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The Rise of Information Technologies in "Non-Informational" Services*

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Summary

This paper looks at the increasingly important role played by information technologies in "non-informational" services. The introduction of these technologies is linked to the complexification of the nature of the product. First, a definition of "non-informational" services is proposed. It is based on the criterion of diversity of media of delivery (tangible object, information, knowledge, individual). It then examines the evolution of the nature of the product in such non-informational services and attempts to analyse the main reasons behind the complexification process.

The "service" society is often described as an information society. At the basis of almost all aspects of it are the informational paradigm and a wide range of information technologies. This confirms one of the fundamental characteristics attributed to these technologies in the evolutionary theory of technical change, namely the universality of their possible spheres of application, which Freeman (1988) calls their "pervasiveness".

The subject of this article is the siege this paradigm is laying to the last "bastions", as it were, of "non-informational" services. Indeed, information and telecommunications technologies are currently being introduced, in some cases on a massive scale, in what are known as operational services, which were initially based on logistics and material transformation, whether in cleaning, transport, car hire, caretaking, hotels, or other services. Thus information is playing an increasingly important role in these activities. The title of this article is paradoxical, therefore, since the operational services described here as "non-informational" can themselves be said to become informational, at least in part, as soon as they start introducing information-processing technologies into their core activities. In other words, the non-informational nature of these services should be considered not as an intrinsic technical dimension but rather as a transitory state susceptible to evolution.

The increasing importance of informational content and of information technologies is sometimes interpreted as an "upgrading" of this type of operational services. This is the case, for example, in cleaning services (Djellal, 1999). More fundamentally, however, the question raised in this paper is important because of its consequences for work organisation and firms' strategies (and in particular their innovation strategies). Indeed, the relationships between services and technology are numerous and diverse (C. and F. Gallouj, 1999, Djellal, 2000); they may be mediated through impact, i. e. of technology on employment, productivity or work organisation, through substitution, as when technology replaces the service provider (self-service), through identity, when the service constitutes the use value of the technology, through diffusion, when the services in question contribute to the diffusion of technological innovations, or through production, when the services themselves produce the innovations.

This article is divided into two sections. In the first section, we attempt to define "non-informational" service activities. Section 2 provides an analysis of the evolution of the nature of the "product" in this type of service, and in particular its increasing complexity. More generally, our objective is to seek out the reasons for the increasing importance of the informational content in services initially considered to be "non-informational".

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1. How are "Non-Informational" Services to be Defined?

The notion of "non-informational services" constitutes neither a theoretical category in the strict sense of the term (i. e. one described in the theoretical literature) nor a statistical category. The definition of such services advanced here draws on the analyses of Gadrey (1991), which can be used to establish a typology of services based on the principal medium of service provision (section 1-1). However, a residual definition of non-informational services (in which all those services whose principal medium is not information would be classified as non-informational) is not satisfactory (section 1-2). A more restrictive definition that gives greater prominence to the presence of a "material" or tangible medium may seem to be more satisfactory (section 1-3). However, such a definition takes no account of the evolution and increasing complexity of the product in this type of service.

1.1 A definition and typology of service activities

Following on from Hill (1977), Gadrey (1991) defines "a service activity as an operation intended to bring about a change of state in a reality C that is owned or used by consumer (client or user) B, the change being effected by service provider A at the request of B, and in many cases in collaboration with him or her, but without leading to the production of a good that can circulate (in the economic sense) independently of medium C".

As far as consideration of the informational or non-informational nature of the product is concerned, the main element in this definition of service activities is the notion of medium, which other authors (Bancel-Charensol and Jougleux, 1997) call the target of the service activity. Indeed, the medium which is involved in provision of a service may take a variety of forms: notably information, a physical good or an individual. Gadrey's definition allows a distinction to be made between various service activities in accordance with their primary function, whether it be the processing (in various ways) of information, of material goods or systems (i. e. their maintenance and repair) or even of individuals (in which case we are dealing with a direct relationship between the service provider and the client or beneficiary of the service).

Another service medium can also be envisaged, namely knowledge. This medium seems useful in the search for a definition of informational services and non-informational services. Thus the information in question will be apprehended in terms either of its technical content or of its cognitive content.

Thus we are in a position to construct a typology of services based on the nature of their principal medium. Table 1 presents such a typology and provides a few examples.

Clearly, most economic activities (whether they involve the production of goods or services) use each of these four media, albeit to varying extents. In particular, information is a universal input. In each activity, however, there is one dominant medium. For example, whereas the main function of the insurance industry is the processing of codified information, insurance companies may also, particularly in the case of assistance or support products, be involved in the provision of services relating to goods (breakdown services) or people (repatriation, medical care etc). Furthermore, the devising of tailor-made contracts aimed in particular at large companies can be likened to a genuine knowledge-processing activity. Indeed, in this particular case, what is being processed is specific, localised knowledge that is not easily transferable. In the case of the hotel and catering industry, even though individuals obviously play a fundamental role in service delivery, the production process is focused primarily on the processing, delivery and maintenance of tangible goods (meals, well-kept rooms, and so on).

The four media considered here provide stimulation heuristic , but bring with them a certain number of difficulties.[1] On the analytical level, indeed, these four media are not always separate. The difficulty arises in particular out of the notions of information and knowledge, which continue to pose considerable semantic and conceptual problems.

Knowledge is often embodied in individuals or objects (technical systems). Thus the purpose of a service whose principal medium is the individual (the end consumer) will be to modify individuals' various states: their state of health or appearance, as well as the state of their knowledge. The category whose principal medium is knowledge essentially comprises knowledge-intensive business services. Thus training consultancy services are considered here from the point of view of intermediate consumption, or even of intangible investment. Although individuals and individual learning processes are involved, it is only in their capacity as a dimension of organisational learning. In other words, the knowledge that is at issue in the provision of training consultancy services is interpreted as being mainly organisational knowledge.

Information, for its part, is regarded here as codified information. In other words, it is taken to be administrative, financial or accounting information contained in dossiers, documents, files, memoranda and so on (Gadrey, 1991).

The information that is at the heart of activities whose principal medium is the processing of information can be said to be generic, standardised information, close to that described in traditional economics (particularly Arrow,

[1] I am indebted to Brigitte Preissl, who has pointed out several of them to me.

1962). Those activities whose principal medium is knowledge come more within the framework of an evolutionist approach. Indeed, knowledge has several characteristics that distinguish it from information: it may be tacit, it is heavily dependent on context (contextualised, localised, specific), and it is cumulative.

Consultancy services and, more generally, knowledge-intensive business services (KIBS) are given as examples of services the main medium of which is knowledge.

However, this does not mean that they do not handle information. KIBS may be defined as information and knowledge processors and producers. Information and knowledge are both their main input and their main output.

In order to understand the activity of KIBS, a standard concept of knowledge as (codified) information is useful. Indeed KIBS transactions do use or produce codified information. However such a standard concept is not enough to grasp the full diversity of KIBS transactions.

According to Gallouj (2000) KIBS activity may be analysed through several basic modes of knowledge processing and production, which modify the spatial characteristics (mechanical transfer of knowledge considered as information), the form (internalisation, externalisation in Nonaka's sense), the scope (generalisation, localisation) and / or the architecture (association, dissociation) of the knowledge in question.

It should be noted that information and communication technologies (ICT) are likely to play an important role in these processes. ICT modify the tradability, transportability, divisibility, appropriability and separability of the information (Preissl, 1995; Antonelli, 1999). They help to store and accumulate knowledge and experience derived from previous KIBS transactions. Some of them (for example multimedia) make it possible to transfer to some extent (Noteboom, 1999) even tacit or procedural knowledge.

1.2 A definition of informational services

On the basis of the definition and typology given above, informational services can be defined as those whose principal medium is codified information. The basic functions of such services are the codification, processing and dissemination of information. This is the case, for example, with banks, insurance companies, electronic information services and administrative services involving the processing of files and dossiers.

In addition, these are services that are extremely sensitive to progress in ICT. They have been adopting and incorporating these technologies ever since the days of mainframe computers, unlike other services (retailing, road haulage, and so on) which did not start using information technology until the days of decentralised computer systems.

Thus informational services are defined by two closely related principal characteristics: information as the "material to be processed" and the intensive use of information technologies. This definition is found implicitly in Barras (1990) and in Pavitt et al. (1989). Barras shows that the innovation dynamic in services (particularly financial services, insurance services and administrative services) is linked principally to the intensive use of information technologies. For Barras, these technologies are the driving force behind a reverse product cycle, in which incremental and then radical innovation processes precede product innovations. In banking, for example, computerisation first affected back-office administrative tasks before making possible the installation of automated teller machi-

Table 1

A typology of service activities by dominant medium

Principal medium	Examples of service activities
Material good (Object or physical system)	Transport and warehousing Retail and wholesale trades Repairs, maintenance, caretaking, cleaning, removals Catering Maintenance services
Information	Banking, insurance and finance Administrative services Postal services, telecommunications, electronic information services
Knowledge	Management consultancy (including in-firm training) Research and development
Individual	Hospital services (medicine and health) Personal services (hairdressing, beauty care, care services, home help services, etc.)

nes and then, finally, the introduction of home banking and the upgrading of counter services (sales, customer advice) (Bertrand, 1991, J. and N. Gadrey, 1991, Tremblay, 1991).

In their sectoral taxonomy of technical change, Pavitt, Robson and Townsend (1989), for their part, highlight a particular trajectory which they describe as information-intensive (i. e. intensive in information technologies). This trajectory depicts the technological behaviour characteristic of financial services and retailing.

De Bandt (1995) defines informational services as "services that intervene directly in the process of producing knowledge and assets, either at the level of intangible investments or in the very functioning of the design and production processes". He identifies three categories of informational services: those linked to the market relationship (market surveys, marketing), those linked to production (maintenance, organisation of production) and those linked to company strategy (consultancy, training, research and so on). In our typology — and this is a semantic difference that should be noted — these services belong to the category whose principal medium is knowledge. We reserve the term "informational services" for those services whose primary function is the processing of codified information (banking, insurance services).

1.3 A definition of "non-informational" services

On the basis of the typology given above, one might be tempted to offer both a residual and broad definition of "non-informational" services. In this case, the category would include all those services whose principal medium is not information, but, depending on the individual case, knowledge, individuals or tangible goods.

This very broad definition of "non-informational" services is not satisfactory, for the following reasons:

— Service activities whose primary function is the processing of knowledge cannot, in our view, belong to the non-informational services category. Even though "information" and "knowledge" are separate media, knowledge is similar in nature to information. The close similarity between the two terms does not mean, however, that we are likening or reducing information to knowledge.

— The same observation can be made of service activities in which the individual is the principal medium. Although the individual is the primary medium for the service activity, information in its various forms is mobilised. The knowledge transmitted in the course of teaching activities can be regarded as information, as can the knowledge that flows from doctor to patient and vice versa, and the same applies to services involving body care.

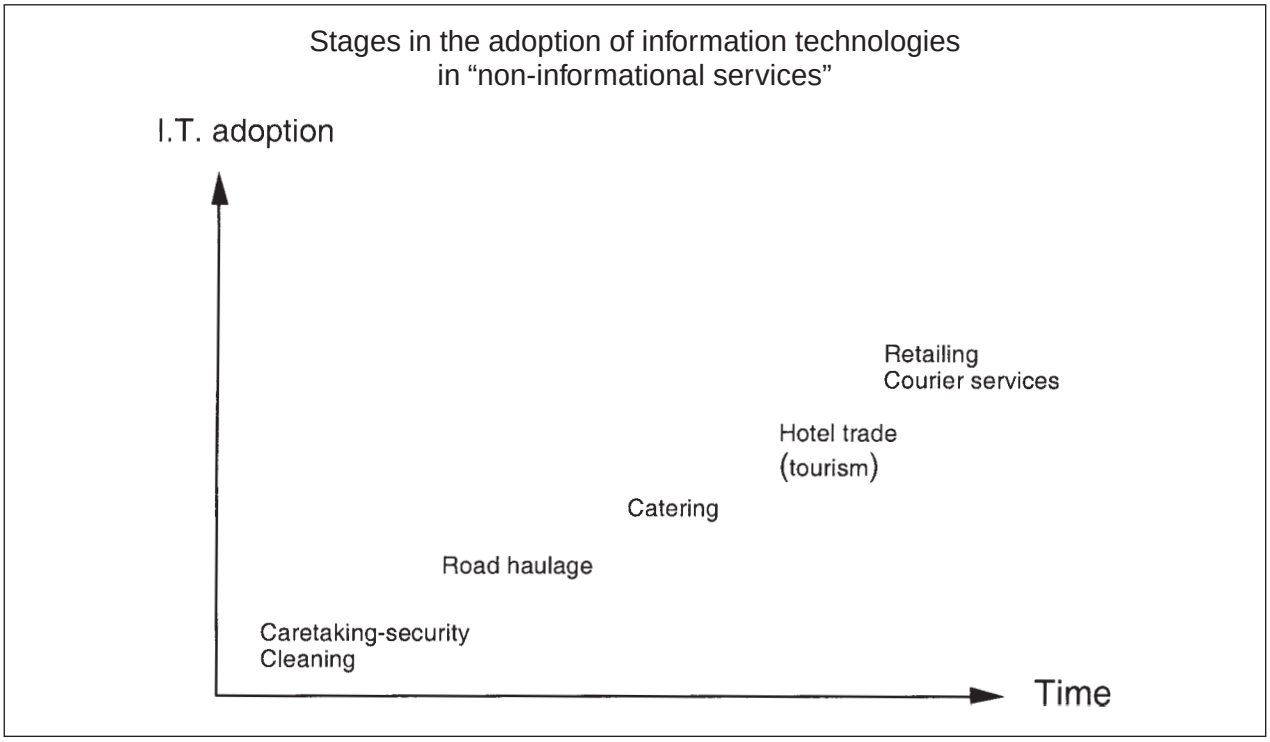
In the light of the criteria outlined above, a restrictive definition of "non-informational" services that puts the emphasis on the tangible medium might be preferred to the broad, residual definition already given. In this definition, "non-informational" service activities would involve the transporting of a tangible good, or the improvement or transformation of the state of a given medium which is itself a tangible product (for example, a good or a material system). Examples for such services are removal services, road haulage, office cleaning, car repairs or security services.

This narrow definition of "non-informational" services does not satisfy us either, since information technologies are now clearly playing an increasingly important role in some of these services. Indeed, it seems to us that information processing functions occupy an important position in the process of producing these "non-informational" services. In some cases, they may even be the dominant function of the service. This does not necessarily mean that there is a shift in the main medium. Road haulage still deals with goods transportation. Nevertheless, informational activities are becoming the key factor in a firm's competitiveness and in value creation.

Within this category of services, there are different stages in the adoption of information technologies (see Figure 1). Some activities, such as large-scale retailing and express courier services, are in an advanced phase of development. Here, the introduction of information technologies is already a relatively well-established and unmistakeable phenomenon. The hotel and catering sector, on the other hand, has reached an intermediate stage, and the use of IT is more intensive in the hotel trade than in catering. However, it should be noted that there are considerable inter-sectoral differences between traditional restaurants, the fast-food trade and workplace catering. Finally, some operational service activities are in the initial phase of the life cycle. This is the case, for example, with cleaning, road haulage and caretaking/security. It might be assumed that there is a correlation between the use of information technologies in distribution and logistics and their use in the hotel trade and tourism or even, in some cases, catering. This correlation is linked to strategies based on the provision of complete service packages and to the establishment of networks as a means of developing a coherent and integrated supply of a wide range of complementary services.

All things considered, we suggest that "non-informational" services should be defined as all those services in which the "informational" component in the broad sense of the term has, until recently, been non-existent or insignificant. In other words, the material component (or the dominant physical element) has hitherto prevailed over the informational or relational component in terms of investment in both the production of such services and the provision thereof.

Figure 1



What are the reasons that might explain the increasing importance of information technologies in these originally “non-informational” services? It seems to us that one of the main reasons is to be found in the changing nature of the product. This is the subject of the second part of this paper.

2. The Increasing Complexitiy of the Product of “Non Informational” Services

Our purpose here is to analyse the evolution of the nature of the product of so-called “non-informational” services and to seek out the factors that might explain the changes that have taken place. We will take as our starting point the functional breakdown of service activities advanced by Gadrey (1991).

2.1 The emergence of informational and service components

A functional breakdown of the service product reveals that there is a certain number of services in which the informational and/or service (or even cognitive) components that did not exist a few years ago now occupy an important or even dominant position.

According to Gadrey (1991), most service activities can be broken down into three functions or operations depending on the medium of their provision:

— logistical and material transformation operations [M], which involve the “processing” of tangible objects, i. e. their transport, transformation, maintenance, repair and so on;

— logistical and data-processing operations [I] which consist of “processing” “codified” information, i. e. producing, capturing, diffusing it and so on;

— relational or contact service operations [R], where the main medium is the client, and which consist of a direct service (provided in contact with the customer).

— Gallouj (2000) adds intellectual knowledge processing operations (K), also known as methodological functions, to Gadrey’s functional breakdown. He demonstrates that they are particularly important in explaining the innovation dynamic in knowledge-intensive business services, such as consultancy. However, they are also present in other types of services, and particularly today in “non-informational” services.

Operational, that is “non-informational” services can be defined (at least initially) as services in which the logistical and material transformation operations (M) are overwhelmingly predominant and the other service components (namely I and R) are negligible. These are activities that use transport and materials processing technologies and so on. The various operations carried out by these services relate for the most part to one or more tangible goods. In the case of road haulage and removal services

(Jougleux, 1999), for example, the function of the service is to transport a good from one location to another without any transformation or information processing operation taking place. In the case of cleaning services, the personnel are allocated to various workplaces, and the principal function is the transformation (or improvement) of a state (of cleanliness). The operations require neither contact nor information processing. The same situation is to be found in caretaking and security, where the function is the allocation of personnel to properties where caretaking and security services are required.

Thus in these operational service activities, the material logistical component of the product has often been the sole component of the product, as it continues to be, to a certain extent, in some small firms, particularly family-run and handicraft enterprises. On the other hand, in the case of large firms, the product can no longer be considered in terms of this single material component. From a dynamic perspective, therefore, it is possible to explain the evolution over time of a process of service provision by examining the nature of the operations carried out by these service firms. Initially, the service activity is defined essentially by material logistical operations. In the second phase of development, the nature of the activity is enriched by the emergence of new operations, namely logistical and data-processing operations and, finally, relational or contact service operations.

It is this process of diversification and enrichment of the operations involved in the production and delivery of "non-informational" services that we describe as the complexification of the product. Thus the product of "non-informational" services can be considered as a combination of operations M, I, R, K.

A certain number of examples can be cited to illustrate these various operations as they are carried out in the road haulage (or courier services), cleaning, caretaking and security, hotel and catering and distribution sectors (Table 2). As has already been stressed, retailing is the most advanced of these activities in terms of information technology use, particularly in the areas of stock management and work rationalisation.

2.2 The "reasons" for the increasing importance of the informational and cognitive content of the product

The emergence of these two new informational (I) and relational (R) components (leaving aside K, which is rarer) calls into question the traditional view of "non-informational" service activities as essentially users of material

Figure 2

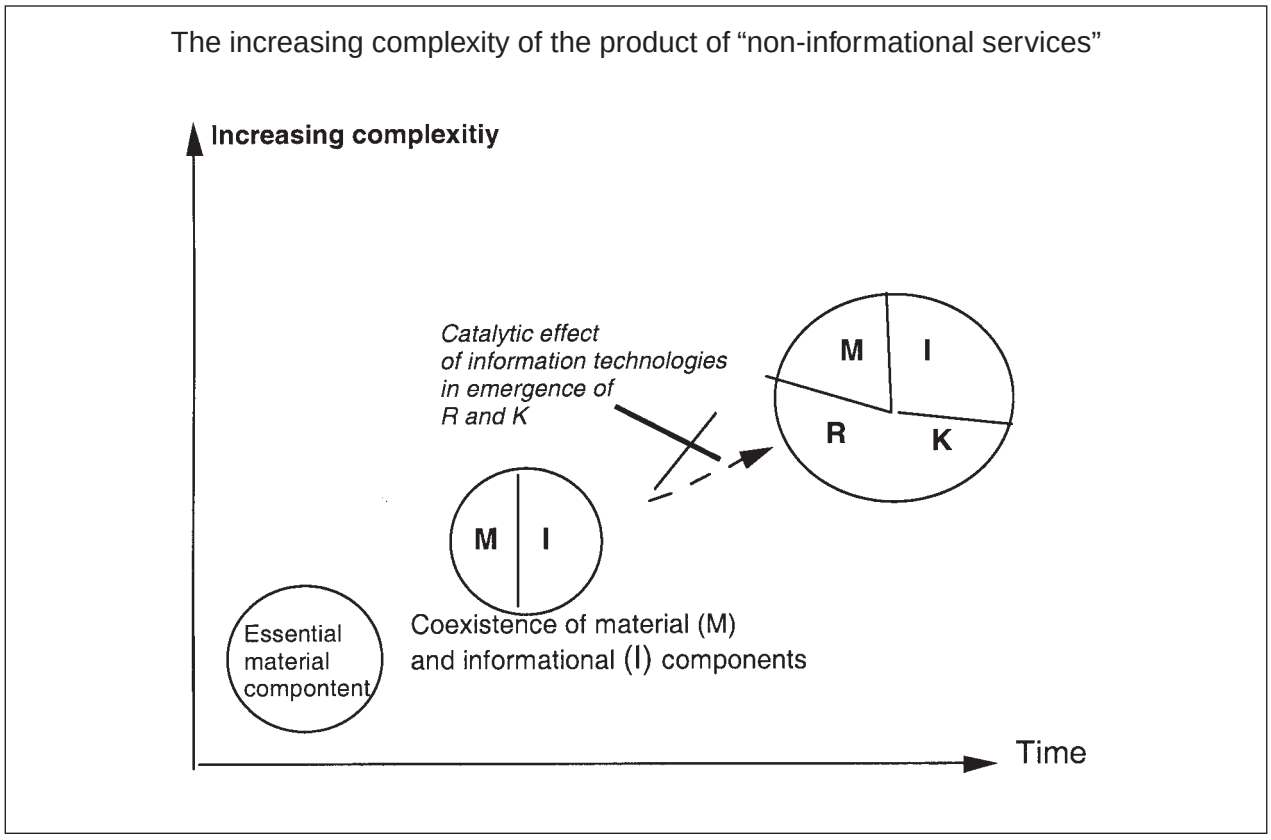


Table 2

Illustration of the co-existence of different operations (material, information processing, relational and methodological) in various service activities

	Material/logistical operations (M)	Information-processing operations (I)	Relational or contact service operations (R)	Knowledge-processing or methodological operations (K)
Road haulage	The moving or transport of goods by means of simple or complex technologies (automated fork-lift trucks, remotely controlled vehicles, automated pallets)	Processing of information flows within and between firms	Commitment to progress monitoring and quality at customer level	Coordination and organisation of the various operations ; search for the necessary competences, etc.
Cleaning	Maintenance, transformation of equipment or premises by means of manual techniques (broom) or sophisticated technologies (robots, automatic cleaning machines, etc.)	Processing of information for internal and external use for the purposes of working-time management, quality management, performance evaluation, etc. The main tools developed are databases, quality control tools, etc. Computer-assisted goods tracking system	Assistance for injured people,[1] — development of reception services in the hotel sector	Emergence of cleaning consultancy companies, whose function is to draw up the job specifications; development of flexible methodologies
Security-caretaking (distinction to be made between services to properties and services to individuals)	Surveillance by means of simple or complex technologies (automation) (e. g.: intercom)	Control of parameters digital code	Quality of environment (permanent “presence” of security staff)	
Hotel and catering	Automation (and standardisation) of rooms	Reservation, checking-in, payment	Various services offered to customers home deliveries	
Retailing	Introduction of Fordist logistical systems	Video cameras, infrared detectors and meters, fixing of prices in accordance with customers’ needs stock monitoring with a view to fixing prices	24-hour deliveries loyalty cards Introduction of ECR through bar codes, interactive kiosks, teleshopping	

[1] A cleaning company has developed a new assistance service for Charles de Gaulle airport at Roissy, where it provided traditional cleaning services. The new service involves the provision of assistance for injured and repatriated individuals.

technologies, whether simple or complex. As a result of the new informational and service content of these activities, there has been a rise in the importance of information technologies, which have not hitherto been deployed in this type of service because of the nature of their principal function. This leads us to inquire into the reasons for the emergence of these components in what were originally "non-informational" services. Our analysis revolves around two main factors: the increasingly important role being played by the customer in service delivery and in transactions, and the reduction in information asymmetries.

2.2.1 The client's role in the transaction process

Initially, the client's function in the transaction process was relatively limited since it involved mainly material/logistical operations. The client's role was confined to a simple transfer of information at the beginning of the transaction through a linear service relationship (standard transaction).

The large-scale outsourcing of a considerable number of operational services, particularly caretaking, cleaning and the transport of goods, combined with quality and productivity demands, the competitive nature of these markets and the diversification and enrichment of the services provided has given customers an increasingly important role in the transaction process.

The important role of information technologies in these services is linked to the processing, transfer and organisation of information. Informational operations, a new and essential component in the product and production process and a factor in innovation, facilitates the development in these companies of service relationships that go beyond the mere linear exchange of information. Indeed, some of the characteristics specific to complex service activities, such as multilateral and/or transversal, interactive, long-term relationships, are beginning to emerge. This set of characteristics applied to certain "non-informational" services is evidence of the importance accorded to the customer in the transaction process. Clients can intervene in the process at any time. They are also able to evaluate the service provided, while the relationship between customer and service-provider is increasingly becoming one based on trust. This trust relationship will be examined in the next section.

Numerous examples of technological and informational innovations linked to the client's role in the transaction process can be provided. In the case of a cleaning firm, there is the example of a "flexible methodology", which takes the form of a software program, developed by the R&D department, which provides for all the types of tasks that might be required by customers. Paradoxically, this tool helps to nurture the service relationship, since it can be used as a starting point for discussions with customers (in the same way as computer networks provide the basis for improving the consultancy and sales functions in banks). Thus the service provider has developed a database with standardised services as a means of reducing the transaction costs occasioned by the need to search for information specific to each type of client. This database, which is similar to those used by certain management consultants, particularly in their search for solutions, is regularly updated in order to incorporate new experiences and new configurations arising out of the needs expressed by clients.

In the transport industry, there are the examples of bar codes, on-board systems in goods vehicles and tracking systems that allow customers to know the whereabouts of their goods at any given time. In a way, these tools are the driving force behind the development of the informational logistical operations out of which a service relationship is likely to emerge.

In retailing, the opportunities for customers to use the "bar code" system and the existence of interactive information kiosks illustrate the co-existence of informational operations and "contact services". In this example, the use of information technologies has a catalytic effect on the development of these latter operations. The information technologies are used to help the customer save time (by avoiding having to wait to get a price, for example), to improve the quality of information and so on.

The information technologies deployed by "non-informational" service firms are not applied solely to goods (or physical systems). As we have just seen, they are also applied to individuals (or customers). We are dealing, therefore, with a complementarity effect, as is suggested by the emergence of relational and cognitive logistical operations. This finding leads us to advance the hypothesis that, in this type of service, the increasing importance of information technologies is also playing a part in the reduction of informational asymmetries.

2.2.2 The reduction of informational asymmetries

It is not our purpose here to go back over the numerous analyses of incomplete contracts (see Williamson 1975, Brousseau 1993, Baudry, 1994) but simply to point out that the increasing importance of information technologies in "non-informational" services can be explained by the fact that they have been called on to help reduce uncertainty. In some cases, they can be likened to a "supervisory mechanism" whose function it is to look out for any opportunistic behaviour that might be adopted by certain participants in the transaction (Brousseau, 1993).

Indeed, it might be hypothesised that it is more difficult to establish trust-based relationships in certain markets for "non-informational" services than in consultancy activi-

ties. In the latter, as Karpik (1989) shows, the existence of well-established networks and the consolidation of relationships between service providers and customers within those networks (reputation, reliability and quality of information and so on) make it easier to establish trust than in non-informational services. In the former, and particularly in goods transport, retailing, cleaning and the hotel trade, multiple and complex relationships are involved. They are not simple bilateral relationships between a customer and a service provider but rather more complex relationships between these two and many other intermediaries entrusted with the realisation of a set of diverse operations. It is at this level of relationships that a "supervisory mechanism", put in place with the aid of information technologies, can be introduced.

In order to highlight the complexity of this multitude of relationships and the underlying problems (informational asymmetries, trust and so on), it is important that the investigation be conducted on two levels. The first concerns the employer-employee relationship within the service firm. The second, which has been the subject of much attention in the literature, concerns subcontracting relationships (see Baudry, 1994; Gorgeu, Mathieu, 1991;) or the client-provider relationship.

The employer-employee relationship

It has already been shown that the production process in this type of service has long been dominated by material technologies. It might well be considered that the absence of ICT has had the effect of encouraging opportunistic behaviour among employees, since of course they perform the tasks required of them but in conditions whose efficiency cannot always be verified by employers. In transport, for example, there is very considerable informational asymmetry, because employers, who obviously cannot accompany drivers, are not in a position to monitor the (non-observable) process by which the (verifiable) result is obtained.

Reference might be made, for example, to the development of on-board computer systems that make it possible to track the movement of goods in real time. This tool was originally designed as a means of analysing fuel consumption (and as such indicated a lack of trust). Its sphere of application was subsequently extended since it allowed employers to exert greater control over time for the purposes of regulatory compliance, work organisation and work team management. These on-board computer systems reduce the room for manoeuvre and initiative available to drivers. In this sense, they replace or supplement the traditional control mechanisms.

The client-provider relationship

It is no longer the service provider who seeks to reduce informational asymmetry, but rather the client.

It might be hypothesised that informational asymmetry is reduced through the establishment of a multilateral, interactive service relationship that produces confidence or control through information technologies.

In the road haulage industry, some firms give their customers access to their information systems. Such access gives customers direct contact with the service provider and the carrier, allowing them to monitor the movement of their goods at all times, in other words to evaluate the service provided and therefore assess its quality.

In the cleaning industry, the example can be cited of a tool developed by a large cleaning company which meets a need of customers who are very demanding in terms of service quality. This is a tool, which might be likened to a flexible methodology, which lists all the tasks likely to be carried out by the service provider at the various phases of the service delivery process. Moreover, the results of quality control procedures are displayed and compared with the productivity results achieved by the customer. Ultimately, this tool can be likened to a supervisory or, at least, an incentive mechanism. It should be stressed that this tool offers both client and service provider substantial savings on transaction costs. It also provides the foundation for a genuine service relationship that goes beyond mere joint participation to create real trust.

3. Conclusion

This article, with its deliberately paradoxical title, has looked at the increasing importance of information technologies in areas of the service sector hitherto unreceptive to these technologies.

The introduction of information technologies, in some cases on a massive scale, has led to a re-evaluation of these service activities, some of which have long lain outside the scope of theoretical investigation. Information technologies are closely linked (although it is difficult to decide on the direction of the relationship) to the complexification of the product in this type of activity. Indeed, operational services are themselves increasingly becoming informational services, in the sense that their initial material processing component is being enriched by an informational component. This complexification of the nature of the product means that the client and the service relationship now play a more important role. It has also led to greater diversity in the forms and trajectories of innovation in the activities in question.

This paper has not tackled certain important theoretical questions arising out of the change in the nature of the product. We will allude to them here only as possible food for further thought. The increasing importance of information technologies in "non-informational" services provides a starting point for a re-examination of questions such as

the industrialisation of services, of the validity of the productivity paradox (Solow's paradox) and the specificity and uniqueness of sectoral technological trajectories. Indeed, the importance of "contact" and methodological operations in the product of "non-informational" services does not seem compatible with the notion that industrialisation can serve as an exclusive and dominant model, that is, that such service activities involve the mass production of standardised services in which the service relationship plays no role. Moreover, the functional breakdown of the product of such services gives credence to the notion that a multiplicity of innovation trajectories might co-exist within the same firm. Finally, this hybridisation of technologies in "non-informational" services complicates the question of how to check for the existence of the productivity paradox, since it is difficult to ascertain to what extent job creation (or loss) is attributable to productivity gains (or declines), to information technologies or to complex material technologies (robotics, automation and so on).

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Zusammenfassung

Der Anstieg von Informationstechnologien in ‚nicht-informationsbasierten' Dienstleistungen

Dieser Beitrag beschäftigt sich mit der zunehmend wichtiger werdenden Rolle von Informationstechnologien in ‚nicht-informationsbasierten' Dienstleistungen. Die Einführung dieser Technologien ist eng mit der wachsenden Komplexität der Dienstleistung an sich verbunden. Zunächst wird eine Definition ‚nicht-informationsbasierte' Dienstleistungen vorgeschlagen. Diese basiert auf dem Unterscheidungsmerkmal des Mediums, mit dem die Dienstleistung erbracht wird (ein dingliches Objekt, Information, Wissen oder eine Person). Anschließend wird die Veränderung der Charakteristika ‚nicht-informationsbasierte' Dienstleistungen untersucht und die wesentlichen Gründe für deren zunehmende Komplexität analysiert.