also provided):

---

Our main sources in **Organisational communication** is Wofford and al. ('78). It explores the relationships between division of work, organisational structure and the need for coordination which have been used in this chapter. Another source in organisational communication is Farace ('77), a very comprehensive book on the topic of organisational communication oriented toward diagnosing and solving practical problems; chapters 8 (Macro networks in organisation) and 9 (Tools for diagnosing communication problems) have been especially useful. Auvinet (1991) Is also a useful reference; based on internal communications at Renault, the french car maker differentiate a static and a dynamic method for network analysis and also gives a good framework for questionnaire design. Some chapters of Clampitt (1991) and Krebs (1990) have also been instrumental in the description of the various purposes of Communication in the business.

From **Organisational Information Processing** we have taken the analysis of the type of media required for a proper communication according to the nature of the message to be transmitted. This line of research was started when Galbraith ('73) suggested that specific organisational characteristics and behaviours could be associated with information requirements. The paper of Daft ('86) tries to answer the question "Why do organisations process information ?". Models are proposed to show how communicational media can be designed to meet the information needs of technology and interdepartmental relations. We have used some of the conclusions of this paper in chapter V. We have also used Grosser ('91) and Ogilvie ('88). It is to be noted that this last article sees the effectiveness of the coordination function as the main source for the "productivity gap" between Japanese and Western firms. This view is increasingly shared today (and the author firmly believes that the Western fascination for computers monitored-operation is not the right way to solve organisational problems).

---

For looking at the procedures and rationalising the administration, we have borrowed our method from Stolowy ('90). This type of inquiry is also covered in **Information Systems Design**: Gore ('83) describes most of the methods used when designing Information systems. That is were we have taken the Data Flow diagram method from. For the first understanding of the functioning of the department we have used some of the elements cited in Le Brun (1990); **Value Analysis**, although intended to be used in product design provides an interesting method to see what is useful and what is not in the communication flow. Moreover, the idea of centring the analysis on the functions of packing rather than on the department itself was very useful when it turned out that the department would be decentralised and the functions split among other departments. Finally, the idea of using a systems approach (Wu 1991) has proved most interesting to provide the framework for the study and understand why some problems between packing and shipping would arise repeatedly.

---

## 23 Functional information in packing

*The aim of the first section of this chapter is to define the tools we will use for the Functional Analysis, the packing activity being taken as an example. Accordingly, leading concepts of Systemics and Value Analysis are portrayed. The second part propose to give a basic comprehension of the operation of the packing section through the application of these techniques*

---

**24 Principles of the analysis**

**25 Systems analysis**

---

A system can be defined as a collection of elements organised toward the accomplishment of a purposeful end. The usefulness of the concept of system arises when one desires to study a complex problem. The systems approach will not only allow to define clearly the limits of the study (defined as the system's boundaries), but will provide a set of concepts and methods to tackle the problem:

*Relations* Rather than trying to describe each element in details, the systems approach insists on the interaction that takes place between them. As such, it is a dynamic rather than static approach.

---

0: The modelisation process

---

*Modelisation* Modelisation is the process of extracting from a situation the elements which are relevant to the problem explored. This process is of uttermost importance. It can be sketched as follow: (next text box).

*Relativity* There are of course numerous representations of a single situation. Thus, we acknowledge that the process of defining a system is before all the choice of a representation of reality among many. Individuals always adopt a model suited to their current preoccupations. A good example of this is the representation of a machine seen by a packer as opposed to the way it is seen by shipping in the next chapter..

---

The relativity of this approach should always be kept in mind whether we analyse the information necessary to perform each function of packing, the way the departments interact when a customer orders spare parts (as represented by the Data Flow diagram in chapter IX), or whether we consider the administrative work on such an order (Paper Flow diagram).

*Growing levels of complexity*The systems view can also allow for a progressive, top-down approach. Here packing will be considered as a set of four functions; each of them consisting in subfunctions with a growing level of detail..

## 26 Value analysis

---

The methodology of Value Analysis was created in 1947 in the USA: Laurence Miles, purchaser manager at the General Electric had the idea to put together:

- The cost of a product
- The "Value" gained through the use of the product.

Applied to product design, the two essential principles of Value analysis are:

- a) Start the design process from what is really useful. This basic, rock bottom need is called the "Just necessary"
  
- b) Make an extensive use of the systems approach at the stages of problem definition and modelisation

In this section, the Value Analysis is intended to provide the framework for our analysis; although we will not make an extensive use of all its concepts; we will retain the following elements.

- The system is described in terms of functions and relations.
  
- The methodology isolates what is necessary (i.e. fulfil functions like packing a machine or placing an order), from the means and procedures used. For example a function like **2.1 Identify crate required** can be carried out in a variety of ways: one can get the information directly from the salesman, read it on a production history sheet or obtain it through the computer database. In other words, we do not want to formulate the problem in a way that implies one type of solution preferably to another.
  
- The final objective is to determine only that what is "Just necessary" to satisfy each function.

Note that in the course of this Functional Information Analysis, the information considered is the one originating from outside the department; elements like the 'know-how', working procedures or the information internal to the department are not considered.



---

## 27 Analysis

### 28 Machine packing & loading

This is considered to be the main function of the department, it is triggered every time a machine is sent out of production. The machine and its accessories are supposed to be ready and checked by Quality Control before Packing starts its work. In the second quarter of 1992, where the study took place, the demand on Packing varied from 9 machines a week (for a value of £108k) to 38 machines a week (for a value of £2035k and including a Saturday's morning's work). The peak of the activity always comes at the end of the quarter - it can be noted that activity was not particularly high in the considered quarter.

#### 1. Machine Packing and loading

##### 1.1. Physical packing & first store

##### 1.1.1. Identify crate requirements

**Information input** : *From Order Entry or Shipping*

- Destination country
- Mode of shipment
- Special crate

##### 1.1.2. Pack machine

**Information input**: *From Production*

- Documents to put inside ?

(Packing list and customer green history copy at the moment)

**Information Output**: *To Shipping*

- Specifications (weight & size) of crate

##### 1.1.3. First store

**Information input** *From Routing sheet*

- Order number

#### 1.2. Mark crate & prepare for loading

##### 1.2.1. Mark crate

---

**Information input:** *From Shipping*

- Destination address
- Special markings if any

1.2.2. Store for loading

**Information input:** *From Shipping*

- Need to be grouped with other crates ?
- Order of arrival of transport Lorries

1.3. Load transport

**Information input:** *From Shipping*

- Advice note
- Export and shipping documents

**Information output:** *From Lorry driver*

- Advice note signed by lorry driver
- Any other documents from the driver

**29 Crate management**

---

*How to read the functional Analysis:*

---

The Subfunctions of **Machine packing & loading** are:

- 1.1. Physical packing & first store
- 1.1. Mark crate & prepare for loading
  - 1.1. Load transport

SubFunction **1.1 Physical packing & first store** can be broken down into:

- 1.1.1. Identify crate requirements
- 1.1.2. Pack machine
- 1.1.3. First store

**The Information needed to carry out function 1.1.1 is:**

+ Information: What kind of crate / foil to use ?

Subinformations:

- Destination country
- Mode of shipment
- Special crate (like exhibition crate for example)

2.           Crate management

The objective of this function is to have a crate ready to pack the machine coming out of production while minimising the volume of the stocks. As it goes with packing, it is subject to the same Hockey Stick effect at quarter's end.

2.1.   Identify crate required

**Information**

**input**           *From Order Entry*

*(history*

*copies)       and*

*Planning*

*(Schedule)*

- Machine size

- Destination and mode of shipment

- Ready-to-pack date

2.2. Order crate

**Information input**

- Function 2.1 completed

---

**Information output** *To Wycombe Timber or purchasing*

- Crate model
- Delivery date

2.3. Modify order/Call off crate

**Information input** *From planning or production*

- Cancellation of order
- Any modification in:
  - Machine/accessories size
  - destination or shipping method

2.4. Receive crate/plywood

**Information input** *From purchasing or own files*

- Memory of order placed

2.5. Store

**Information input**

- No information external to the department.

### **30 Stocks handling**

Stocks handling means having all the necessary consumable to carry out packing. Note that plywood, softwood and shrinkwrap foils are ordered through Wycombe Timber in a procedure similar to crate management.

Some of the consumable, like cartons are also used by other departments that come down to Packing whenever needed.

### 3. General consumable management

#### 3.1. Identify consumable requirements

**Information input**

- None from an external source (stocks are within department)

#### 3.2. Order consumable

**Information output:** *To purchasing dept*

- Order sheet

#### 3.3. Receive & store orders

---

---

**Information input:** *From Goods In*

- Nature and quantity of items received
- Memory of order placed (order sheet)

### **31 Accessories packing & loading**

This function is carried out under packing. Its context is explained further in chapter VI.

#### 3. Accessories & spares packing

##### 3.1. Physical packing

**Information input:** *From production/stores/others, ultimately from Order Entry*

- Green history copy and packing list
- Pack specification

##### 3.2. Mark and store

**Information input:** *From Order entry/shipping*

- Address label

**Information output:** *To shipping*

- Package ready

##### 3.3. Transport/Parcel post/Courier loading

**Information input:** *From shipping*

- Export and parcel/courier/post documents

**Note:** Making a detailed functional analysis on accessories and spares packing is not easy because:

- Items to pack can be brought directly from virtually any department.
- Shipment modes are many (parcel UK, parcel International, several couriers companies, transport companies for heavy items..)
- Items are sent to occasional customers as well as to Instron agent and subsidiaries or to the Canton site.

---

- Items can be of varied nature, size and weight (from oil barrels and load cells to small items and software).

**Therefore, external information requirements can be quite varied.**

### **32 Conclusion**

Using the methodology, four main functions of the packing activity have been identified and described in terms of functional information transaction. Some functions, like machine packing require a lot of interdepartmental communication (in this regard the interdependence with shipping is high), but are quite straightforward in terms of information required (one would talk of *uncertainty* rather than *equivocality* in information requirements - see **Chapter V. D.** -). Other functions, like orders handling require very few external pieces of information.

One of the main conclusions of this preliminary study is that a particular attention must be devoted to Spares Packing whose information requirements have been shown to be particularly varied.

During the last weeks of the dissertation, decision has been made to change the reporting structure of the department. The two machine packers were to report respectively to one of the two production cells each.

This does not affect the Functional Analysis, as the functions to be carried out remain the same.

---

## 33 The communication network

*Communication is to the business organisation what electrical current is to a wiring system.*

*In the preceding chapters, we have defined what Functional Communication meant and what the information conveyed was. After this look at the electric current, let us now examine the wiring system itself:*

*The purpose of this chapter is to introduce Communication Networks and parallel their structure and communication links with the nature of the information processed.*

*Network analysis techniques are then applied to Instron's Packing function thanks to the data collected during the course of the previous chapter.*

*A questionnaire also is designed to collect additional information.*

---

### **34 Communication network theory**

#### **35 Communication networks: a definition**

As soon as an organisation comprises more than fifty members, it is impossible that everybody is in relation. Within the organisation, communication moves from person to person through the repetitive contacts between members. The concept of *communication network* refers to this pattern of communications.

So "An organisation's communication network emerges from the accumulation of member-to-member interactions" (Farace and al. '77). The most routinized interactions are likely to be the ones that convey Functional Communication.

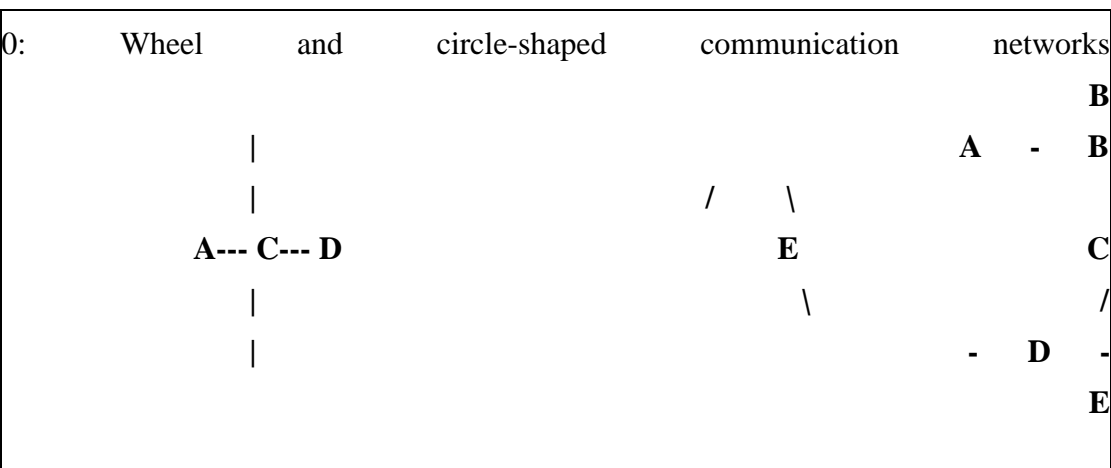
According to McClure ('78), it is possible to categorise communication networks according to their function; thus an Expertise network (pertaining to communication of a technical nature) can be added to the Formal Authority network and a Social network which is devoted to the sharing of non-work related information can also be considered. In this chapter, we will mainly consider the Functional Communication network, which role is to convey routine operational information.

#### **36 Network structure and problem-solving**



Harold J Leavitt ('73) has designed experiments to measure how the shape of the group communication networks could influence the efficiency of problem-solving. He formed two groups of five people. The first one had the structure of a wheel and the

second one was circle-shaped:



In the wheel structure, only the centre of the wheel could communicate with all the others, while in the circle each member could

communicate with two others only.

Leavitt then assigned two tasks to the groups and measured their performance:

- The first task was as follows: Among five objects that every member possessed, two were of the same colour (red). The purpose was to find what that colour was. The wheel structure was the fastest by far.
- The second task was the same as the first one, but the colours of the objects were not as clear-cut as before (colours like pale red or light blue). In this second case the circle structure showed the better performances while the wheel structure kept on making mistakes even after many tries.

From these experiments, it is clear that the structure of the communication network has an influence over the information processing capabilities of the group. Leavitt concluded that the egalitarian structures (where everybody had access to the same quantity of information) was better to tackle a complex problem, while hierarchical structures start the work faster and in good order, thus are most efficient when the work is simple. The next paragraph makes use of this experiment, but considers the problem in more general terms of coordination.

---

### 37 Coordination within the network

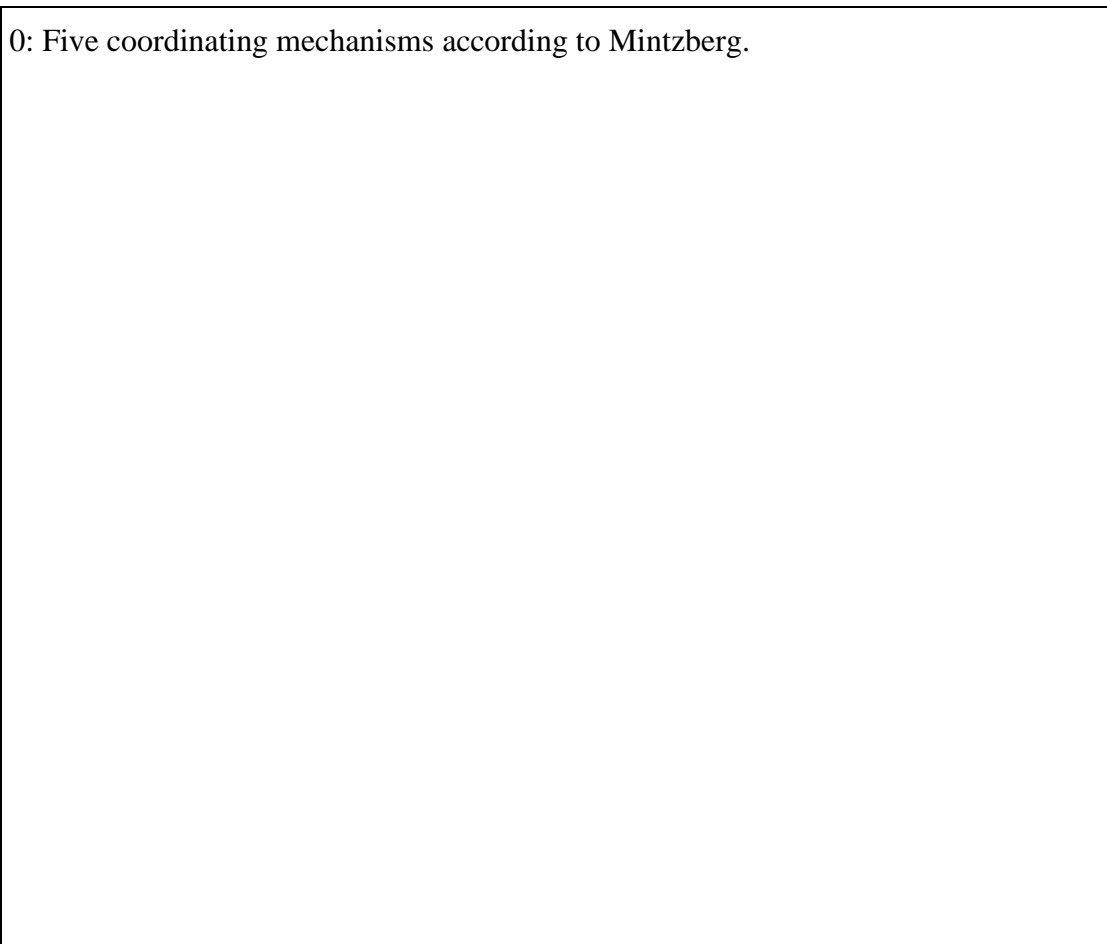
According to Mintzberg ('83) there are five possible coordinating mechanisms for a communication network:

- *Mutual Adjustment* is the process of achieving coordination by communication directly between the people who are actually carrying out the work (or *operators*). When a large number of people have to work together, this method requires a considerable number of communication lines. This system of mutual adjustment can

be paralleled with Leavitt's circle structure.

- *Direct supervision* occurs when one person takes responsibility of the work of other under his command and monitors their action. This coordination mechanism allows for a certain amount of economy in terms of communication lines. Like in

0: Five coordinating mechanisms according to Mintzberg.



Leavitt wheel structure, the communication lines between operators do not need to exist.

- Mintzberg then considers a third mechanism: *Standardisation* (figure 8) is a way of achieving coordination even before work is undertaken. If the two latter forms of coordination could be placed under the general heading of *communication* (as defined

---

in chapter IV), this particular coordination mechanism could be termed *program*. The more the work is standardised, the less important the need for communication. According to Mintzberg, three areas can be standardised: The work process (the content of the work is specified), the output (the results of the work must take a predetermined form) or the skills (the kind of training necessary to perform the work is specified)

### 38 Medium and message nature

Information processing makes a difference between two kinds of information contingencies: *uncertainty* arises when the main problem is the absence of information needed to undertake a given task. It is the "difference between the amount of information required to perform the task and the amount of information already possessed" (Galbraith 77) it can also be defined as the absence of answer to an explicit question.

By contrast, *equivocality* arise when there are many conflicting ways of interpreting a given situation. High equivocality means confusion and lack of understanding. The main difference between uncertainty and equivocality is that uncertainty can be resolved by asking yes-no questions, while equivocality cannot. Daft and Lengel (86) see three sources for uncertainty and equivocality in a firm: *Technology*, *Interdepartmental relations* and the *Environment*.

- *Technology* is the knowledge, tools and techniques used to transform inputs into organisational outputs. Perrow ('67) defined two underlying task characteristics: *task variety* which is the frequency of unexpected events that occur in the process, and *task analysability*. When work is not analysable, people have difficulties developing exact procedures and have to rely on judgment and experience rather than on rules or routines. Task variety means uncertainty in the information requirements for carrying out the task, while analysability goes with equivocality.

- *Interdepartmental relations* can also be a source for equivocality: the characteristic that influence equivocality is *differentiation*. In a functionally-organised company, each department develops its own specialisation, time horizon, goals and jargon. Bridging wide differences across departments is a problem of equivocality reduction.

---

By contrast, uncertainty is generated by the mutual interdependence of departments: the more they depend upon each other to accomplish their task, the bigger the amount of information that needs to be exchanged and the uncertainty that needs to be reduced.

- A final source for uncertainty and equivocality is the *environment*. In an uncertain environment the need to reduce equivocality is foremost, while in a regular environment, one can rely on the collection of explicit data.

The next question is how organisations can be designed to meet the needs for uncertainty or equivocality reduction. Daft and Lengel (86) argue that the appropriate communication tools can provide information of suitable richness to reduce equivocality, as well as to provide sufficient data to reduce uncertainty. *Richness* is defined as the ability of the medium to change the understanding of a problem. In order of decreasing richness the media classifications are (1) face-to-face, (2) telephone, (3) personal documents such as letters or memos, (4) impersonal, written documents such as forms.

Knowing its information requirements and the media to use, the organisation must

0: The appropriate communication structures to reduce uncertainty and equivocality within the organisation.

now find ways of organising its communication structure to match these requirements.

- Rules and procedures are a means to establish a known response to problems that have arisen in the

past. They typically apply to recurring, well understood phenomena, therefore they play almost no part in equivocality reduction. At Instron, procedures are mainly detailed within a procedures manual. This manual has been established in an effort to fulfil European Community Quality System Standard

---

EN 29001.

- Formal information systems include periodic reports and computer database. They can only pertain to the most measurable and well understood aspects of information, hence they are moderate or low in richness and, although they convey a lot of data they are weak for reducing equivocality. There are many such reports at Instron, like the weekly shipments reports.

- Special reports include one-time studies and surveys. Even if the primary role is to obtain data they have to interpret it and thereby reduce uncertainty. Such surveys can be typically carried out by students or consultants.

- Planning is a dynamic process that includes elements of both equivocality reduction and data sharing. Once plans are set, equivocality is reduced, while comparing actual performance to targets allows for a better evaluation of performance. At Instron, senior managers have to establish in advance the budget of each department on a yearly basis.

- Direct contact is the simplest form of information processing. Through discussion and exchanges, equivocality is reduced. But data can be exchanged as well in order to reduce uncertainty about specific questions. Direct contact takes place on a variety of occasions; When special coordination is required like at the end of the quarter when the heads of commercial and the production departments meet to set priorities

- An integrator is a person placed at the boundary of two different activities. His role can be the transmission of data, but the primary purpose is to overcome disagreements and reduce differentiation between departments. A spares supervisor (from Marketing) used to monitor spares orders (mainly handled by production) and play the role of an integrator between the two departments.

- Finally the comparative advantage of Group meetings is equivocality reduction rather than data processing. Participants can exchange opinions and judgements face-to-face, but it is difficult and time-consuming to process a lot of data this way. There are many group meetings at Instron like the Approved Suppliers List Update.

Our information processing model for organisational design could be summarized as follows: (see next figure)

---

**39            Formal**  
**communications**  
**network**

**40    Organisational**  
**structure**

Message flow in  
business

organisations has traditionally been described in terms of *Formal organisation structure*. Hence the organisational chart of Instron, as shown in chapter I.2 maps the prescribed hierarchy of power relationship within the organisation. Depending on the job title and job descriptions certain formal relationships are expected in the performance of responsibilities. For example, the people to whom a company member must report, the people who must report to that company member, those whom he works directly with - all have formal communication relationships that show up on the organisational chart.

Several strategies have been developed to increase efficiency of formal message flow in modern organisations. The most famous is the matrix organisation: In this structure, a member reports both to a superior in the hierarchy (like a head of department) and to a project leader. The relative importance of the two bosses can vary accordingly to the importance of the project undertaken. As project members come from different functions, the structure will increase opportunities for interaction among members from different parts of the organisation.

**41 The Functional Communication network around packing**

To investigate the Functional Communication network around Packing, a questionnaire has been designed. The author had three objectives in mind :

---

a) Discover what the actual network of functional communications in the two units of packing and shipping is.

b) Locate the main problems-causing areas in the two departments.

c) Unveil the "cultural" side of organisational information processing find how people think communication should work.

The questionnaire mainly revealed two things:

- As it was expected from the preliminary study, the main source of problem was internal communication. The two leading causes of problems in Packing were:

1) Interface with the production cells: e.g a machine is packed while some accessories are left behind, or a machine arrives to be packed, but there is no crate ready to pack it or its accessories.

2) Interface with shipping; e.g. misunderstandings about the crates to be loaded in a particular lorry, machines packed for sea freight when the transport mode has been changed and bad coordination in general.

- The author also noticed that employees carrying out the most complex tasks were also the most open to working in a matrix structure.

An in-depth description on how the questionnaire was designed and the interview conducted can be found in appendix 5.

With the results of the questionnaire the author has also been able to map the circuits of routine communication. The next figure depicts two functions: Machine Packing and Spares Packing. This picture only regroups the links which are routinely used. The nature of the information exchanged can be found in the functional analysis of the preceding chapter.

---

0: Routine Functional Communication network around packing



---

---

It can be seen that there are two functional networks which tend to work in isolation from one another; the Spares network, which needs to carry out the highest variety of tasks is closer in shape to Leavitt's egalitarian circle structure, while the machine packing network is more centralised (the packing supervisor collect the information from the production cells and monitors the work of the two packers). The relationships with shipping tend to bypass the supervisor to address the packers directly. We will see later that this is mainly due to the need to reduce equivocality.

When the end of the quarter arrives, a new network emerges; The number of workers packing the machines can more than double with the addition of people from other departments. During this period, packing also has to receive instructions directly from the production manager. The new network could be sketched as follow:

---

0: Functional communication around packing at quarter's end.

As a matter of fact, it is not possible to map completely the interactions that take place during this period; Moreover the actors in the network hold very different roles:

- The production manager intervenes to set priorities

- The packing foreman's role is centred on trying to coordinate the work of the packers.

- The network that appears around the packers is mainly like an expertise network; The workers from other departments need advice to carry out the work.

Moreover, this later network cannot be considered Functional Communication "Stricto sensus" because it occurs only once every three months and is never twice the same.

Ordinarily, when they have a problem or need to check something, the shipping employees tend to walk down to Packing to obtain the information they need. They seldom use the phone, although it would save them a lot of time.

This can be explained by the equivocality of the information. Even if it seems routine and simple, misunderstandings between the two departments arise quite often because

<i>The problem as seen by..</i>	<i>Packing</i>	<i>Shipping</i>	of the differences in point of view (as portrayed in the next box).
Work according to	Size and weight of the Machine - Destination - Transport	Details of contract or Letter of Credit mode	Errors committed may seem strange because there is little complexity in the communication
Preliminary control	Machine checked by Quality Department	Order checked by Credit Control	involved (like "load these crates into the lorry of this
Final goal	Get the machine out as soon as possible	Receive customer payment as soon possible	transport company"), but nevertheless they tend to occur quite often. This is not
Think in terms of	Machine	Order	due to the <i>information uncertainty</i> , but to the <i>equivocality</i>

arising from the difference in point of view. That is why a rich channel, namely face-to-face communication is preferred.

However there are drawbacks to this mode of communication; Mainly the time it takes to walk up and down between packing and shipping.

These two departments, which should work together are not only separated by their reporting structure (the packing foreman reports to the production manager, while the shipping manager reports to the head of the commercial department), by their priorities (packing packs and sends, while shipping is customer-centred), by their education (manual workers as opposed to white collars), but they are also physically

---

separated. This is another barrier to communication ("First we shape our buildings, after they shape us" Churchill said).

#### **42 Conclusion**

At the end of August '92, the packing department was in the process of being decentralised to the production cells. This move is likely to improve the relations with shipping to a certain extent; The manufacturing process at Instron involves a lot of product customisation and the production cells can be more sensitive to the needs of shipping, thus reducing *equivocality*. For example, they will be able to provide more details regarding the content of each crate (because the technical knowledge is within the cell).

However this does not solve completely the problem and it is likely that a great deal of face-to-face communication will still have to take place in the future. Moreover, shipping will have to work with two different departments (Systems Integration and Hydraulics, each reporting to a different manager) instead of one previously.

As shown in this chapter, this modification of the organisational structure is likely to induce changes in the network that can be more than simply the suppression of the packing foreman; along this change in the structure of the network, a change in the way the information is processed will occur. Overall, it is likely that, after a period of adaptation there will be an improvement in Functional Communication because the network will promote direct interaction between the packers and the production cells.

The work of the machine packers may become more interesting, it might also be easier to cope with the increased workload at the end of the quarter because there will be no need to transfer workers from one department to another; cell workers will simply swap to another task without having to change supervisor.

The main problem that can arise at the end of the quarter is coordination because the cell managers will have to cope with the coordination of packing, as well as their usual tasks. If we review Mintzberg's coordination mechanisms, *mutual coordination* will not be effective because it requires too many communication links and the use of occasional workers doing the job only at the end of the quarter will not allow the time

---

to set *standards*. Thus coordination will need to be assured through direct *supervision*, adding to the already important workload of the cells managers.

---

## 43 The spares circuit

*In this chapter, we study the problem of the relationship of the Packing activity with its environment from an entirely different point of view: Rather than centring our study on the activity itself, we aim at replacing it in its global context.*

*Here, we will study packing as the end of the accessories and spares order circuit.*

*The study techniques applied are data flow analysis, Paper flow diagrams and Network analysis.*

*The use of these methodologies, will allow us to draw some conclusions on the circuit as a whole.*

---

#### **44 Introduction to the study**

The previous part of the dissertation has been organised around one concern: How to understand, model and improve the relationships of the packing function with its immediate environment. This is the "traditional" approach to organisational problems.

Shigeo Shingo (89), Japanese industrial consultant, father of the SMED optimisation method and of the Kanban technique advocates a very different approach to production problems; instead of focusing the study on the work of a function, he considers the system formed by the production line as a whole. Thus the departments are replaced in their context, the priority being not analysing and improving the functions themselves, but speeding up the flow of products through increased coordination.

This approach leads to a different organisation; instead of grouping workers around functions, they are grouped around products.

In the course of this chapter, we will try to prove that adopting the Shingo approach would bring a useful contribution, not only to production problems, but to the analysis of office work processing. Doubtlessly, planning, stocks management, purchasing and other tasks carried out in the offices represent the main source for delays in total lead time in our case study.

This study of the spares and accessories circuit will necessarily be less detailed than the one we conducted previously because numerous departments and activities are concerned: the purpose here is only to illustrate the profits that might be drawn from this shift in point of view.

The techniques we will use are picked up from different domains; Data Flow Analysis is used in Information System design, Paper Flow Diagrams are mainly used by organisation consultants and Communication Network Theory is a line of research in Organisational Communication we described in chapter V.

#### **45 Data Flow Analysis**



---

Gore and Stubbe define a data flow diagram as "A network that uses special symbols to describe the flows of data and the processes that change or transform data through a system". Unlike other Flow diagrams it is constructed by using a set of symbols that do not imply any physical implementation.

The Data Flow Diagram utilises only three types of symbols:

- The information processors: which are the successive departments that handle the orders.
- The Data storage systems: which are databases in this case.
- The Data Transmission routes. The four most common routes are shown while the other, like the in-house production of load cells and jigs have been ignored in order to keep the diagram to a reasonable size.

The Data Flow diagram and its Key are detailed on a A3 sheet in appendix 5.

**46 Paper flow diagram**

---

No survey is necessary to realize that there is too much paperwork at Instron! The bulk of the forms are computer-generated: NCR (or No carbon Required) paper makes it easy to produce as many copies of a document as desired. Hence, the need for an extensive study of the administrative and paperwork system.

A paper flow diagram is a graphical representation of the procedures used in the company. It provides a synthetic representation of the procedures and forms utilised. It also underlines:

- The sharing of responsibilities i.e. where controls, actions and decisions are carried out: The department carrying out the action described is displayed on the right-hand side of the diagram; Each line or series of lines can be paralleled to one department.
- The link with other circuits, inside or outside the company.

On the diagram, the procedures are represented according to their order of occurrence. The meaning of the symbols used are detailed, along with the diagrams themselves, in appendix 4.

The main advantages of the flowcharts are described in Stolowy ('90).

- The paper Flow chart conveys more information than a written description of the procedures. It is the best way for a newcomer to understand how the system works.
- Building a Paper Flow chart can only be made through a strict and careful approach: as a result no operation or form can be left out.
- The chart is a powerful tool for modifying and improving the circuit: e.g. one can immediately see the consequences of the suppression of a given form on the departments involved.

The major drawbacks of this method are:

- It does not take time into account; duration of the tasks and delays are ignored.
- Constructing the diagram takes a lot of time - the accessories and spare procedures took five full days of work to edit.

#### **47 Network Analysis**

---

Auvinet (1991) differentiate two approaches for the study of communication networks.

a) A static approach: The investigator stays in a department or with a person and observes the information transaction from that point. This static approach was the one we used in the first part of the study.

b) A dynamic and analytic approach: The investigator actually follows the information. At every step the receiver/transmitter is questioned in order to determine:

- How he received the information
- What route he thinks the information he passes on will follow.

The Paper and Data Flow analysis were a good opportunity to put in practice the second, dynamic method. Of course the inquiry covered more departments than the questionnaire but, unlike the questionnaire just one or two question were asked.

The network along the spares orders could be summarised as follow (the link between two persons meaning: A knows what the role of B in the circuit is).

The immediate conclusion of the study is that most of the time, workers and employees are too close and entwined in the situation to see it clearly. Widespread unawareness of the rest of the departments cause ignorance, even of the very way through which orders are handled. Everybody knows the "Next step" and the person they hand their information to, but what "the step after" is, remains a mystery.

#### **48 Conclusion**

---

Observing of the data flow diagram, three remarks can be made:

- Reducing the number of alternative circuits should be a priority. For example, an order should not leave the store before it is complete: Back orders turn the Tidy ship department, the role of which should be mainly to test the quality of item before sending into a secondary storage point. Approximately 70%-80% of the orders arriving in fast spares are incomplete, as a result retrieving back orders and matching them to the order they belong becomes a major function of this department. It is the role of stores to do this.

- Shortening the circuits is always desirable. Of course a maximum of orders should go through Fast Spares, but this would mean more items should be held in stores. After stores a maximum of orders should be processed directly to packing through the PCD way if possible.

- As Value analysis would say (Le Brun 1990) a special attention must be devoted to the areas where we have "loops" in the circuit (like between packing and shipping for example). A loop occurs when information must be processed by department A before it is sent to department B, then it must be sent to Department B, processed and sent back to A; of course, delays add up and can become have a multiplied impact if any of the two departments is overloaded.

In such a case, two solutions are possible:

a) Open the loop by trying to process all the information so that this coming and going is not required.

b) Integrate the two functions in one. e.g. give some planning competence to spares supervising or vice-versa.

---

Looking through the paper flow diagrams is not easy: obviously the procedures are too complex and too much paperwork that is not necessary is involved. However, antiquated procedures and outdated routings are not the result of one person's irresponsibility. Rather, the procedures seem to have an inertia of their own, building up slowly until the entire order processing capabilities become clogged. Rules that make perfect sense are not discarded when the situation changes. Hence, some departments receive and store information they no longer desire. e.g. The information conveyed by blue history copy which is routed all along the way of an accessory order and ends in a file in marketing could as well be obtained directly from the mainframe; moreover this information could be retrieved and processed much faster by the computer.

In general, as a result of excessive departmentalisation, more attention is paid to the rule rather than the reasoning behind the rule, which can only be obtained by knowing what is the use of the information for the other departments.

Periodic cross-departmental screenings in which procedures and information-flow guidelines are carefully examined should be lead regularly. Any important change on the information system should be preceded by a careful study of implications for other departments.

---

## 49 A Summary of the methodology

*In the course of this chapter, we will review the methodology introduced in this dissertation.*

*We will also attempt to appraise the main advantages and weaknesses of each of the three steps of the method; Functional Analysis, Communication Network Study and Circuit Analysis.*

*Finally, we will highlight the points which would need to be studied further.*

---

## **50 A review of the methodology**

In this dissertation, a methodology to investigate the efficiency of the coordination function in a business organisation is characterised. We have chose to tackle the problem by examining how Functional Communication circulated within the company.

The methodology we proposed in this dissertation is organised around three complementary phases. Each of these stages has its own place in the investigation.

The connections between the different methods and the investigation pattern could be summarized as detailed on the next page (The polygon boxes have been used to denote Data Collection methods)

From the figure, it is clear that we have uncovered two ways of reaching conclusion.

- The first approach, the static one, is described in the course of chapters IV and V. A preparatory Functionally-Oriented study is a prerequisite for the Network Analysis.
  
- The dynamic approach can be conducted on its own and leads to a series of innovative conclusions about the system.

In the next paragraphs, we review each of the major phases of the investigation and show how they were applied to the case study.

---

0: A synthesis of the methodology and the links between the different phases of the study.



---

## **51 The Functional Analysis**

The association of the Systems approach with Value analysis is instrumental in defining the boundaries of the problem, but also in gaining a clear understanding of the nature of the information required to carry out the activity.

- The top-down approach is progressive and give a clear definition of the problem. In our case study, we have reduced Packing to four basic functions: Machine Packing, Crate management, Consumable ordering and Spares Packing.
- The systems approach provides the framework for this, but also stresses the relativity of each individual approach. Thus, we have decided to restrict this part of the study to interdepartmental Functional Communication.
- The main drawback of this first part is that, if it gives a good grasp on the problem, it does not provide any insight to solving it.
- However, the Value Analysis approach has a great advantage; being centred on the functions to be carried out, it is independent of the procedures used. In our case study, we confirmed that a change in the organisational structure of the department (here the Packing department was to be decentralised), did not affect the validity of the analysis. This is definitely the main benefit of the methodology.

## **52 The network Analysis**

---

Communication network analysis provides the theoretical background for the comprehension of the communication patterns.

- The network structure must match the coordination needs, as well as the nature of the information that must be processed. Our case study highlighted how these constraints could have an influence on the spares and the machines packing Functional Communication network.

- There is also a parallel to be made between the type of media chosen to convey the information and the nature of the data transmitted. Our method, based on the concepts of uncertainty and equivocality reduction was fecund in explaining why shipping clerks kept on walking up and down between the two departments despite the fact that apparently uncomplicated information was searched for and did not seem to justify such a loss of time.

- Data collection is the main obstacle for the Network Analysis phase. In this study, we suggested a framework for this; In this purpose a questionnaire was designed. However, it is impossible to conduct successfully the Network Analysis phase if the Functional Analysis has not been completed; the information analysis in terms of equivocality and uncertainty demands a sharp preliminary study.

### **53 The circuit Analysis**

---

The circuit approach radically enhance the picture of company-wide Functional communication. A detailed panorama of the contribution of the different company functions to spares orders processing can be provided. Unlike the two previous approaches, that were complementary, this one could have been conducted independently. Three analytical tools are featured:

- Data Flow Analysis permits the characterisation of the cross-functional links woven to receive, plan and achieve the delivery of customer order. As usual for customised product business, the circuit chosen for the case study is quite complex, but the Data Flow diagram can provide the lines for an appropriate description.
- By contrast, the Paper Flow charting method give a genuine and in-depth perspective on the administrative system. Thus, some conclusions can be drawn on a possible rationalisation of the paper flow. However, this method is quite time-consuming.
- Then, a second application of Communication Networks is attempted, but this time through a dynamic strategy. In the case study, this lead to a better awareness of the fact that the functions contributing to the spares order tended to operate in isolation.
- This dynamic study can be very efficient in targeting problems in a circuit. Its main flaw is its superficiality. Nevertheless, the need for simplification and clarity in the procedures is essential. The dynamic study can also be used as a starting point to redesign the circuit of spares orders, as proposed below.

**54 A study of the cellularisation of spares order processing**

---

There are four main customer-oriented processes in the production department:

- Production of Electro-Mechanical machines
- Production of Servo-Hydraulic machines
- Production of structural testing machines
- Input and delivery of spares and accessories orders.

These four activities can be considered as key business processes, however, as shown in chapter VI they are processed in a way that involve the passing of the original customer order through nearly all the departments in production.

Creating a series of four cells with a large autonomy for planning, purchasing, pulling spares from stock, packing and shipping them could greatly improve delivery lead times, as well as the management of the whole process.

Instron is currently re-shaping some of his manufacturing departments into production cells. the author thinks that production cells design concepts can be successfully applied to functions other than production, namely to office functions like planning, purchasing and stocks management.

A first step in this direction would be to place the whole spares circuit under a single reporting structure and undertake a study on how the functions contributing to the circuit could be integrated further.

This study would also show the way for the reorganisation of Instron's organisational structures around business processes for the years to come.

---

## References

CLAMPITT, PG. (91)

*Communicating for managerial effectiveness*

Sage Publications

p. 218

FARACE, RV. ; MONGE, PR. ; HAMISH, HM. ('77)

*Communicating and organising*

Addison-weysley p 178

GORE, M. ; STUBBE, J (1983)

*Elements of systems Analysis*

C. Brown Co, Third edition

KATZ, D. and KAHN, RL. (1966)

*The sociology of organisations*

Wiley and son

as quoted in WOFFORD, JC. *Organizational communication* (Mc Graw-Hill 77) p347

KREPS, GL. ('90)

*Organisational communication*

Longman, second edition

LEAVITT, HJ ('73)

*Organization in the future: interaction with the external environment, with others*

Praeger

LITTERER, JA. ('73)

*The analysis of organisations*

(John Wiley & son, 2d edition)

as quoted in WOFFORD, CW. *Organizational communication* (Mc Graw-Hill, 77) p344.

MCCLURE, CR. ('78)

*The information rich employee and information for decision making: review and comments*

Information processing and management (78) vol 14 pp.381-394

as quoted in GROSSER, K. *Human networks and information processing* Annual review of information science and technology (91) vol 26 pp 349-402

MINTZBERG (1983)

*Structures in Five*

Prentice-Hall

PERROW ('67)

*A framework for comparative analysis of organisations*

American Sociological Review

vol 32, pp. 194-208

RACE, P. ; SLACK, N.

*Manufacturing Strategy*

Part 1, module 1, Advanced Manufacturing System M. Sc. (Brunel University, 90).

---

Figure 2 and 3 as in REASON, PJ. *Forecasting at Instron using quotation-based information*, BME4, (Brunel University, 92)

SHINGO, S. (88)  
*Non-stock Production, the Shingo System for continuous improvement*  
Productivity press

SMITH, A. 1776  
*Wealth of Nations*

WILD, R. (1989)  
*Production and Operations Management*  
Chapter 1, Cassel, fourth edition.

WOFFORD, JC. ; GERLOFF, EA. ; CUMMINS RC. (1977)  
*Organizational communication*  
Mc-Graw Hill

---

## Bibliography

---

### **Organisational communication**

WOFFORD, JC. ; GERLOFF, EA. ; CUMMINS, RC. (78)

*Organisational Communication*

McGraw-Hill

- Chapter 19: "Formal Organisation and Communication"

FARACE, RV ; MONGE, PR ; HAMISH, MR (77)

*Communicating and organizing*

Addison Wesley

A very comprehensive book on the topic of organisational communication oriented toward diagnosing and solving practical problems; chapters 8 (Macro networks in organisation) and 9 (Tools for diagnosing communication problems) have been especially useful.

KREPS, GL (90)

*Organizational communication*

Longman, second edition

Chapter 10: "Internal communication system" pp. 201-224

AUVINET, JM. (91)

*Organiser la communication en milieu industriel*

Les éditions d'organisation

Based on internal communications at Renault, the french car maker. Chapter 4 (L'audit de communication) deals with network analysis and questionnaire design.

CLAMPITT, PG (91)

*Communicating for managerial effectiveness*

Sage Publications

- Chapter 4: "Information" pp. 103-110

- Chapter 5: "Communication channels" pp. 111-121 & pp.135-145

- Chapter 8: "Interdepartmental communication"



---

SCHNEIDER, AE ; DONAGHY, WC ; NEWMAN, PJ (75)

*Organizational communication*

Mc Graw Hill

- Preface pp. 9-13

- "Oral communications" pp. 50-54 & pp. 60-63

### **Organisational Information Processing**

This line of research was started when Galbraith suggested that specific organisational characteristics and behaviours could be associated with information requirements. Later studies demonstrated that there is a relationship between task variety and the amount of information processed within work units.

GROSSER, K (91)

*Human networks and information processing*

Annual review of information science and technology vol 26 pp 349-402

Comprehensive study of the role and structure of informal networks in organisational information processing

DAFT, RL ; LENGEL, RH (86)

*Organizational information requirements, media richness and structural design*

Management Science Vol. 32 No 5, May 1986 pp.554-571

This paper tries to answer the question "Why do organisations process information ? ". Models are proposed to show how communicational media can be designed to meet the information needs of technology and interdepartmental relations.

OGILVIE, JR ; POHLEM, MF ; JONES, LH (88)

*Organizational information processing and productivity improvement*

National Productivity Review Vol. 7 Iss:3 pp. 229-237

Three information processors are characterized: Organisational structure, Organisational culture, which is defined as "The interrelated set of beliefs, shared by most people, about how people should behave at work", and Computer Information Systems. The authors claims that a successful coordination arise from the congruence of these three major factors.

### **Administration audit**

STOLOWY, H. (90)

*Les Flow-charts*

Audit et management

Cahiers francais n 248 (oct-dec 90) pp. 66-67

In this issue, Les Cahiers Francais provides an overall framework for the application of Flow Charting to the description and control of administrative procedures; examples are given of the administrative handling of orders and purchases.

### **Information systems design**

DUPUY, Y. (87)

*A quoi sert l'approche système ?*

Les Cahiers Francais n 223 (oct-dec 87)

A very good introduction on the application of the systems approach to the business.

GORE, M. ; STUBBE, J (83)

*Elements of system analysis*

Brown Company publishers, 3rd edition

- Flowcharting pp. 129-154

This book describes the methods used when designing Computer-Based Information systems. Clearly demonstrates the importance of the systems approach in Information Systems design.

WU, B. (91)

*Manufacturing Systems*

---

---

Brunel M.Sc. AMS Lecture book

Block 4 investigates the conception of Data Flow diagrams and other representation methods for modelisation. Block 1 gives an extensive review of systems concepts.

### **Value Analysis**

DEBRAY, J (91)

*Initiation à l'analyse de la valeur*

Cours de deuxième année IDN

APTE Nord

An introduction to Value Analysis: its origins, objectives and main methods.

LE BRUN, JP (89)

*Analyse de la valeur*

Séminaire groupe d'animation de la promotion G1

IDN

Progressive definition of the concepts used in Value Analysis. Oriented toward design and formulation of the functions expected from a manufactured item.

---

**APPENDIX 1:**

Instron's corporate objectives

**APPENDIX 2:**

Original project definition

*these appendixes are only available on the paper version of this document.*

**APPENDIX 3:**

Functional communication at Instron

Design of the questionnaire issued to the personnel of shipping and packing

---

## Questionnaire design

The design of the questionnaire has to be carried in regard of the issues we wish to investigate. We have three objectives in mind :

- a) Discover what the actual network of functional communications in the two units of packing and shipping is.
- b) Locate the main problems-causing areas in the two departments.
- c) Unveil the "cultural" side of organisational information processing find how people think communication should work.

A handout was issued to everybody before the interview, so that they could prepare their answer to the most complicated questions in advance. Some questions were not on the questionnaire. For the first part of the questionnaire, the purpose was to obtain a "thought-about" answer, while a more a more spontaneous reply was expected in the second part.

After an introduction stating the purpose of the questionnaire and reminding the confidentiality of answers, a first question was asked that was not on the handout.

The first thing was to differentiate the type of jobs that do not require a lot of communication like those involving stable procedures from other jobs demanding a lot of functional communication (like jobs involving one-shots and customized products), the question was:

**1) Do you think communication is important in your job ?**

---

The purpose of this question was more to channel attention on the focus of the survey and define functional communication than anything else.

The following questions were directly concentrating on functional communication itself.

**2.1) What is your main job and what are your other jobs?**

**2.2) Who do you need to speak to most often for each of these tasks ? - How often ?**

**2.3) From the point of view of the "Flow of work", who comes before you for these tasks, who comes after you ?**

The idea was to split the total job into a collection of simpler tasks that would be easier to analyse and describe.

Functional communications being very often linked to the "Flow of work", some emphasis is placed on this view.

Next questions concentrated on problems and how they were dealt with usually .

**3.1) What are the problems that slow down your work ?**

**Who do you see to have them solved ?** (Functional communication again)

**Do you have any suggestion on avoiding these problems ?**

By this time, most of the "spadework" is done, we have most of the "formal" pieces of information;

The second part of the questionnaire needs to be devoted to more opinion-related questions.

These next questions are "closed" questions, opposed to the former ones in that the possibility of answer is limited to four options only: the purpose is not to discuss endlessly about them.

The series of closed questions bear on:

---

---

**4.1) An employee cannot get orders from more than one boss.**

The hidden question here is: what would people think of a matrix organisation?

**4.2) All working procedures must be documented**

A question about *programs* and whether they should or could be laid down on paper.

**4.3) A good coordination cannot be achieved without a centralized authority**

Same question as the first one, but insisting on coordination rather than hierarchy.

**4.4) Job specialisation brings a better performance**

What would people think of a different kind of organisation. Doing a variety of jobs rather than specializing in only one.

**4.5) There is too much paperwork in the company**

An idea often heard at Instron... and in other companies. See the paper flow diagrams.

**4.6) Is management interested by employees suggestion for improvement?**

In order to get some information about the employee management relationships.

The next question is of the "Pick up one answer" type

**5) The most important things to improve at Instron are:**

- **Job training: better knowledge on how to do a job**
- **Managers to employees communication**
- **Employees-manager communication**
- **Communication between employees of different departments**
- **Motivation**
- **Give the employees a better understanding of what the company does.**

---

The next questions were not on the handout

Another try at the communication network:

**6.1) Who are the people you see the most often ?**

- **What information do you need from them ?**
- **What information do they get from you ?**
- **How often do you see them ?**

Actually, this question was quite the same as the first one, but it sometimes allowed the collection of new elements previously left out.

**6.2) In your work, do you have to spend a lot of time in other departments? In what purpose ?**

**6.3) What could you do to make life easier to Shipping/Packing ?**

A question designed to elicit a reaction, knowing the relations between the two departments are not always good.

The questionnaire was conducted during an interview (60 to 90) minutes long. After starting with the most "formal" questions, the interview grew more and more open in order to examine further the various problems. Topics were covered as they arose and much was said about personal opinion and relations inside the company. The results pertaining to the dissertation are detailed in chapter V.

---

**APPENDIX 4:**

Spares and accessories Orders: Data Flow diagram and key

**APPENDIX 5:**

The spares and accessories circuit: Paper Flow diagrams I and II and Key

*these appendixes are only available on the paper version of this document.*