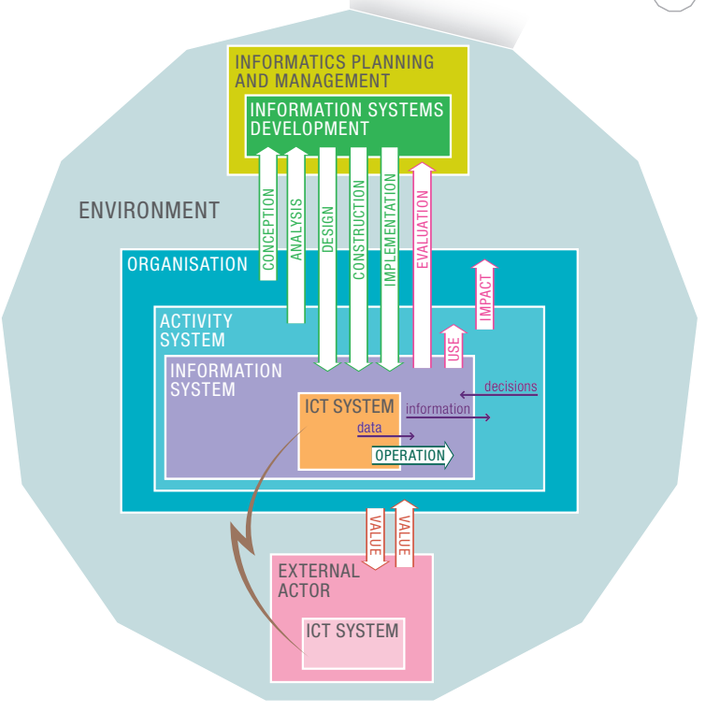
CHAPTER 1

Introduction: the domain of business information systems



'When I use a word', Humpty Dumpty said in a rather scornful tone, 'it means just what I choose it to mean – neither more or less.'

Lewis Carroll (1832–1898), Through the Looking Glass (1871), Chapter 6.

CHAPTER OUTLINE

What are business, information and systems all about?
Why study business information systems?
Organisational informatics
Organisation and environment
Activity systems
Information systems
Information
ICT systems
The development process
Operation, use, evaluation and impact
eBusiness and eCommerce
Planning and management
Summary and key themes
Focus on value
References

What are business, information and systems all about?

This book looks at the intersection between business organisations, information and systems. Business ORGANISATIONS can be thought of as systems of activity which rely on systems of information. In modern businesses, information systems in turn rely on systems of technology, particularly information and communication technology (ICT).

Organisation: A social collective in which formal procedures are used for coordinating the activities of members in the pursuit of joint objectives.

ICT: Information and communication technology, any technology used to support information gathering, processing, distribution and use. A term used to encapsulate hardware, software, data and communications technology.

Output: The elements that a system passes back to its environment.

Information system: A system of communication between people. A system involved in the gathering, processing, distribution and use of information.

These are the main distinctions between these three types of business system:

- An **activity system** is a logical collection of activities performed by a group of people in pursuit of a goal. The key OUTPUT of an organisational activity system is therefore activity or action. Synonyms for an activity system are an organisational or business process.
- An INFORMATION SYSTEM is a system of communication between people. Information systems are systems involved in gathering, processing, distributing and using information. The key output of an information system is of course information, which is used to support activity systems in organisations.
- An ICT SYSTEM is an organised collection of hardware, software, data and communication technology designed to support aspects of an information system. An ICT system outputs data for interpretation as information within an activity system.

In this book we first look in some detail at the make-up of each of these systems, and how it is critical for modern businesses to design them effectively. Second, we consider the effects of the interaction or intersection between these systems. Finally, we discuss the importance of effectively managing both business systems and their interaction, and the contribution this makes to modern business success.

Why study business information systems?

ICT system: A technical system, sometimes referred to as a 'hard' system. An organised collection of hardware, software and communications technology designed to support aspects of an information system.

System: A coherent set of interdependent components which exists for some purpose, has some stability, and can usefully be viewed as a whole.

Process: A transformation of input into output. In information systems a process is a transformation of incoming data flow(s) into outgoing data flow(s).

ICT underpins many aspects of daily life, but the SYSTEMS and PROCESSES that support it, and the ethics surrounding it, are often overlooked. Often we only notice that ICT is involved in something, and what it does, when there is a problem with either the technology or the way it is being used.

For example, consider mobile phones. Your personal unblocking key (PUK) code is critical to the successful operation of the system: you must have it to change network, or to unblock a phone that has been blocked by mistake. But the chances are you won't even know it exists until you need it. Or take a credit card theft insurance scheme: perhaps you use one of those too. It will be based on a database the company running the scheme sets up, into which it puts the credit card details of subscribers. If the scheme works correctly, you probably won't give a thought to this database. But if something goes wrong – perhaps it sends out your credit card details to the wrong postal address – you'll become very aware that it's an ICT system, and a fallible one with a design fault. You might ask yourself then, what is really the greater risk: having your details on this database, where they might get into the hands of the wrong people, or actually having your credit card stolen?

When things are running smoothly, the only people who take much notice of ICT systems are ICT professionals. But things only run smoothly if businesses are able to anticipate future needs, plan what they need to do to meet them, and put those plans into practice. To do this, they need managers who understand the needs of the market and the organisation, and the capabilities of ICT systems. and are able to reconcile them.

Information: Data interpreted in a meaningful context.

Power: The ability of a person or social group to control the behaviour of some other person or social group.

Transactional data: Data that records events taking place between individuals, groups and organisations.

Supplier: A key type of organisational stakeholder. Organisations that supply goods and services to an organisation.

Data: Sets of symbols.

Why information systems are important for business

It's often said that INFORMATION is POWER. In business there's certainly truth in that: all over the world, information is critical to the competitiveness of the private sector. The modern business organisation demands information about, for example, its customers, orders, sales, stock and inventory. It needs this information to be integrated, and it needs it to be accurate and up to date. As a result the management of information is critical to business success.

Companies collect significant amounts of TRANSACTIONAL DATA about their own activities, and about the behaviour of their SUPPLIERS and customers (Burnham, 1983). Transactional data are DATA that record events that take place between individuals, groups and

organisations. They are essential to monitoring the performance of organisations in competitive MARKETS. For example, Tesco collects vast amounts of information about what people buy in its supermarkets. It uses this both to find out how well particular stores are performing, and to discover which product lines sell best to which types of customer.

Market: A medium for exchanges between buyers and sellers.

Today we often hear terms like eBusiness (electronic business), eCommerce (electronic commerce) and eGovernment (electronic government), which show how important ICT and information systems are to modern organisations. Although these are relatively new terms, ICT has been used to transform internal and external business processes for at least three decades. But it can be argued that the role it plays has become larger and more central over time, as technology has developed and led to new business TECHNIQUES, both internally and more recently externally. For instance, although Tesco has used ICT for many years, it is only relatively recently that it was able to offer customers the ability to order their groceries online.

Technique: A systematic activity within the development process.

As individuals we also need an increasing range of information, in order to live our lives effectively, at work, at home and in our leisure time. For example, we need an increasingly large range of identity information: passports, driving licences, credit cards, debit cards, library cards, employee identity cards and so on.

ICT has also caused changes to the way work is carried out. One significant change over time is in the degree to which individuals work from home or on the move. Now they can use ICT to keep in contact with an 'organisational hub' wherever they are. A European survey conducted in 2003 (SIBIS, 2003) showed that 2.5 per cent of UK employees were then working remotely from home using ICT on at least one day each week. A further 9 per cent in the United Kingdom did so occasionally or on a supplementary basis. Many people believe these percentages have doubled since 2003.

So we can say with confidence that information underpins modern society. In the 1970s Daniel Bell, a US sociologist, made a series of predictions about the state of Western societies in his influential book *The Coming of Post-Industrial Society* (1972). He claimed that they were becoming information societies, and it is now generally accepted that this has happened. The same is true in much of Asia. Bell's argument was that just as there was an industrial revolution in the nineteenth century, in the latter part of the twentieth century there was an information revolution. This has led some commentators to suggest that where in the twentieth century we lived in an industrial society, our twenty-first century society will be best described as an information society (Castells, 1996).

Information society: A term very loosely used to refer to the effect of ICT, information systems and information generally on modern society.

One key indicator of an INFORMATION SOCIETY is the way in which information is increasingly regarded as an important economic 'commodity'. For instance, it underpins news media, the music industry and the entertainment industry. These so-called 'content' industries are experiencing some of the most rapid growth in western economies. Many organisations in other sectors now also devote most of their time to information-related activities, so they can be described as information corporations. One of the clearest examples is Google, the market leader in the web search sector.

Many people expect this trend to continue. ICT forms the critical infrastructure for modern organisations; they are converging around common standards, and this is leading to increased integration and interoperability of electronic devices and systems.

Digital convergence: The convergence around digital standards allowing interoperability of digital technologies on a global scale.

However, the picture is not entirely rosy. Many people are worried that this type of CONVERGENCE could enable governments (or other groups) to take greater control over people, and about the dangers if information falls into the wrong hands. In many countries there is continuous debate and negotiation over what information the government or other bodies should be allowed to collect about individuals, what purposes this information can be used for, and how its integrity can be protected.

How business information systems relates to other academic disciplines

Not surprisingly, since information systems are essential in so many ways for modern organisations and individuals, this area is very interdisciplinary in nature. Business students will be familiar with some of the disciplines with which it overlaps, from other modules in their course.

To understand how business information systems relates to other disciplines, we can view it as being made up of a number of interdependent areas of interest. We look at all of them in this book, and they are also shown in Figure 1.1.

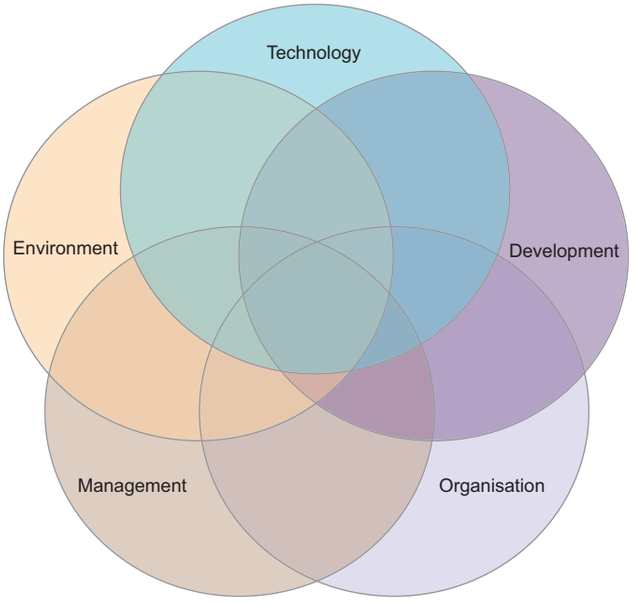


Figure 1.1: *Elements of the field*

Environment: Anything outside the organisation from which it receives inputs and to which it passes outputs.

Management: A key control process for organisations.

- **Environment**. To understand the value of information systems to organisations we need to understand the economic, social, political and physical environment within which the organisations using them operate.
- **Organisations.** One of the main focuses of the book is on how modern information systems contribute to organisational performance: supporting traditional organisational forms, and leading to new ones being introduced.
- **Management.** The promise of the technology is only achieved when managers find effective ways of managing information, information systems and ICT in their organisations.
- **Technology.** Of course, those studying this field need to know something about the technology involved. This includes both the use of the technology, and the principles that underlie it.
- **Development.** This concerns appropriate ways of constructing information systems that support human activity, particularly decision making.

This way of dividing the subject area enables us to consider more clearly how business information systems overlaps with five other established disciplines (Figure 1.2). These are known as **reference disciplines** (Keen, 1980), since they provide us with major frames of academic reference.

- **Economics**, **politics** and **sociology** overlap with the subject through its emphasis on context, particularly the social and economic effects of information systems and ICT.
- **Organisational theory** (and particularly **organisational behaviour**) overlaps with the subject through its emphasis on organisational issues.
- **Management science and operations management** overlap with the subject through its interest in appropriate management.
- **Computer science** overlaps with the subject because of the need for KNOWLEDGE about the workings of contemporary ICT.
- **Software engineering** overlaps with the subject through its interest in the process of developing information systems.

Knowledge: Knowledge is derived from information by integrating information with existing knowledge.

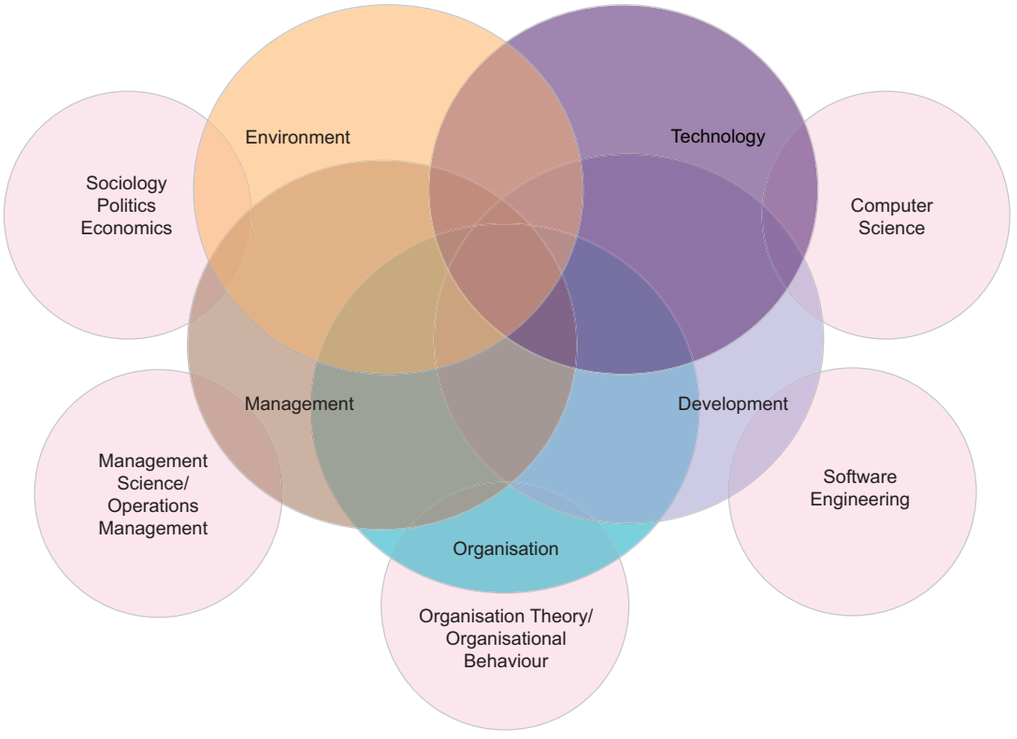


Figure 1.2: *Reference disciplines*

Concept: The idea of significance. The collection of properties that in some way characterise a phenomenon.

Within the area of **business and management** itself (see Chapters 4 and 5), the CONCEPTS of **information** and **system** are both integral and integrating. This means that information systems are critical to understanding contemporary operational practices in marketing, sales, customer relations, production, finance, human resources, procurement and distribution. An understanding of information, information systems and ICT is particularly important to management practice in these areas, so there is a strong argument for placing an understanding of this area at the heart of operating and managing the modern business.

Information systems and value

The idea of *value* is critical to the study of information systems. We can map some of the many shades of meaning of 'value' onto the different contexts we have just outlined:

- the concept of value as the essence of economic systems
- the organisation as a value-creating system embedded within a wider value network
- the human values embedded within information systems (meaning that the design of such systems is a value-laden activity).

Taking value and ICT together leads to questions such as:

- What is the value of ICT to business?
- How do we ensure the value of ICT to business?
- How do we improve the value of ICT to business?

In one sense, these questions are relatively easy to answer. If modern organisations switched off their ICT systems they would fail to operate effectively; many would fail to operate at all. In another sense, the questions are more difficult to answer. Chief executives in many global companies have continually asked questions about the value of ICT. Many billions of dollars has been invested globally in ICT, but companies still find it difficult to put an accurate monetary value on the return to the organisation from this investment.

Typically this is because of the way in which ICT is considered by both business managers and technologists. Both groups tend to focus more on the technology itself than on its

application. But all the value lies *in the application*: the most advanced and brilliantly networked computer system is worthless (except to companies that make or sell the equipment) unless the organisation has a worthwhile use for it.

ICT infrastructure: The set of interrelated ICT systems used by an organisation.

ICT is translated into value through the mediating force of *information*. This means that to ensure that ICT systems have value, organisations must ensure that their ICT INFRASTRUCTURE matches their information needs, which involve activities both inside and outside the individual organisation. Chapter 9 discusses some of the many examples of information systems that have failed in organisations. Sometimes the failure was so bad that it brought down the entire organisation, as happened, for example with the UK Child Support Agency.

Throughout this book we argue that to improve the value of ICT, organisations need to employ good practice in the planning, management, development and operation of their ICT infrastructure. Businesses (and nonprofit organisations) operate in increasingly volatile environments, within which their needs often change; they need to be skilled in adapting the ICT infrastructure to these changing needs.

How this book will help

To summarise, information systems are critical to the modern world: in business, in other sectors, and to individuals as well. It's important to appreciate their importance and to understand their founding principles. This book shows you how to use best practice to ensure that you and your organisation get the most value out of your ICT investment, now and in the future.

The focus here is on the application of information systems *in organisations*, and because this is so intimately tied up with other aspects of organizational management, we look at some of those as well. We introduce a number of key skills that are important not only for information systems professionals, but for general business management. These are intended to provide an appreciation of important approaches, frameworks and techniques in the area.

Models are useful, to help us understand what is going on, and plan how to change it. A number of modelling techniques are used throughout the book. Together, they provide a good grounding in the applications of modelling, especially for the analysis and design of many kinds of business systems.

Overall, this book should enable you to develop an understanding and practical appreciation of information systems. It will serve you well, both in the study of related disciplines and in your working career.

Organisational informatics

Informatics: The study of information, information systems and information technology applied to various phenomena.

The term 'information systems' is used in a number of different ways, so let us expand on the brief definition we gave at the beginning of this chapter. It can refer to:

- **A product**: a system of communication between members of a group of people. (These days many communication systems involve technology, although there are ways of communicating without technology too, of course, and have been for thousands of years.) For example, an orders and sales processing system is an information system, used to communicate between members of the selling organisation, and between them and their customers. In modern settings such a system of communication is likely to use various elements of ICT. So a sales orders processing system within some organisation is an information system designed to handle and record sales orders from customers.
- **An academic field of study**. Over the last three decades the field of information systems has become established in many centres of higher education around the world, in both teaching and research.
- **An area of industrial practice.** Many organisations across the world work in planning, managing and developing information systems for other organisations. Many of the largest and best-known business consultancies do a lot of their work in this field. Some organisations in other fields, which originally developed their expertise in setting up their own systems, also sell their know-how to others.

Informatics field: The academic study of informatics issues and problems.

It can be confusing, though, to use the same term in each of these different contexts, so in this book we use a set of terms with distinctive meanings:

- Here, **information system** refers to a system of communication between people, within and between organisations.
- **ICT system** is the term we use for technology: hardware, software, data and communication technology designed to support an information system.
- **Informatics** is our term for the related academic discipline and area of professional activity.

Informatics is a particularly useful term. It covers a broader area of interest than simply information systems. It considers the place of information in communication and action, and the use of various artefacts or technologies as tools within this process: in short, it takes in information systems, ICT systems, the processes that concern them and the information that flows between them. It's also a term that is often used in relation to specific *applications*. For instance, health informatics, bio-informatics and chem-informatics are the terms for the application of information, information systems and ICT systems to processes within the health sector, biology and chemistry respectively.

The main focus of this book is on applications in organisations: by which we mean not just businesses, but a range of private sector, public sector and voluntary sector organisations. The study of applications in this context is known as **organisational informatics**. This is a wider term than the related **business informatics**. So from now on, 'informatics' is used as shorthand for organisational informatics, which is broadly used as a synonym for the discipline of information systems.

Informatics is very much a *systemic* discipline. It is interested not in ICT, information systems, information and organisations in isolation, but in their *interaction* and its effects. To make sense of systems of any kind it is useful to create models which illustrate the interactions of their components, interdependencies, and their effects. This book is structured around a core model (which we shall encounter shortly) which captures the key elements of informatics as well as the interaction between these elements. In essence, this model provides a map of the entire area, which we call here the **informatics domain**.

Our model is founded on the premise that the effects of an information system for an organisation emerge over time, as the result of interaction of the system and its organisational context. We need to understand these effects in order to design and run systems that provide benefits for the organization, and avoid the hazards that information systems are sometimes prone to (Silver, Markus and Beath, 1995).

The informatics domain model forms the basic structure for the book. Each of the component elements contained in the model is covered in much more detail in one chapter of the book. So you might not understand all the concepts introduced here right away, but you can explore them throughout the book, and follow links to further chapters at any time if you want to delve into one particular aspect. This chapter not only introduces the model, it acts as a summary and reference for it.

Introducing the informatics domain model

Value: A general term used to describe the outputs from an organisation.

The model begins with the key context for the application of information systems: the organisation itself (see Figure 1.3). Any organisation is considered as a series of interdependent activity systems. When these are combined in action they produce value of some form (see Chapter 2). VALUE is the key flow between an organisation and actors in its environment (see Chapter 7). The value produced by a business organisation is typically the products or services it provides for its customers. (Of course, nonprofit organisations have value too, although there it takes different forms.) The organisation also receives value from other actors in its environment, such as its suppliers or partners. Hence, a business organisation is a value-creating system which interacts with a wider value network that makes up its environment.

Any activity system relies on an information system. An information system (see Chapter 4) is a system of communication between a group of people, which is used by the group to coordinate its members' actions. On the basis of information supplied by the information

system, people in the group decide what actions to take (see Figure 1.4). So information is essential to the effective control of organisational action.

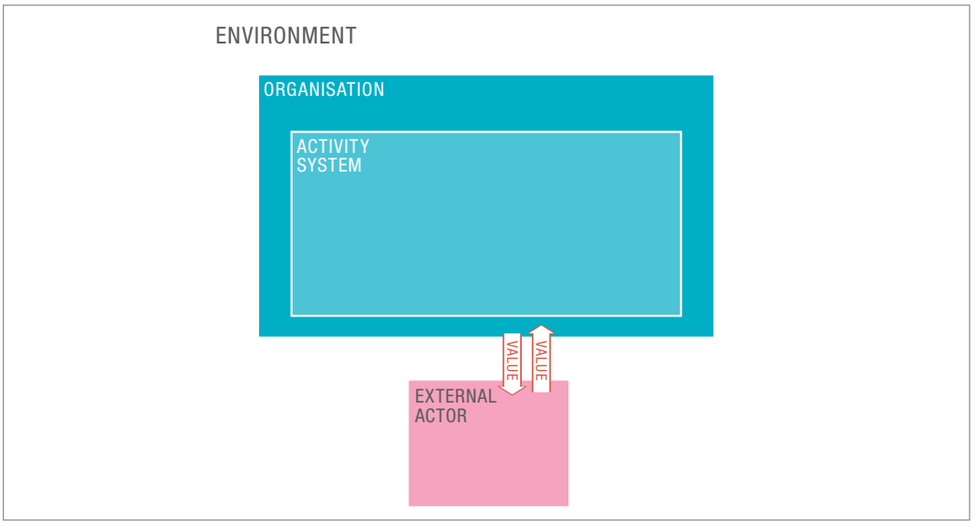


Figure 1.3: *Organisation, activity systems and environment*

Datum: A unit of data.

Information is data interpreted in some context (see Chapter 3). The context for business information is the wider activity system. A DATUM – that is, a unit of data – is one or more symbols used to represent something. Data is supplied to the information system by its ICT system (see Chapters 5 and 6). The ICT system processes business data, such as records of sales orders, and produces information, such as the total number of sales orders received in the last quarter, for the purpose of business decision making (see Figure 1.5).

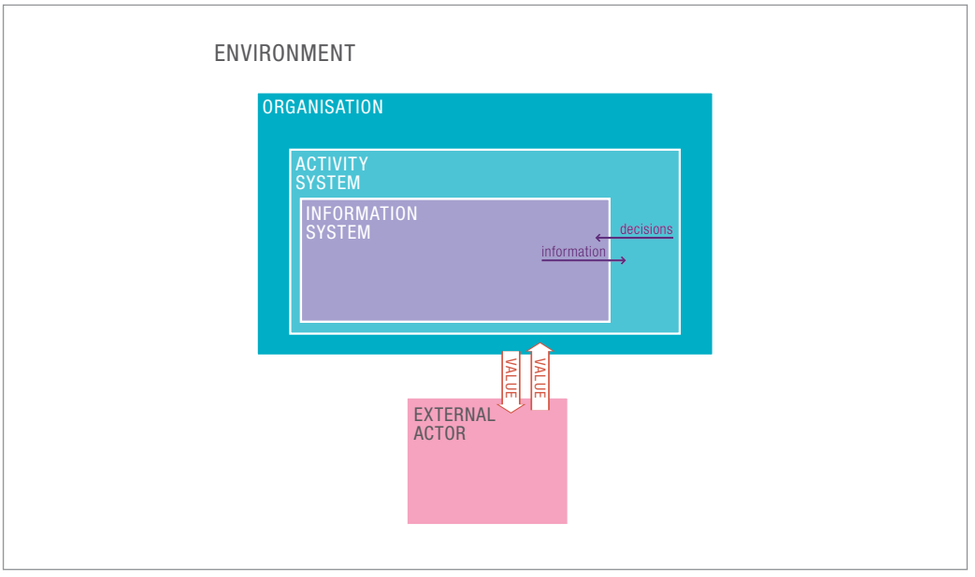


Figure 1.4: *Information systems*

eBusiness: Electronic business. The conduct of business using information and communication technology. A superset of eCommerce.

eCommerce: Electronic commerce. The conduct of business commerce using ICT such as that supporting the Internet.

ICT (see Chapters 5 and 6) consists of hardware, software, data and communication technology used in support of an information system. Traditionally, ICT has been used to improve the operation of internal activity systems in organisations. More recently, it has also been used to improve activity systems between the organisation and its wider value network. Central to this is EBUSINESS and ECOMMERCE (see Chapter 8). eCommerce refers to the use

of ICT to enable activities within the wider value network. We use eBusiness as a term for the use of ICT to enable both internal and external activities (see Figure 1.6).

Business systems have to be developed. By this we mean that a clear case has to be made for their creation, the key requirements of the system have to be determined and represented, a design has to be produced for the system, and the system has to be built and implemented. Since the focus of this book is business information systems, we focus on these activities in a business context. All these activities (see Figure 1.7) are stages within what we refer to as the **information systems development process** (see Chapter 12).

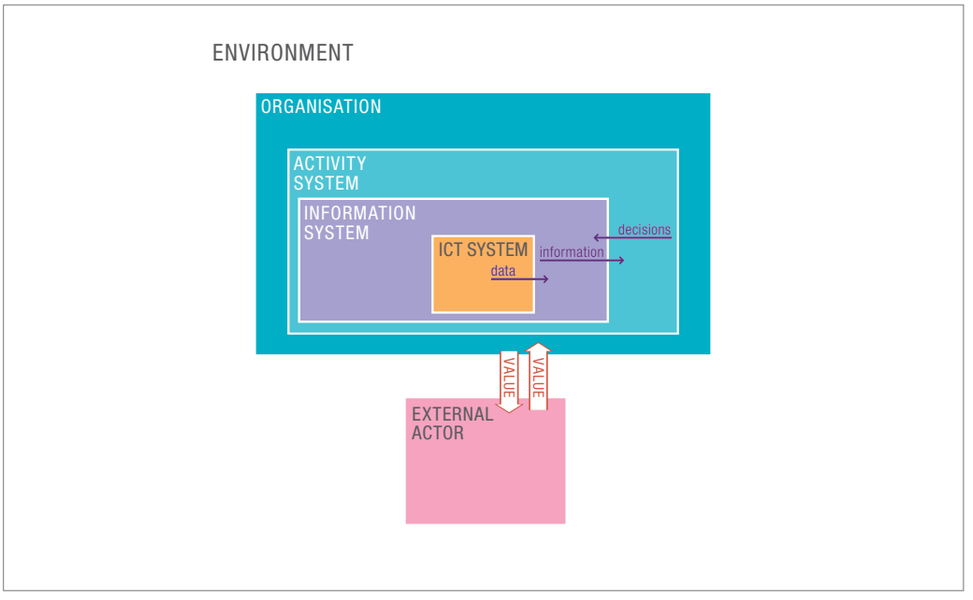


Figure 1.5: *Data and information*

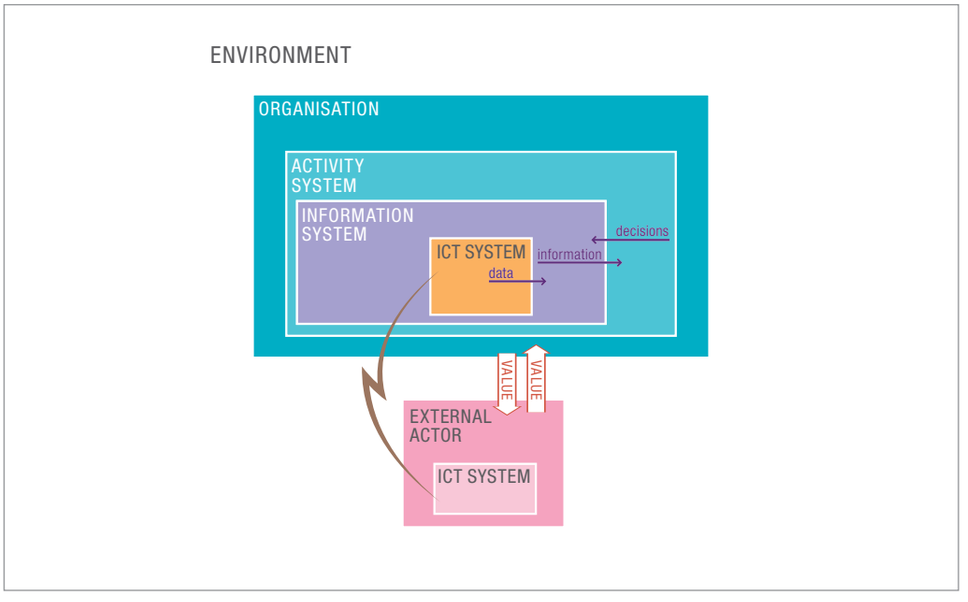


Figure 1.6: *ICT systems and infrastructure*

After an information system is introduced, it begins to have effects on the organisation (see Figure 1.8). We can divide these into **first-order effects**, which concern issues of use, and **second-order effects**, which concern the impact of the information system on the activities of individuals, groups and the organisation as a whole (see Chapter 9).

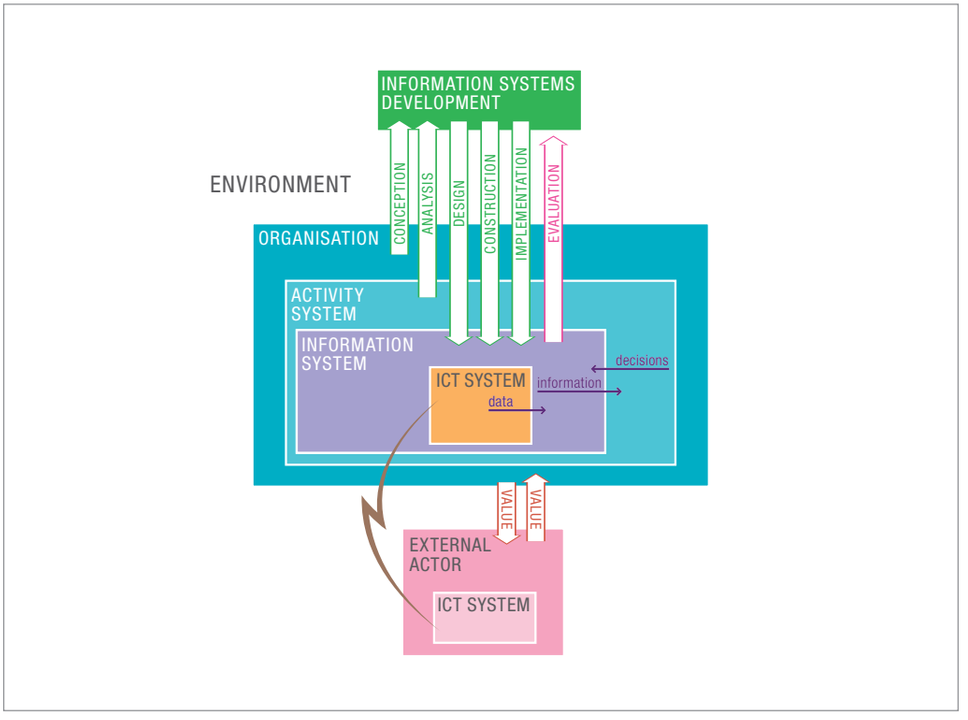


Figure 1.7: *Information systems development*

Peter Drucker's 'The theory of the business' (1994) attributes organisational success to three factors:

- businesses understanding their external environments
- businesses undertaking missions (developing strategies) consistent with their external environments
- businesses developing the core competencies needed to accomplish their missions.

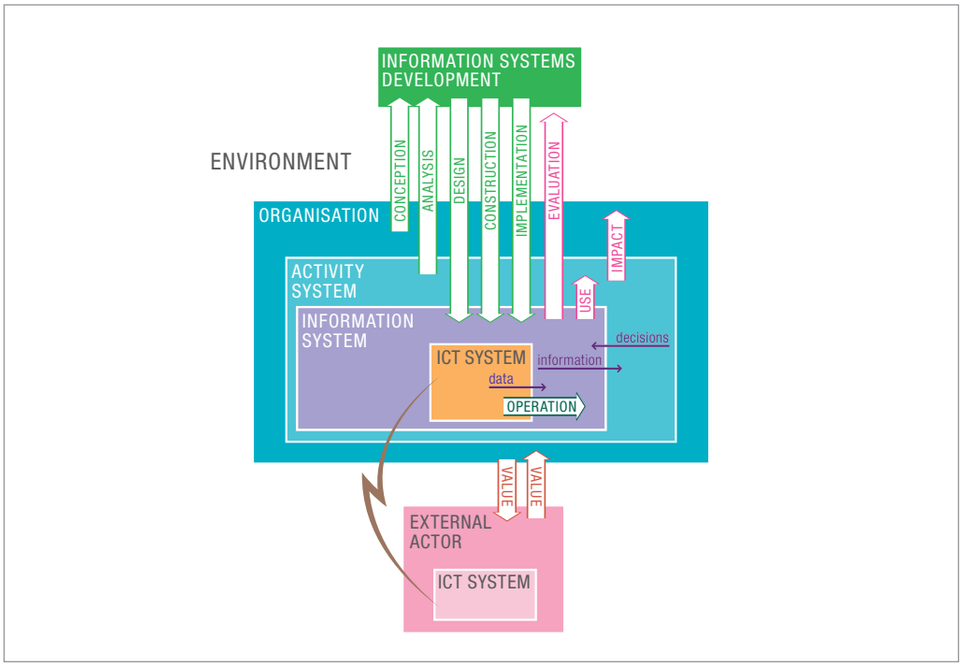


Figure 1.8: *Use and impact*

Since information is central to the modern organisation, organisational success depends not least on information systems success, and this calls for effective informatics planning and management. Planning and management (see Figure 1.9) are necessary to ensure that information systems are aligned with organisational strategy (see Chapter 10).

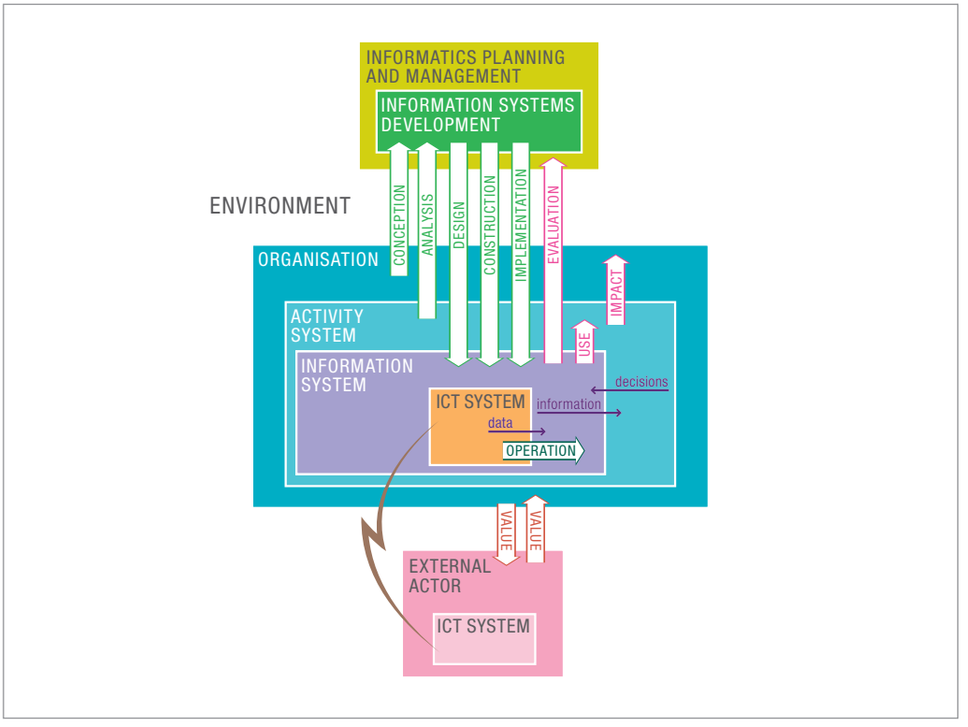


Figure 1.9: *Planning, management and operations*

The rest of this chapter introduces key elements from this model, and shows its relevance by applying it to a case study of a small company that is part of a multinational organisation. First we describe the position the organisation found itself in during the mid-1980s, with little use of ICT, then we consider how and why the organisation developed its first ICT system, and what form this took. It had some early success with the system, and this led to the gradual rollout and extension of an integrated INFORMATICS INFRASTRUCTURE throughout its parent organisation. But that was less easy, and there are still management problems with which it is grappling today.

Informatics infrastructure: The sum total of information, information systems and information technology resources available to the organisation at any one time.

Organisation and environment: an illustrative case

Goronwy Galvanising is a small company which specialises in treating steel products such as lintels (beams), crash barriers and palisades (fenceposts) produced by other manufacturers. (Although the name is fictionalised it is based on a real company.) It is a subsidiary of a large multinational, Rito Metals, whose primary business includes the extraction and processing of base metals such as zinc and the PRODUCTION of various metal alloys. Rito Metals has ten galvanising plants similar to Goronwy across Europe. The Rito Metals head office coordinates administrative activities such as finance and human resources, but each plant manages its own operational activities in areas such as sales and logistics.

Production: The set of activities concerned with the creation of goods and services for human existence.

Put simply, galvanising involves dipping steel products into baths of molten zinc to provide a rustproof coating. In the trade, untreated steel products are known as 'black' and treated ones as 'white'. The galvanising process causes a slight gain in weight.

As much as 80 per cent of Goronwy's business (in the mid-1980s, when this case study starts) was with one major regular customer, Blackwalls steel, with the rest coming from other customers on a more irregular basis.

Goronwy's staff comprise a plant manager, a production controller, an office clerk, three shift foremen and 50 shop-floor workers. The plant remains open 24 hours per day, seven days a week, so most of the production workers, including the foremen, work shift patterns.

We can think of Goronwy Galvanising as a system, as indeed we can any organisation. A system can be defined as a coherent set of interdependent components that exists for some purpose, has some stability, and can usefully be viewed as a whole. Systems of interest to informatics are generally referred to as OPEN SYSTEMS. These are systems that interact with their environment. So we can model them using an **input–process–output** model, of the organisation within its environment.

Open system: A system that interacts with its environment.

- By the **environment** of a system we mean anything outside the system that has an effect on the way the system operates. We usually identify a number of agents or actors with which the system interacts.
- The INPUTS to the system are the resources it acquires from agents in its environment.
- The **outputs** from the system are those things that it supplies back to agents or actors in its environment.
- The **process** of the system is that set of activities that transform system inputs into system outputs.

Input: The elements that a system takes from its environment.

Physical flow: This represents the flow of tangible or physical goods and services such as foodstuffs and automobiles.

Figure 1.10 illustrates at a high level the component, physical elements of Goronwy Galvanising as an open system. Its main inputs are black products and its main outputs white products. Both these PHYSICAL FLOWS are represented as broad arrows on the diagram. The process, or **transformation**, is the galvanisation. Along with the physical flow of steel products there is a corresponding information flow, consisting of documents which detail deliveries and dispatches of material. These are represented on the diagram as narrow arrows with document symbols.

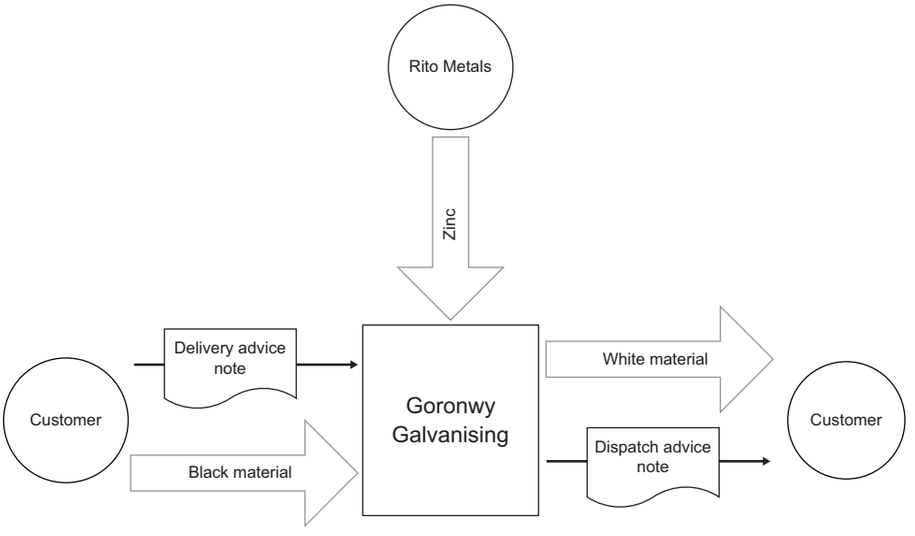


Figure 1.10: *Goronwy Galvanising as a system*

The main actors in Goronwy's environment are its suppliers and customers. There are two kinds of supplier, one of which is also its customer: the steel fabrication firms – Blackwalls and the smaller customers – that provide black goods to be galvanised. The second supplier is Rito Metals, which supplies zinc as raw material for the galvanising process.

From this perspective, we can see the overall purpose of the organisation as being to create value, through the process or transformation at its core. For commercial organisations that value becomes concrete when they sell their products or services and make a profit. We can

also think of the organisation as part of a **value network**, in which there are flows of value between the organisation and the actors in its environment (its customers and suppliers). So as well as creating value itself, Goronwy adds value to the outputs of other actors in its value network. Steel producers, steel fabricators and zinc producers are all part of Goronwy's value network.

We shall encounter the concept of system in a number of different ways in this book. In a sense, it acts as a unifying theme. For example, we discuss and make distinctions between:

- a system of activity (an activity system)
- a system of communication (an information system)
- a system of technology (an ICT system).

In the sections that follow we investigate each of these in turn.

Activity systems

We can view an organisation as a number of interdependent human activity systems (or **activity systems** for short). An activity system is a social system, sometimes referred to as a 'soft' system. It consists of a logical collection of activities, processes or tasks performed by a group of people in pursuit of a goal. The precedence or order of activities is normally critical, as this determines the flow necessary for the coordination of work.

For Goronwy, the main activity systems consist of processes for:

- receiving unfinished products
- galvanising these products
- dispatching finished products back to customers.

The 'black' material – steel fabricated products of various forms – is delivered to Goronwy on large trailers in bundles referred to as batches. It is unpacked by an inbound logistics operative and checked for discrepancies or problems that would make it unsuitable for galvanising. If satisfactory, the products are then galvanised and left to dry. The white material is then checked again, and any unsatisfactory material is regalvanised. Satisfactory white material is bundled on trailers and dispatched back to the customer. The activity system is shown in Figure 1.11, with dotted lines indicating the precedence of each activity in the system. In other words, the dotted lines indicate the workflow through the activity system.

Control: The mechanism that implements regulation and adaptation in most systems.

Feedback: The way in which a control process adjusts the state of a system being monitored to keep it within specified limits.

In any activity system there will also be some form of embedded CONTROL. Control is the idea that any system (including social systems such as organisations) needs to be regulated in some way, and must also be able to adapt to changes in its environment. Regulatory control is typically implemented through a process known as FEEDBACK, in which information is collected from a monitored process and is compared against defined levels of performance for the system. This information then triggers actions designed to maintain the system's performance within given bounds.

Figure 1.11 includes two regulatory control processes. Each one consists of a sensing or monitoring activity, a decision-making activity (represented by a triangle) and an effecting activity. The first control process checks to see that black material is of a suitable form to be processed. If the material is satisfactory it is passed on to galvanisation. If it is not satisfactory, it is returned to the customer ungalvanised. The second control process checks to see that galvanisation has operated effectively on particular batches of steel products. Therefore, in both control processes, information and decisions will trigger appropriate action to ensure that the organisation performs effectively, such as returning damaged unfinished products to the customer or regalvanising steel products before dispatch.

Information systems

Information system: A system of communication between people. A system involved in the gathering, processing, distribution and use of information.

Every activity system relies on an associated INFORMATION SYSTEM: that is, a system of communication between people. Information systems are systems involved in the gathering, processing, distribution and use of information. In this way they support human activity.

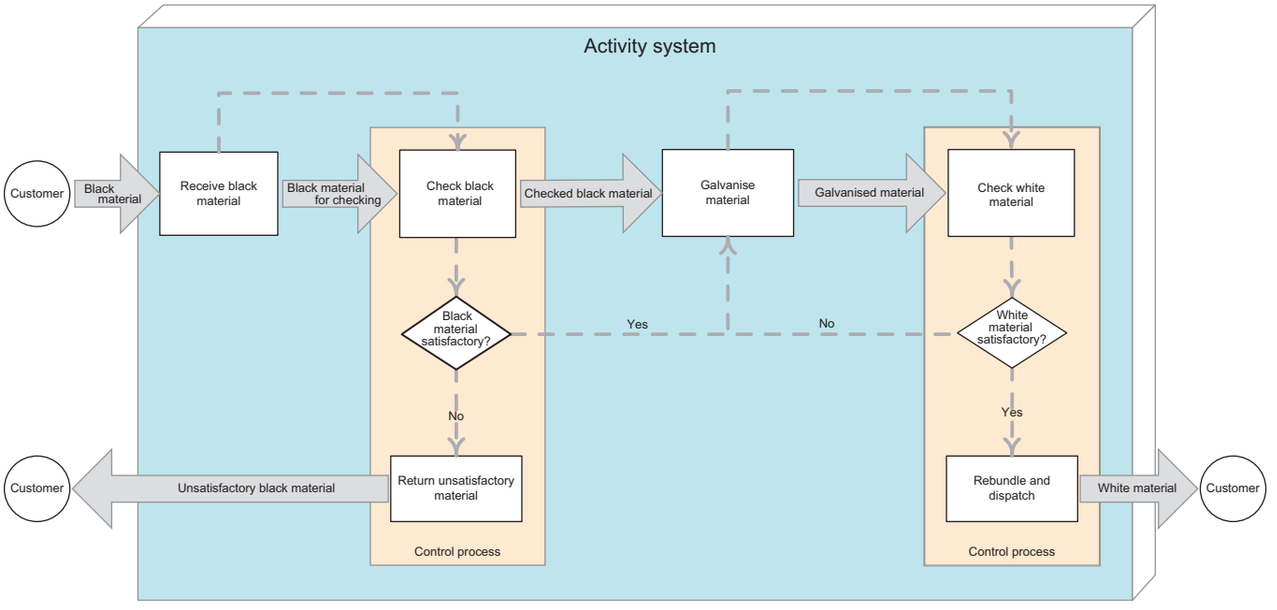


Figure 1.11: *The activity system at Goronwy*

By way of example, let's look first at the information system Goronwy Galvanising used in the 1980s, before mass computerisation. It was a manual information system in the sense that it relied on the flow of documents to inform the coordination of activity.

A trailer arriving from a customer might be loaded with a number of different types of steel product. These were divided into batches, and each batch was labelled with a unique order number. Each trailer was given a delivery advice note detailing all the associated batches on it.

Since Blackwalls was Goronwy's major customer, the delivery advice note system was designed to dovetail with Blackwalls' own internal system. Blackwalls itself generated the order numbers. Figure 1.12 shows a typical delivery advice note from Blackwalls detailing all the black material on a particular trailer. The information about each particular batch is referred to as an **order line**.

Blackwalls Steel Products		Delivery Advice			
Advice no.: A3137	Date: 20/01/1988	Customer Name: Goronwy Galvanising		Instructions: Galvanise and Return	
Order no.	Description	Product code	Item length	Delivery qty	Weight (tonnes)
13/1193G	Lintels	UL150	1500	20	145
44/2404G	Lintels	UL1500	15000	20	145
70/2517P	Lintels	UL135	1350	20	130
23/2474P	Lintels	UL120	1200	16	80
Haulier: International 5	Received in good order: ✓				

Figure 1.12: *Sample delivery advice note*

On arrival at the galvanising plant the black material was unpacked by an inbound logistics operative and checked for discrepancies with the information on the delivery advice note. There are two major types of discrepancy:

- A **count discrepancy**, between the number of items delivered and the number indicated on the delivery advice note.
- A **non-conforming black discrepancy** arises when some of the material is unsuitable for galvanising. For instance, a steel lintel might be bent or the material be of the wrong type.

The operative would note both kinds, by making a comment in the appropriate box on the delivery advice note.

When all the material had been checked, the delivery advice note was passed on to the production controller who, with the office clerk, copied by hand all the details on the delivery advice note, including any discrepancies, to a job sheet. A separate job sheet was filled in for each order line on the delivery advice note (a sample is shown in Figure 1.13).

Job Sheet		Job No.: 2046			
Order no.	Description	Product code	Item length	Order qty	Batch weight
13/1193G	Lintels	L150	1500	20	145
Count discrepancy	Non-conforming black	Non-conforming white	Non-conforming no change		
Galvanised	Despatch no.	Despatch date	Qty returned	Weight returned	
Y					

Figure 1.13: *Sample job sheet*

The job sheet was passed down to the shop floor of the factory, where the shift foreman used it to record details of processing. Most jobs passed through the galvanising process smoothly. The steel items were placed on racks, dipped in the zinc bath and left to cool. The site foreman then checked each job. If all items had been galvanised properly he put a Y for yes in the box on the job sheet, and passed it back to the production controller.

Occasionally, some of the items were not galvanised properly. They were classed as non-conforming white, and also noted on the job sheet (and typically scheduled for regalvanising).

When the shop floor had treated a series of jobs, the production controller issued a **dispatch advice note** and sent it to the outbound logistics section. Workers in this section used the information on it to stack the white material on trailers – one trailer to a dispatch advice note – ready to be returned to the manufacturer.

The discrepancies meant there was not a one-to-one correspondence between the delivery advice notes and the dispatch advice notes, so the production controller needed to record the separate dispatches associated with a delivery on the job sheet. You can see how this worked from the typical dispatch advice in Figure 1.14, where the final order, 23/2474P, had not yet been delivered in full.

Figure 1.15 is a diagram of the entire information flow through the system. This information or document flow parallels the flow of work or activity through the system, so it shows both physical transformation processes and information-handling activities. The open boxes represent information stores, places where records such as delivery notes were kept.

Information

After this first introduction to information systems, let's step back and take a look in more detail at the idea of information itself.

Delivery notes, dispatch notes and job sheets are all **information elements** within the information system: they flow through the system. Employees use the information on these documents to make decisions: in Goronwy's case, for example, what material to galvanise. They then act on the basis of their decisions. If the information is incorrect, the wrong decisions will be made, and the process will not perform effectively. Information – and more particularly, good-quality information – is therefore essential for the effective coordination of activity. Without the information recorded on delivery notes, dispatch notes and job sheets it would prove difficult to coordinate the work of inbound and outbound logistics staff with shop-floor staff galvanising material. The same is true of the relationship between information

and systems on a more general level: all systems rely on the provision of accurate information in order to operate control processes effectively.

Goronwy Galvanising		Dispatch Advice					
Advice no.: 101	Date: 22/01/2003	Customer Name and Address: Blackwalls					
Order no.	Description	Product code	Item length	Order qty	Batch weight	Returned qty	Batch weight
13/1193G	Lintels	UL150	1500	20	145	20	150
44/2404G	Lintels	UL1500	15000	20	145	20	150
70/2517P	Lintels	UL135	1350	20	130	20	135
23/2474P	Lintels	UL120	1200	16	100	14	82
Driver:	Received by:						

Figure 1.14: *Sample dispatch advice note*

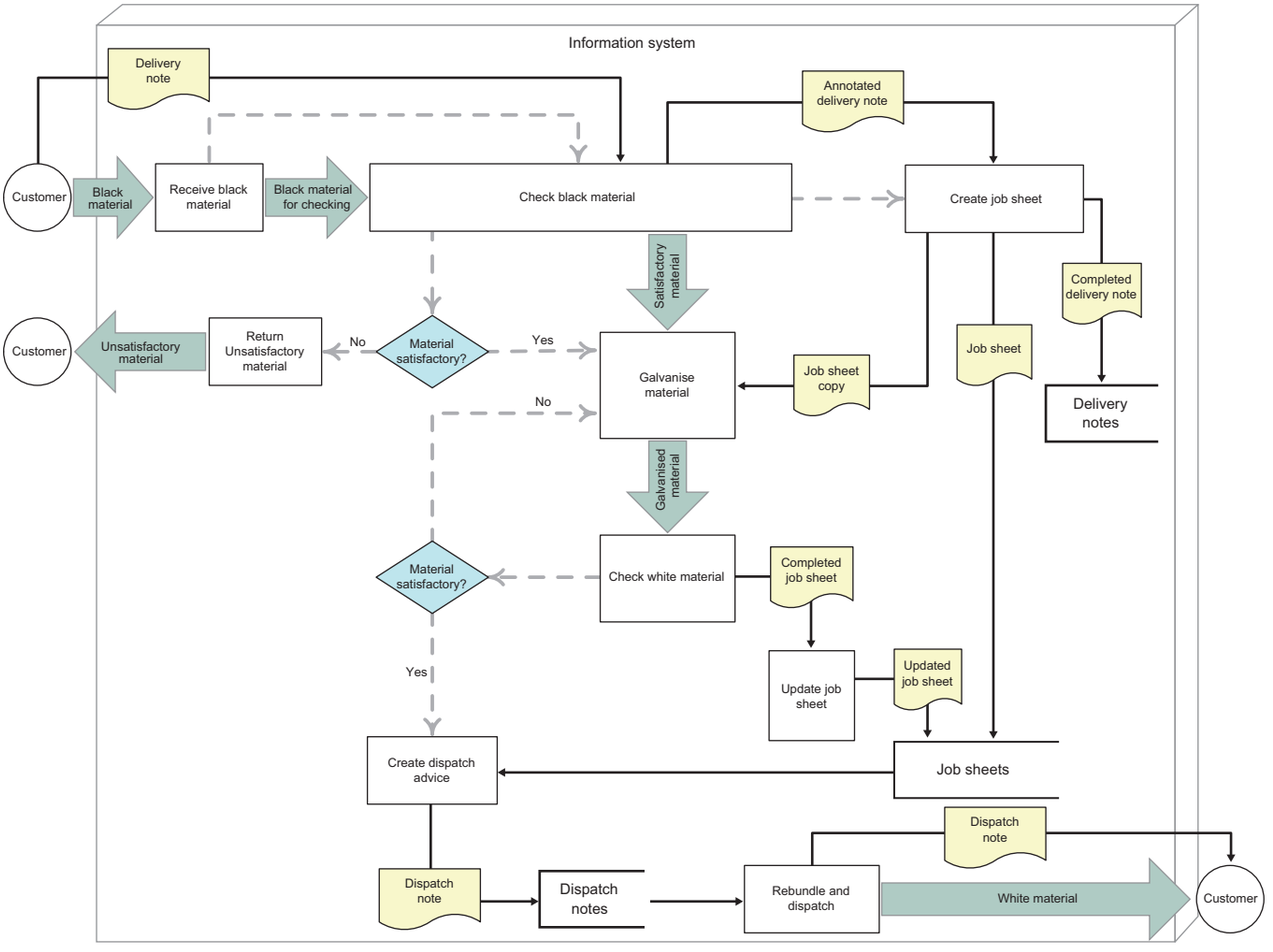


Figure 1.15: *The information system at Goronwy*

Information therefore supports human activity, in the sense that it enables decisions to be made about appropriate actions in particular circumstances. Decisions and decision making lie between information and action, and are a critical aspect of any activity system. In this sense, management can be seen as a control process in organisations. Management is

an activity system that controls other operational activity systems. The primary activity of management is making decisions concerning organisational action.

Effective management decision making relies on three interrelated information-handling activities:

- Effective definitions of the performance of an activity system. This means turning the defined purpose or purposes of the activity system into a defined set of performance measures.
- The construction of effective performance management systems for managerial activity. This means establishing clear ways of establishing the performance of operational activity systems against performance measures.
- The collection and processing of information from operational activity systems. This means establishing effective information systems to capture and manipulate the information required for performance management.

To stay with the Goronwy example, one definition for the performance of this system might be to achieve efficient throughput of materials for the galvanising process. Goronwy could measure this efficiency in a number of different ways. For example, it might measure the amount or proportion of non-conforming black and white material identified over a particular period, such as one month. This would involve keeping track of the amount of non-conforming material, and the total amount of material processed, perhaps categorised by type using product codes, as well as the date of processing. So Goronwy needs an effective information system that captures and processes this type of information.

In defining an information system we not only need to represent the *flow* of information, we need to model the *structure* of information, particularly the information of relevance to decision making. For this purpose we need an **information model**. There is a sample information model for Goronwy Galvanising in Figure 1.16.

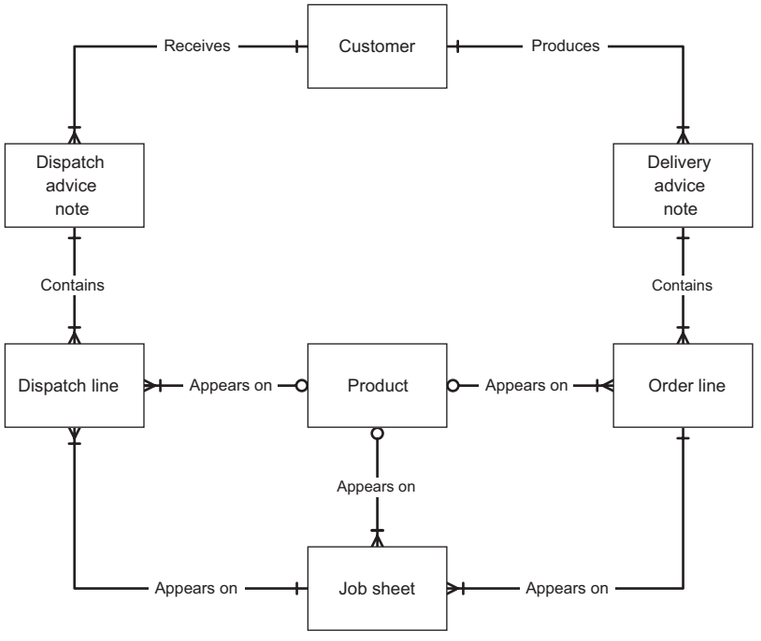


Figure 1.16: *Information model for Goronwy Galvanising*

The boxes on this diagram indicate individual elements of information, and are referred to as **information classes**. The connecting lines indicate an association between information classes. The symbols attached to each line represent a number of rules governing the behaviour of the association between classes: this is explored in more detail in Chapter 3.

For example, a fork or crowsfoot on the end of a line indicates a one-to-many relationship. So a delivery advice note (class) contains (association) many order lines (class). Each order line corresponds to a row or record of information on the delivery advice note in Figure 1.12. An order line represents information about one particular order, such as the product to be galvanised and the quantity of the product in the batch. Therefore, the order line directly corresponds to a batch on an inbound trailer. It also directly corresponds to a job sheet, which may also indicate the non-conforming black material that is returned because of identified discrepancies.

ICT systems

As the Goronwy example has shown, information systems do not need to use modern ICT. But modern ICT makes systems work better and faster, and in today's complex global world, most information systems use it to at least some degree. We can see why by looking at some of the problems with the system Goronwy used in the 1980s:

- Information needs to be shared among a number of people: for Goronwy, they include inbound logistics operatives, production controllers, shift foremen and outbound logistics operatives. So copies of it are needed, and making manual copies is slow and therefore expensive.
- A lot of time was taken transferring information from one type of form to another: for instance, from delivery advice notes to job sheets.
- Every transfer stage is an opportunity for human error to creep in, and this can lead directly to processing errors, which are costly and time-consuming to correct.
- It is difficult to analyse information held manually. Even if it works well for production purposes, it does not provide a good resource for managers who want to collate and analyse it to determine trends such as the throughput of the plant or the productivity of the workforce.

As a result, Goronwy and its parent company looked at moving to an ICT-based system for basic administrative functions. Let's consider what this means in practice.

Technology amounts to a set of artefacts for doing things. ICT is the term for any type of technology used to support data gathering, processing, distribution and use. ICT systems consist of hardware, software, data management technology and communication technology:

Hardware: The physical (hard) aspects of ICT consisting of processors, input devices and output devices.

Input device: A device concerned with the input of data.

Output device: A device that outputs data.

Software: The non-physical (soft) aspects of information technology. Software is essentially programs – sets of instructions for controlling computer hardware.

Programming language: A language for instructing a computer system.

Data management: The set of facilities needed to manage data.

- **Hardware** is the term for the physical aspects of ICT: processors, INPUT DEVICES such as keyboards and OUTPUT DEVICES such as monitors.
- **Software** is the term for the non-physical aspects of ICT. Essentially this means programs: sets of instructions for controlling computer hardware. Types of software include operating systems (such as Windows Vista), PROGRAMMING LANGUAGES (such as Java) and office productivity packages (such as Microsoft Word).
- **Data management technology** consists of artefacts for storing data on peripheral devices such as hard disks. Data are normally stored in databases managed by a database management system (such as Microsoft Access).
- **Data communication technology** consists of programs and devices used to manipulate and transmit data. Communication technology forms the interconnective tissue of ICT, and includes cabling, transmitters and routers. Communication networks between computing devices are essential elements of the modern ICT infrastructure of organisations (see Chapter 8).

ICT systems are technical systems. They are frequently referred to as 'hard' systems in the sense that they consist of an assembly of designed artefacts. But an ICT system is not just made up of hardware: it is an organised collection of hardware, software, data and communication technology designed to support aspects of an information system. It takes data as input, manipulates the data as a process, and outputs manipulated data for interpretation within a human activity system. The relationship between these three types of system is shown in Figure 1.17.

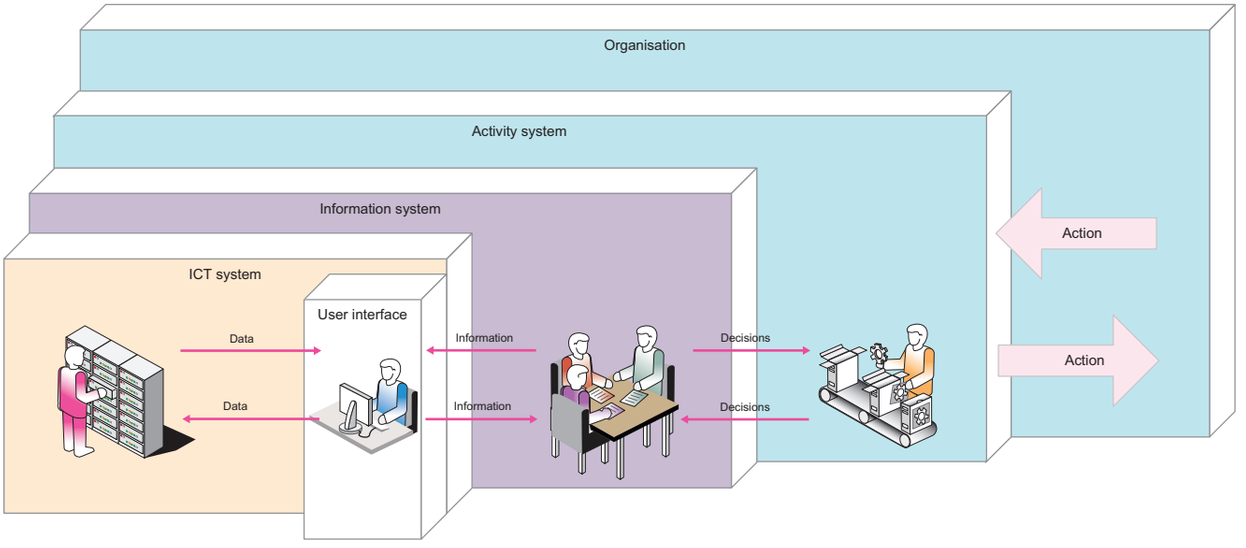


Figure 1.17: *An ICT system, information system and activity system*

Data, information and sociotechnical systems

A **datum** is, as we said earlier, a symbol (or group of symbols) that is used to represent something. (**Data** is its plural.) Since an ICT system deals with manipulating and transmitting data, it is therefore more accurately referred to as a **data processing system**.

Information is *interpreted* data: it consists of data placed within a meaningful context. The use of the term 'information' therefore implies a group of people doing interpretation (for more on this, see Chapter 3). Consider the string of symbols UL150. Taken together these symbols form a datum, but by themselves they are meaningless. To turn these symbols into information we have to supply a meaningful context. We have to interpret them. In the Goronwy Galvanising information system, this group of symbols is a product code identifying a type of steel lintel of a particular length.

Let's look at how Goronwy Galvanising might set up an ICT system. Staff would enter (or input) data that describe the properties of orders on delivery advice notes (such as product codes and quantities). This *data* is then manipulated, by linking it to other data collected (such as discrepancies identified at inbound logistics), to provide *information* on processed orders. This part of the ICT system then supports *human activities and actions* concerned with the effective quality control of raw material into the production process. For instance, the ICT system might identify that two pieces of data do not match. But it would take a human being to interpret this information, and come to the conclusion that a lintel has been lost from a particular order. And it's down to human beings to take *action*: perhaps to return a batch to the customer. So the organisation introducing an ICT system really needs two things; first, a good data and ICT system, and second, human beings who effectively and efficiently make use of the system to ensure that the organisation meets the needs of its customers.

Sociotechnical system: A system of technology used within a system of activity.

The key lesson to be drawn from Figure 1.17 is therefore that many systems in organisations are examples of sociotechnical systems. A SOCIOTECHNICAL SYSTEM is a system of technology used within a system of activity. Information systems are primary examples of sociotechnical systems: they consist of ICT used within an activity system. They therefore span ICT and activity. Part of the human activity will involve the use of ICT systems, through an interface. The information provided by the information system will also drive decision making, leading to further action within the organisation.

The development process

Business case: The case made for the utility of an information system.

In order to justify the investment required to develop a new information system, an organisation must make a BUSINESS CASE for it. It evaluates the investment strategically and assesses its feasibility. The organisation also attempts to estimate the degree of **risk** associated with the **development project.** This phase of information systems development is known as the **conception phase.**

Generally speaking there are three ways in which human activity and ICT can be used in combination within a new information system:

- ICT can be used to **support** aspects of an existing information system. This implies that some aspects of the information system are computerised but that the activity system supported remains largely unchanged.
- ICT can be used to **supplant** aspects of an existing activity system and its associated information system. This implies that certain aspects of both the activity system and the information system are automated, in the sense that the logic of the ICT system replaces some aspect of human decision making and action.
- ICT can be used to **innovate**, creating new activity systems for organisations. This is the most radical use of technology.

Let's go back to Goronwy Galvanising. Its managers drew up a business case for a new ICT system which outlined many of the problems with the existing manual information system. They decided to keep the existing activity system much as it was, and to base the design of the associated ICT system closely on it. They chose this **support** option because there was a low risk of failure in the development effort.

Systems analysis: The part of the development process devoted to eliciting and representing the requirements for systems.

If the business case for a new information system is made successfully, then the development process progresses to the SYSTEMS ANALYSIS phase. This involves identifying and specifying requirements for the new information system. These typically describe the **functionality** of the information system: that is, they concentrate on what an information system should be able to *do*.

For instance, a core part of the functionality for Goronwy's system involved capturing, storing and manipulating data associated with the receipt of orders from customers. Another part was a function for reporting regularly on the number of orders from particular customers and the amount of non-conforming material returned.

Systems design: The part of the development process devoted to designing the functionality of systems.

Once the required functionality has been identified, the next development phase is SYSTEMS DESIGN. This is the process of planning the shape of the information system to meet the requirements established by the earlier analysis. If the aim is to use ICT to supplant an existing system or to innovate, then it is necessary to jointly design an ICT system and its associated activity system. In other words, the designer does not only need to consider the shape of software, hardware, data and communication, they also need to design new forms of work to be used with the new ICT. But when the aim is to use ICT to support existing ways of doing things, the focus of design is primarily on the shape of the ICT system alone. This is what we focus on in the rest of this section.

We can think of an ICT system as consisting of three interdependent subsystems or layers for which designs need to be formulated (see Figure 1.18):

- a data management layer
- a business layer
- an interface layer.

The data management layer

Database: An organised pool of logically related data.

Since ICT systems are essentially data processing systems, they rely on a core repository: somewhere to keep the data used in the system. This repository is normally referred to as a DATABASE, and is controlled by the **data management layer**. The design for the structure of the database at the heart of the ICT system is referred to as a **data model**. Essentially, this data model defines what data is stored within the system and in what form.

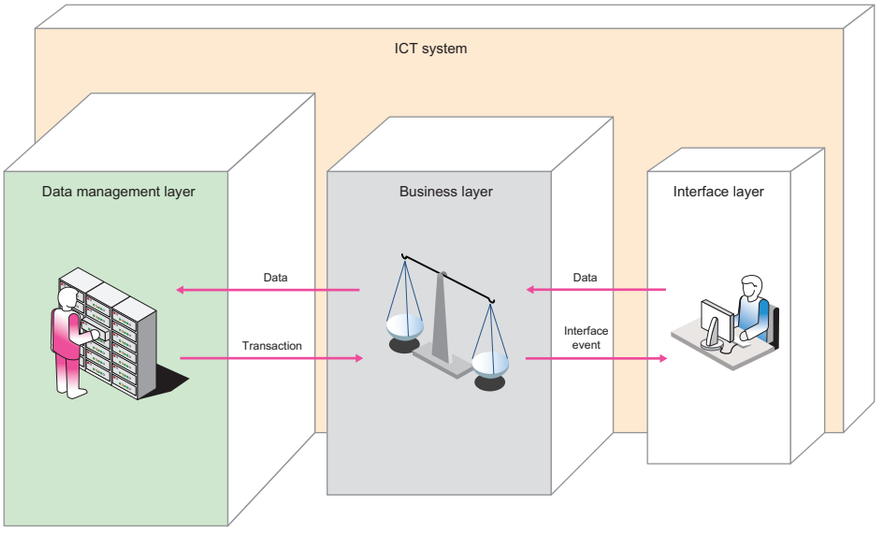


Figure 1.18: *Layers of an ICT system*

For Goronwy, the structure of data might be defined as:

Customers (Customer name, Customer address, Customer telephone no.)
DispatchAdvices (Dispatch no., Dispatch date, Customer name)
DeliveryAdvices (Delivery no., Delivery date, Customer name)
Job-sheets (Job no., Order no, Count discrepancy, Non conforming black, Non conforming white, Non conforming no change)
Products (Product code, Product description, Item length)
Order lines (Order no., Delivery no., Product code, Order qty, Order weight)
Dispatch lines (Order no., Dispatch no., Returned qty, Returned weight).

These definitions are derived directly from the information model represented in Figure 1.16. They act as a design shorthand for specifying data structures in this database, such as *Customers* and *Dispatches.* Each data structure is a collection of data elements, and each data element consists of a set of data items. A sample of the data that might be entered into 'Order lines' is shown in Figure 1.19. In this example, *OrderNo* and *DeliveryNo* are examples of data items. Each row of the TABLE represents a data element. Each data element is identified by a key data item: in this example, the key is the value associated with an *OrderNo*, and such keys are underlined in the data structure definitions above.

Table: The major data structure in the relational data model.

Data structure

Order-lines

Order No.	Delivery No.	Product Code	Order Qty	Order Weight
13/1193G	A3137	UL150	20	145
44/2404G	A3137	UL1500	20	145
70/2517P	A3137	UL135	20	130
23/2474P	A3137	UL120	20	180

Data element

Data item

Figure 1.19: *Order lines data structure*

The business layer

The business layer of a typical business ICT application consists of three interrelated elements: transactions, business rules and update functions.

Transactions

A transaction changes a database from one state to another. There are four major types of transaction activities associated with a database, collectively referred to as CRUD:

- **Create** transactions create new data elements within the data structures of a database (more on this in Chapter 6). For example, in Goronwy's new ICT system, a 'create' transaction might be used to enter a new order line against a particular delivery advice.
- **Retrieval** (or **Read**) transactions access data contained within the data structures of a database, and are often called query transactions. In Goronwy's new ICT system a 'read' transaction might be used to assemble a list of the order lines appropriate to a particular delivery advice.
- **Update** transactions cause changes to values held within particular data items of data elements in a database. In Goronwy's new ICT system an 'update' transaction might be used to change the value OrderWeight associated with a particular order line.
- **Delete** transactions erase particular data elements. In Goronwy's new ICT system, a delete transaction might be used to remove a particular order line from the database.

Business rules

A considerable amount of the functionality of an ICT system is taken up with **business rules**. These are found in both the business layer and the data management layer. They ensure that the data held in the data management layer remains an accurate reflection of the activity system it represents. In other words, the data held in an ICT system should display integrity; it should accurately reflect the state of its activity system. In the case of Goronwy, the data stored in the data structure *jobs* should accurately represent batches of material that either have been successfully processed by the company in the past or are in the process of undergoing galvanisation.

Update functions

Update functions represent units of functionality associated with a particular ICT system. They include both business rules and transaction types. Update functions are triggered by **events**, which are typically activated from the interface or from other update functions. When an update function is activated, transactions are fired at the data management layer of the ICT system and cause changes to the database.

For instance, the Goronwy ICT system might have an update function named *create order line*. When activated, this function would first check that a dispatch advice existed for the order line. Then it would check to see that the order line had not already been entered and that the data to be entered was in the correct format: for instance, that the order number is unique and a correct product code had been entered. If all these checks proved satisfactory, a new row would be entered in the order-lines table.

The interface layer

User interface: The part of an ICT system that allows the end-user to use the system.

The interface layer is responsible for managing interaction with the user, and is generally referred to as the USER INTERFACE, or sometimes as the **human-computer interface**. User interfaces are typically designed by creating mock-ups of menus and screens.

Menus enable the user to navigate between different elements of the interface.

Screens are normally concerned with data maintenance or data retrieval. Data maintenance screens allow the user to enter new data into the system or amend existing data, and trigger update functions which handle create, update or delete transactions as described above. Data retrieval screens allow the user to extract data from the system, and trigger update functions which handle retrieve transactions.

Figure 1.20 shows a proposed design for a menu and data entry screen associated with the Goronwy Galvanising system. The data entry screen permits the user either to enter a new Jobs record or amend an existing Jobs record.

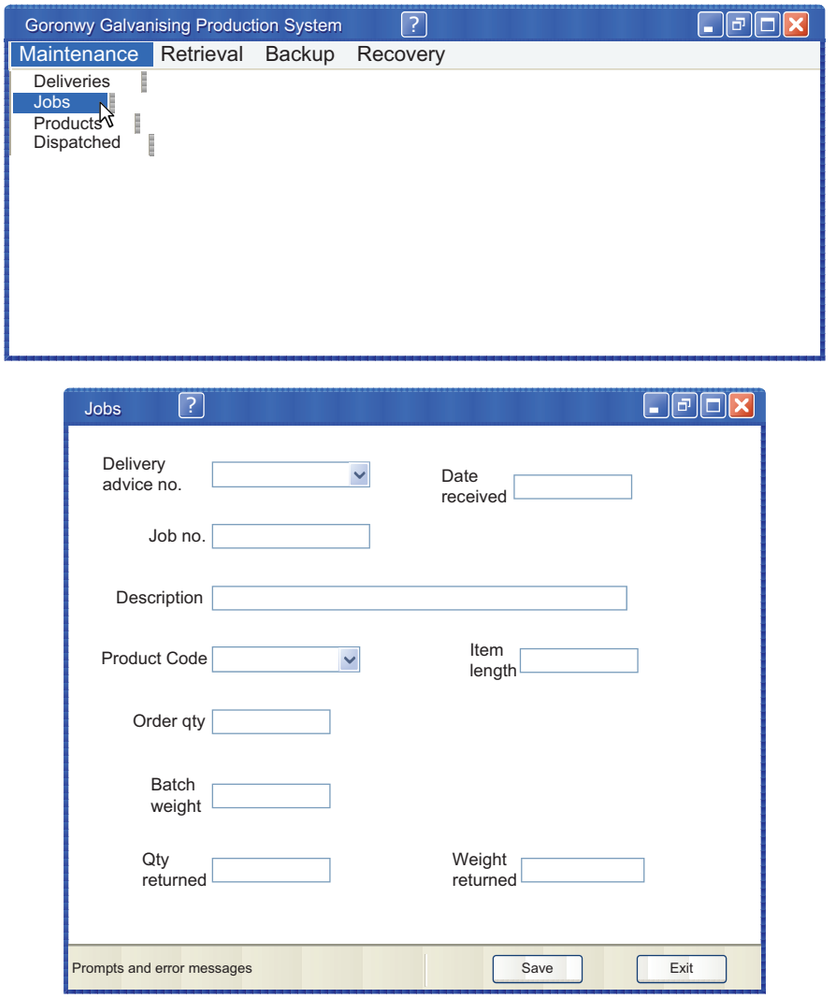


Figure 1.20: *Part of the proposed interface for the Goronwy ICT system*

Systems construction: The part of the development process devoted to constructing systems.

The design or system specification acts as a blueprint for SYSTEMS CONSTRUCTION. Once the ICT system has been designed, the systems construction phase can begin. This involves building the three layers of the ICT system (data management, business and interface) using development tools such as programming languages and database management systems (which are discussed in Chapter 9).

Outsourcing: The strategy in which the whole or part of the informatics service is handed over to an external vendor.

Systems construction may be undertaken either by a team internal to the organisation or by an outside contractor (a form of construction known as OUTSOURCING). Many information systems are now also bought in as packages and tailored to organisational requirements. In the case of Goronwy there were no internal technical staff in the organisation and staff could find no external package covering all the desired functionality, so they outsourced construction to an external vendor.

Systems implementation: The part of the development process devoted to delivering the system into its context of use.

The final phase in the development process is SYSTEMS IMPLEMENTATION. This involves the delivery of the system into its context of use. It can be done in a confident manner by immediately moving from the old to the new system. Alternatively, it can be approached in a cautious way in which the old and new systems are run in parallel for a period to ensure that there is a fallback position. Because Goronwy was new to innovations of this form, it decided to run the manual system in parallel with the new ICT system for two months. At the end of this period it had had no significant problems with the technology, so the plant moved over entirely onto the ICT system.

Operation, use, impact and evaluation

Once an information system is built and implemented it has to be operated and used. The information system will then impact upon its activity system.

Operation

The process of operation not only involves using the ICT system for data entry, retrieval and processing, it also involves enacting procedures to ensure that the system is continuously available as a safe service to use by workers. This means ensuring that security procedures and technologies are in place to protect against unauthorised ACCESS to data. It also means ensuring that both the availability and continuity of the system are assured. Hence, for example, suitable procedures have to be put in place for backing up data and recovering it in the event of system failure.

Access: A precondition for the electronic delivery of services and goods. Stakeholders must have access to remote access devices.

Use and impact

Obviously, once an information system is introduced into an organisation, it begins to be used and to have effects on that organisation. It is important to evaluate closely how it is used and what impact it has, in order to ensure that the objectives for introducing it in the first place are achieved.

Two questions need to be asked:

- **Is the system actually being used?** In reality many systems do not get used; they may be abandoned instead.
- **How is it being used**, and is this in line with what was intended in its original design? If not, is the unintended use positive or negative? For example:
  - A system supporting decision making might also be used as a tool for improving customer relations.
  - A system designed for use by management executives might be used to intimidate subordinates and stifle creativity and innovation.

In order to evaluate impact, we must consider the effect of the information system on individuals, groups and the organisation as a whole (this is examined in greater depth in Chapter 9). For example, it could lead to shifts in the power and influence of certain groups or individuals.

Goronwy tried to minimise the risk associated with the introduction of its new ICT system, but it still led to a number of changes, many of which were unintended. For example, inbound logistics and outbound logistics staff began to assume more responsibility for correct entry of data. The production controller gradually began to assume more of a supervisory role, especially in quality control, and the office clerk did much of the data entry associated with production.

Evaluation

On the surface at least, business organisations invest in information systems for one of three reasons: to do things more efficaciously, to be more efficient or to be more effective. Each type of gain can lead to improved profitability.

Efficacy: A measure of the extent to which a system achieves its intended transformation.

Efficiency: A measure of the extent to which a system achieves its intended transformation with the minimum use of resources.

Effectiveness: A measure of the extent to which the system contributes to the purposes of a higher-level system.

- EFFICACY relates to the core competencies of the organisation. For example, appropriate application of ICT can improve output from those activities that the organisation has to do well.
- EFFICIENCY relates to ways in which ICT can enable better utilisation of resources: for example, increased worker productivity. Efficiency measures relate the inputs to the activity system to its outputs. Hence, improvements in efficiency mean doing the same thing with less resource or doing more with similar resource.
- EFFECTIVENESS in organisational terms means improving the contribution an activity system makes to the organisation as a whole. This normally involves attempts to increase market share or competitiveness (Checkland, 1999).

In order to evaluate the performance of a new information system, a business should assess

whether or not the efficiency, efficacy or effectiveness of the business has been enhanced as a result. If it has, the next question is whether this has led to a financial return greater than the initial investment in the system.

When Goronwy introduced its new system, it found staff were identifying much more non-conforming black and white material, because more quality checks could be made both at inbound logistics and after production. This initially caused problems with customers: they were getting more non-conforming material returned to them, and it took more time to return finished goods. However, after a few months customers began to comment favourably: they saw they were getting a better quality of service. Workers seemed to adapt to higher quality control standards, and over time production times started to decrease because there were fewer problems with both inbound and outbound material. Higher levels of customer satisfaction tend to lead to more orders, from the satisfied customers themselves or from their recommendations to others. So in *efficacy* terms, the ICT system seemed to have a good effect. Both satisfaction levels and order levels can be used to measure this effect.

In terms of *efficiency*, smoother throughput led to greater productivity. This enabled the plant to take on more business, and as a result it became the most profitable galvanising operation within the Rito Metals group for two years running. Hence, Goronwy proved itself to be the most *effective* galvanising plant in the group.

eBusiness and eCommerce

The application of informatics to organisational issues in the private sector is known as electronic business (eBusiness) or electronic commerce (eCommerce). The two are not the same.

eBusiness

An eBusiness is a business in which the use of ICT is critical to supporting both its internal value chain and its external value network. The internal **value chain** consists of the series of activity systems by which the organisation delivers a product or service to its customers. The external **value network** consists of the activities, relationships and flows of value between the organisation and actors in its external environment.

For Goronwy, it is possible to show how the introduction of the new ICT system led to the establishment of its parent company, Rito Metals, as an eBusiness. Goronwy's new ICT system continued in operation for a couple of years, then Rito Metals carried out an evaluation. It concluded that the system had improved the plant's performance in a number of ways, as we have seen. Executives at headquarters made a strategic decision to roll out the ICT system to all ten galvanising plants in the group. As well as wanting to improve the information handling at the plants, they wanted to see them using standard activity systems.

This rollout took a further two years to complete, as some plants found it difficult to adapt. When it was complete it became possible to create a management information system (MIS) at headquarters, fed with data from the individual plant ICT systems. To enable this, a dedicated wide-area communication network was created, linking each plant with headquarters.

Now Rito Metals could carry out more effective strategic management of its galvanising plants, because it was able to obtain an accurate and up-to-date picture of operations and problems at particular plants, making them easier to identify and rectify. In this sense, the MIS enabled more effective control of the separate business units.

In developing an integrated ICT and information systems infrastructure, Rito Metals moved in the direction of becoming an eBusiness, because the use of ICT became critical to supporting its internal value chain.

eCommerce

eCommerce means the use of ICT in value chains within the wider value network, such as supply and customer chains :

- The SUPPLY CHAIN consists of activity systems by which an organisation obtains goods and services from other organisations to enable it to conduct its business.

Supply chain: The chain of activities that an organisation performs in relation to its suppliers.

Customer chain: The chain of activities that an organisation performs in the service of its customers.

- The CUSTOMER CHAIN consists of activity systems by which an organisation distributes value to its customers.

The objective of much eCommerce is the redesign of activity systems with ICT to support electronic delivery of products and services. Such joint organisational and technological change typically involves:

- Investigating and implementing various ACCESS CHANNELS for different organisational stakeholders (such as managers and employees concerned with the internal value chain and customers and suppliers in the wider value network). An access channel consists of an ACCESS DEVICE and COMMUNICATION CHANNEL.
- Constructing front-end ICT to manage interaction with STAKEHOLDERS (such as customers and suppliers working in supply and customer chains)
- Re-engineering or constructing back-end ICT.
- Ensuring front-end/back-end ICT systems integration.
- Ensuring secure stored data as well as secure transactions along communication channels.

Access channel: An access device plus an associated communication channel.

Access device: A mechanism used to formulate, transmit, receive and display messages.

Communication channel: The medium along which messages travel.

Stakeholder: The group of people to whom an information system is relevant.

Front-end ICT system: An ICT system that supports a front-end information system.

Back-end systems are those that are used within the organisation, while FRONT-END SYSTEMS are those that it uses to interface with its stakeholders (its customers and suppliers).

Among the commonly used access channels are face-to-face contact and telephone conversations, but channels that use ICT are being introduced more and more in both the public and private sectors. Typical remote access devices are Internet-enabled personal computers (PCs) and a growing range of mobile devices such as personal digital assistants (PDAs). Front-end ICT systems include corporate websites. Using these brings a number of advantages to both the organisation and its external stakeholders: for example, customers can log on to the website to access an organisation's services 24 hours a day, 365 days a year.

Goronwy went down this route in the mid-1990s. It started by introducing hand-held devices for inbound and outbound logistics operatives, linked via a plant wireless communication network. The workers could use the devices to access data from the central system, and update it with information on receipt and dispatch.

Goronwy used the Internet and the web to upgrade its customer chain technology. These are often thought of as the same, but in fact they are distinct:

- The INTERNET is a set of interconnected computer networks distributed around the globe.
- The WORLD WIDE WEB (WWW or Web) is an application which runs on top of the Internet. It is basically a set of standards for the representation and distribution of chunks of content (such as text, graphics and images) connected through associative links, known as hyperlinks.

Internet: A set of interconnected computer networks distributed around the globe.

World Wide Web (WWW): A set of standards for hypermedia documentation. It has now become synonymous with the Internet.

One of the most critical examples of the use of the web in business is of course corporate websites, made up of logical collections of web documents normally stored on a computer system referred to as a web server.

Initially, corporate websites were created primarily as an additional promotional tool, to inform customers about the business and provide them with contact details, but many businesses have since invested to increase their levels of interactivity and therefore their APPLICATIONS. Many companies now provide fully transactional websites through which customers can choose and purchase items, track delivery progress, email queries and so on.

Application: A term generally used as a synonym for an ICT system or another piece of software designed to perform a particular function.

Goronwy initially invested in a limited corporate website which merely promoted its services and provided contact details. It then created a companion website specifically for repeat customers such as Blackwalls, so they could enter details of orders and track their progress from receipt through galvanisation to dispatch.

To enable fully transactional websites, organisations need to update the information dynamically from back-end databases, and to ensure that information entered by stakeholders updates the company information systems effectively. So when a customer inputs delivery details, this information needs to be available to all the other systems that need it. This demands integration and interoperability of front-end and back-end systems within the ICT infrastructure. For Goronwy, the back-end ICT infrastructure managed the data model we described above as well as the business rules, update functions and transactions critical to what we referred to as the business layer.

Database system: A term used to encapsulate the constructs of a data model, DBMS and database.

After ten years of operation, Goronwy decided to upgrade its ICT system onto a new hardware and software base, to make it easier to develop web interfaces and integrate them with a central corporate DATABASE SYSTEM. The system was redesigned and rewritten, and the company also invested to ensure the privacy of electronic data held in the system, and the security of transactions travelling both within Goronwy and between Goronwy and the central ICT systems at Rito Metals. This continual investment in the ICT infrastructure is evidence of its growing value to the performance of the business.

Planning and management

For Goronwy, information systems and ICT infrastructure are central not only for the operation of its individual galvanising plant, but also to the ongoing operation of the Rito Metals group. There is also increasing pressure from the competitive environment: Goronwy, like all organisations, needs to match what its competitors do, and to offer some things they do not, to gain a competitive edge. ICT is central to this.

This creates a need for effective planning for and management of information, information systems and ICT. We call these collectively the **informatics infrastructure.** This is known as INFORMATICS PLANNING.

Informatics planning: The process of defining the optimal informatics architecture for an organisation.

Informatics service: The organisational function devoted to the delivery of informatics services.

All this means, of course, that an organisation needs informatics professionals to provide an INFORMATICS SERVICE, which consists of planning, management, development and operation of information systems. It has the choice of employing people to carry out these functions, or outsourcing them.

Goronwy's choices are dictated in part by the fact that it is one organisation within a larger group. It initiates formal informatics planning and incorporates it into the ongoing development of general business strategy. Rito Metals runs a periodic review of its infrastructure in the light of technological developments. Most recently this process led to the rollout of radio frequency identification (RFID) tagging (see Chapter 8). This enables the company to better integrate its information across supply, internal and customer chains.

Initially, Rito Metals took the strategic decision to employ no informatics professionals. It outsourced all the development of its initial systems, but as it came to use more and more ICT and information systems, top-level management decided the group needed an internal workforce devoted to informatics processes. It still uses some outsourcing, however. Much informatics planning and management is tackled in-house by a group of from 10 to 20 individuals, but most development and operations work is conducted by external vendors. For instance, provision and operation of its communication network has been outsourced for a number of years.

Conclusion and key themes

This book is about the *interaction* of business systems with information and its wider context. Because our focus is on the application of informatics in organisations, there are a number of themes that run through the book. Each of them relates to the issue of value and ICT.

- An information system need not necessarily be computerised. The processes of gathering, processing, storing and distributing information have been undertaken in human societies for many thousands of years. Technologies based around the digital computer are only the latest form of information and communication technology (ICT).
- Organisational informatics is concerned with information in general, as well as information systems and ICT in particular. It is important to understand what information is, and how it is related to effective decision making and human action.
- We cannot properly understand information and an information system without understanding the context. This operates at several different levels: the organisation or part of an organisation that uses the systems; markets, societies and economies (for instance, with systems making up a national financial infrastructure); and more recently focus has shifted to the global scale, particularly for information systems such as the web.
- An information system must fit its context: the organisation, its strategy, its processes

and its environment. Information systems that do not fit are likely to be resisted, underused, misused, sabotaged and unprofitable. They are likely to have negative effects on organisational performance.

- The 'value' of ICT in a given organisation relates to ICT's place within its information systems, and the way in which these information systems impact on the organisation, enabling it to remain viable and sustainable.

The next three chapters consider the fundamental bedrock of the issue of value. In Chapter 2 we consider the organisation as a value-creating system. This leads us to consider the place of information in support of value-creation and value-adding activity in Chapter 3. The concepts of system and information are then brought together in our consideration of the place of information systems in organisations, and the role of ICT in those systems, in Chapter 4.

Focus on Value

The concept of value is a common thread which ties together the range of topics considered in this book. The *Oxford English Dictionary* defines value as *the importance or usefulness of something*. Here we are concerned with the value of ICT to organisations. We can only understand it if we consider the layered contexts within which ICT is used and applied.

There is key value in organisational informatics as an academic field of study and an area of organisational practice. In an academic field of study, much new knowledge emerges at the boundaries between established disciplines. Organisational informatics is interdisciplinary in its interest in the interaction between organisational or business systems of many forms. Much current organisational experience relies on the interaction between these systems, so knowledge of organisational informatics is particularly important for the business practitioner in helping to understand and control their performance.

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