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Productivity of Business Services - Towards A New Taxonomy

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Preface

Statistics show that the expanding service sector accounts already for three quarters of GDP in the developed economies. Moreover, there is abundant evidence on high variation in productive performance across the service industries. This suggests divergent technological and institutional trajectories within the tertiary sector. While conceptual knowledge on services and their performance has accumulated substantially, the overall landscape on productivity and competitiveness is still inconclusive. As noted by number of authors the research on service productivity is still in its infancy.

The purpose of this paper is to develop further the analytical framework of service productivity. The approach is based on the notion that service definitions, classifications and performance measurement are strongly interdependent. Given the ongoing restructuring of businesses activities with higher information content, it is argued that the dichotomy between manufacturing and services should not be taken too far. Industrial evolution also suggests that the official industry classifications are increasingly outdated and new taxonomies for empirical research are therefore needed.

Based on the previous analyses and new insights the paper clarifies the debated concept of service productivity and identifies the critical dimensions by which the service industries cluster. It is also demonstrated that the dimensions enable to construct new service taxonomies which bear essentially on productivity opportunities at the business level. Needles to say the key determinant explaining the development and potential of productivity growth is innovation activity. As an extensive topic of research, however, service innovation is tackled here only in a cursory way.

The paper is constructed as follows: the first section focuses on the conceptual issues and evolving nature of service activities. A workable definition of service should capture the diversity of service activities, as well as the aspects of service processes, comprehensively. The distinctions and similarities between services and manufacturing are discussed, too. Section 2 deals with the service productivity, a persistent and controversial issue in academic literature and policy. With the assessments of strengths and weaknesses of the main schools new insights based on value creation will be brought in.

Industry classifications and taxonomies are discussed in Section 3. It begins with a short analysis of the official classifications and their evaluation from the perspective of empirical research. Using well-known examples it is shown that the taxonomies on the manufacturing industries have a clear analogy with the business services. As there is a growing interest to regroup services too, the work to date, has been less systematic and inherently qualitative. Based on the earlier contributions three-dimensional service taxonomy is constructed which highlight the key dimensions of productive performance. The main findings and implications are summed up in Section 4.

1 The Essence of Service

In the common language service seems to be well-comprehended. That is, anyone has a clear understanding what service is when it is expected or supplied. A closer look at the contexts where services appear reveals, however, a high ambiguity and difficulty in its universal definition. With individual ad hoc perceptions, service may be defined systematically by the type of service activity, business activity or industrial sector. The diversity of approaches and definitions is reflected in the scientific literature too, which further confuses an interested, non-professional reader. To avoid that, it is intended here to give a selective overview on the most central dimensions useful for this study.

1.1 Evolving Service Activities

The sector comprising market-based services in the modern market economies has evolved through series of techno-economic sequences. To date, its growth is being driven by two complementary forces. First, the global and intensified rivalry manifests itself in search for more effective division of labour and outsourcing of auxiliary business services within the manufacturing sector, in particular. With this push effect, there is a growing demand for diverse business services, boosted by increased economic activity and welfare. This pull effect is also concerned with infrastructural services like transportation, communication and banking, as well as increasingly diverse consumer services.

As there is general consensus among scholars on the forces shaping the industrial order, it is less so when the conceptual issues of service activities and performance is concerned. By and large this is due to the structural change of the service sector, and the historical tradition to treat service businesses as a homogenous residual of the more “productive” manufacturing, constructing and agriculture (Smith, 1776). Indeed, service is a complex and subjective matter, which allows for individual interpretation and perception.

A classic definition

As conveyed by the management literature, there are some key characteristics common of all service activities. The underlying features of the service output are its intangibility and client-specifity, which are sources of other distinctive attributes. Among these are perishability, non-storability, co-production with the customer, as well as uncertainty associated with the service outcome. Instead of listing the distinctive features, a comprehensive definition needs to be more descriptive as suggested by Peter Hill (1977):

a service may be defined as a change in the conditions of a person or a good belonging to some economic unit, which is brought about as a result of the activity of some other economic unit with the prior agreement of the former person or economic unit (Hill, 1977).

This raises two issues which seem to be necessary conditions for a service activity. First, the attributes of the objective, human or non-human, should change through the service process, according to the specifications of the contract. Most often the change means up grade of the specific attributes of the object. Second, to be a service the upgrade should be performed externally by a service provider. As a general observation Hills´ definition helps tackle the inherent problems associated with service intangibility.

At a time Hill wrote his article the essence of a service was well captured by that definition and the other attributes mentioned above. As a result of technological and market change however, more flexible interpretations are needed. For example the asserted concurrence of production, delivery and consumption of services do not hold universally. While still characteristic of number of manual services, software and recording technologies enable the storage of an increasing number of knowledge based services, which breaks the concurrence.

More specifically, as the service processes are most often non-storable the outcome will increasingly be. To a growing extent too, the production and consumption of the services can be spatially separated. For instance, information and communication technologies are increasingly used in the delivery of number of engineering and diagnostic services. This is demonstrated by ongoing service off-shoring, or global outsourcing.

A related development is the transformation of manual services with an active customer interface into self-produced back office activities by the customers themselves. Hence, digitalization of both business and consumer services has shifted the emphasis from processes to outcomes, with increased self-service content. Illustrative examples can be found in retail trade, banking and insurance. In fact, for the self-services the object of transaction is a not a service as defined above, but *freedom* comparable with buying a car. In this regard customer is purchasing spatial or temporal freedom in performing the service activity by himself.

To conclude, there are two alternative ways of interpreting the consequences of new technological and market opportunities. First, it can be argued that the Hill's definition of services still holds but the technology displaces obsolete service functions and transforms them into new forms of commodities which are hybrids between services and physical products. Another interpretation is that technological change reshapes the service processes and logistics which necessitate conceptual upgrading, respectively. Though this should be semantics only, it is a major source of confusion in the public and academic discussions.

A general definition

While workable Hill´s definition is just one of the numerous efforts which are all inevitably incomplete. Instead of trying to pick out the most feasible one, it is more appropriate to investigate the common factors of various service definitions. This has been successfully performed by Heiskala Tiihonen and Soininen (2006) in their construct of service mass-customization model (Heiskala et al, 2006). Based on their extensive literature analysis the authors observed that four dimensions are repeatedly brought up in various definitions. This gives grounds for the name, Four Worlds Model.

The *object-of-service world* refers to recipient of the service, which can be an individual, consumer, a firm or a public body (Gadrey, 2002b). The *needs world* explains why a customer is willing to buy a particular service. To materialize a service transaction must create value to the customer, either in the form of utility and experience in case consumer service or financial benefit in case of business-to-business services. As will be pointed out in Section two a customer type makes an important distinction and bears on the service productivity concept.

The third world is called *service solution*, which covers the specification and agreement on what is to be delivered. In the service management literature an equivalent term is service outcome or offering, which is kept separated from the service process which generates the outcome (Brax,

2007). Finally, *process world*, synonymous with classical service, specifies the delivery process and the resources needed in the provision of the service outcome.

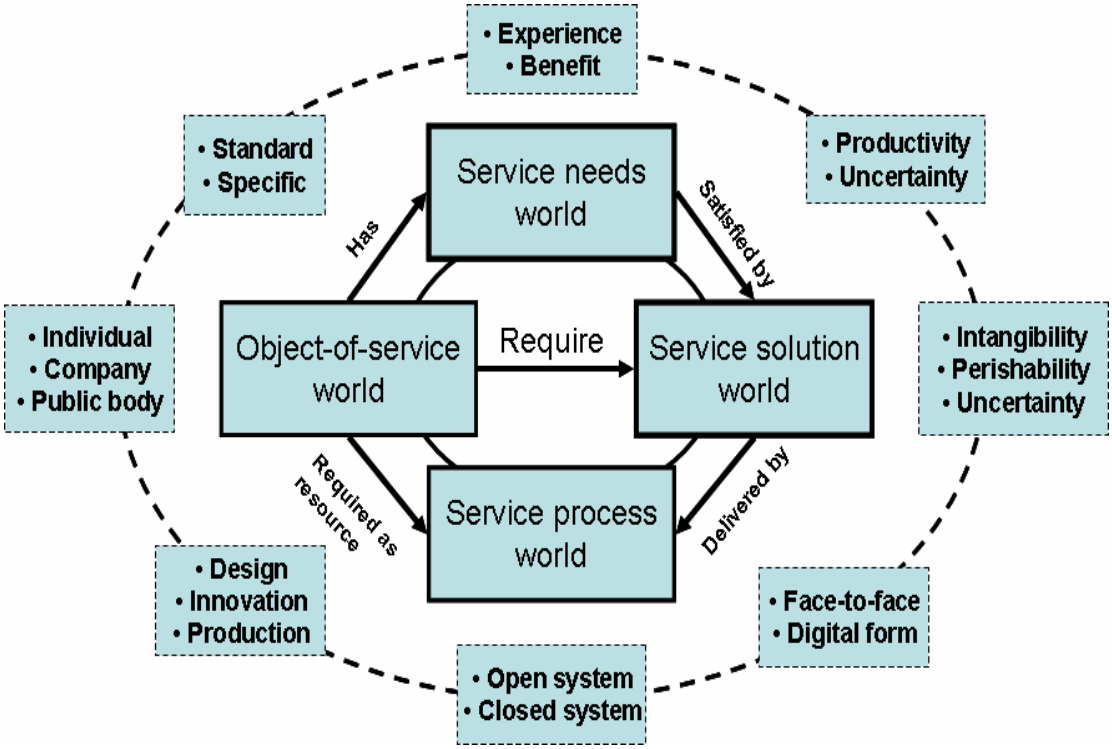

Figure 1. The Four World Model (modified from Heiskala et al., 2006)

The schematic Four World Model - the inner circle in Figure 1 - presents the key elements of service activity and highlights the relations between them. To illustrate, the original model is augmented with the dotted circle, which highlights the associated characteristics pointed out in the service management literature. For example, the object of service world refers to clients, which may be individuals, companies or public institutions. Clients in turn are required as a production resource for the service process world, which, as explained in more detail in Section 2, are closed or open systems.

Business services

With regard to service businesses a basic distinction is made by customer segment services are provided with. Consumer services constitute service provisions such as heath care, movies or restaurants consumed typically by individuals. Producer services in contrast, are used as intermediate inputs in other firms´ production processes. This makes a notable difference regarding market behaviour as well as production technologies and business strategies available for service companies. As the focus of this study is geared on the producer services, and more specifically, business service, a short review on their characteristics and classification is appropriate.

Building on Hill´s definition (see above) Kox and Rubalcaba (2007) define business services by their role for clients: *Business services is a set of service activities that – through their use as intermediary inputs – affect the quality and efficiency of the production activities, by complementing or substituting the in-house service functions* (Kox & Rubalcaba, 2007, p. 3). The authors correctly note that it is question of activities that in many cases could be performed

internally by clients, and in doing so functional services are pervasive in all production processes. To qualify their argument further the existence and growth of business service industries indicates that they enjoy some comparative advantage over in-house functions in performing the service functions. Service outsourcing is a field of vast literature and consultancy business for the business services themselves.

Section 3.1 which focus on service taxonomies highlights the residual approach with which business services are treated in the official industry classifications. For the larger sector comprising producer services, Kox and Rubalcaba (2007) have developed a taxonomy which illustrates the degree of generality of service functions. In this regard the highest generality is shown by *network services* (e.g. distribution, energy, transport and telecommunication), for which in-house production is rarely a viable option. While also standard, *operational business services* (e.g. security services, cleaning, bookkeeping etc.) are more specialized in supporting specific functions.

The highest degree of customer specifity is shown by knowledge intensive business services (KIBS) also called professional services. As with operational services KIBS are increasingly out-sourced while leaving complementary knowledge base in-house too. For these services (e.g. computer services, management consulting, legal services, marketing and engineering) knowledge intensity is characteristic of inputs and outputs in service production.

1.2 Services vs. Manufacturing

A standard dichotomy

As indicated by number of academic studies the most distinctive features of service activities are their intangibility and high involvement of clients as co-producers and co-innovators (e.g. McLaughlin and Coffey, 1990). More generally, the search for the typical characteristics of services is geared to the differences between services and manufacturing. To follow the logic of service management literature, the manufacturing industries instead, produce tangible outputs with minimal customer involvement in the production processes.

Though an oversimplification, this contrast facilitates, to a certain extent, analyse the key dimensions of the two economic sectors. In short, what is logical and intuitive for manufacturing, is most often complex and incomprehensible for the services. For instance, from the intangibility of the service follows the impossibility to partition the output into measurable units. As s result the quantity of the output must be approximated by service intensity and quality of the service outcome. While for the service industries the principal input is labour, manufacturing is more dependent on physical capital.

Intangibility implies further that for services input and output are inseparable and hence, the quality of labour is reflected in the quality of output, the main indicator for service performance. Since the quality is dependent on the assessment of an individual customer, performance evaluation of service is highly customer-centric. In difference to tangible products, subjective perceptions on quality are more intrinsic for the services. This is a major source of producer uncertainty. This is reinforced by weak documentability and reproducibility[1] of services processes, which increases customer uncertainty about the desired benefit and utility of the service. For manufacturing again, these problems are by definition, non-existent.

[1] These latter features are not direct consequences of tangibility, but results from tacit information inherent in service processes.

Relevant boundaries

Related to the dichotomy above an important corollary usually ignored in the academic literature is the dynamics how intangibility and service characteristics shape competition and market structure. With a little oversimplification, manufacturing is characterized by offerings the properties of which are *perfectly* visible to customers. As a result production and delivery can occur instantly and competition among suppliers is transparent and, without new innovations, unchanged.

For many services there may be a fierce competition originally too, but once the first contract with a client has been made, the parties are locked-in at least for the period of expected delivery. For that period there is no competition but a bilateral monopoly which strives for an outcome acceptable for both parties. If a satisfactory outcome is realized business relationship may continue, assets become increasingly specific and competition on subsequent contracts may cease. This learning process and asset specifity (Nelson & Winter, 1982; Williamson, 1985), as called in economics of organization, is a viable explanation for the alleged weak competition in some service industries.

Customer involvement and transaction dynamics are related to the issue of the relevant boundaries of production processes. Is it a production unit, a company or value chain? For the goods production, the answer is still straightforward. Though the subsequent stages of the manufacturing value chains are technologically and economically interdependent, performance of each unit can be evaluated separately. As long as there is no outside involvement the production is technologically closed, which is the case in most manufacturing processes.

In the context of services, the production system is technologically open as the customer is usually an essential input to the service production process. Due to the co-production, a relevant production boundary is customer – client entity, which works more like a lateral co-operative. By the same token also larger co-producing entities such as geographically concentrated networks and clusters, can be defined as a relevant production boundaries (Coase, 1937).

Co-evolution

Theoretically, it is quite easy to demonstrate the key differences between service and manufacturing activities. In reality, however, such a dichotomy is not so clear-cut. Instead, the determinants differentiating between manufacturing and services are continuous variables which describe the spectrum of industries between the hypothetical *pure* manufacturing and service (Metcalfe and Miles, 2006; Viitamo, 2003).

This is illustrated by growing interest for modularization of products and services. The principal idea here is to utilize the scale economies of mass-production and simultaneously, a high customer value arising from variation and customer-specification[2]. From the service point of view modularization is a strategy to transform intangibility into more tangible form and transform tacit information to a more codified form. This enables service to utilize the efficiencies characteristic of manufacturing processes[3]. Mass-customization demonstrates the ongoing industrial evolution, bridging the gap between traditional services and manufacturing (See Table 1).

[2] It allows for a cost efficient way of differentiation and diversification. That is, the marginal costs of product variation in serving different customers are close to zero.

[3] In particular, mass-customization is applicable for services with high frequency of transaction, low need for customer participation and services that can be digitalized. Typical services are finance, insurance, maintenance and cleaning.

Classical manufacturing ↔	**Modularized services**	↔ Classical services
The product is tangible	**The service is semi-material**	The service is intangible
Ownership is transferred in transaction	**Ownership is partly transferred in transaction**	Ownership is not generally transferred in transaction
The product can be resold	**The service can be passed and sometimes resold**	The service cannot be resold
The product can be demonstrated effectively	**The product can be demonstrated be references**	The service cannot be demonstrated
The product can be stored	**The product can be sometimes stored (disc, self service)**	The product cannot be stored
Consumption is preceded by production	**Consumption precedes production in many cases**	Production and consumption generally coincide
Production, selling and consumption are spatially separated	**Production, selling and consumption are spatially separated in many cases**	Production, selling and consumption are often spatially united
The seller produces the product	**The buyer takes part in composition**	The customer takes part in the production

Table 1. Modularized services as an intermediate between manufacturing and services (Sundbo, 1999)

There are other lines of reasoning which challenge the alleged dichotomy, too. The notion that services are pervasive and dominate all economic activity in the developed countries, is justified by the fact that service industries produce only a faction of all service outputs of the developed economies. As Metcalfe and Miles (2006) note, most of the service functions are produced widely across the economy – indeed practically all business services have their in-house equivalents within most companies.

Even more conclusive status for services is given by Edith Penrose in her theory of firm (Penrose, 1959). To quote "the productive activities of such a firm are governed by what we shall call its productive possibilities that its entrepreneurs see and can take advantage of. A theory of firm is essentially and examination of the changing productive opportunity of firms…it is never the resources themselves that are the inputs in the production processes, but only the services that the resources can render. The services yielded by resources are a function of the way in which they are used…" (Penrose, 1959, pp. 25-31).

Though the extensive outsourcing of service activities by the manufacturing firms, service businesses, such as maintenance, may account for more than 50 % of the corporate revenue. Baumol (2002) makes a complementary note that innovation activities and R&D, which are at the heart competitiveness, are essentially service functions. Accordingly, within the services there is to be found the main component of the remarkable growth engine of industrial capitalism (Gadrey and Gallouj, 2002). No doubt, if all the administrative, maintenance and management service activities, produced in-house are accounted for, we see that services are really pervasive.

Fallacious services

Opposite to the mainstream approaches is what may be called neo-Marxist view on industrial evolution. It regards the economic transformation into a service society as a fallacy (Sayer and Walker, 1992). First, what is commonly called the expansion of the service sector is by and large an

historical continuation of the division of labour in the industrial capitalism (Smith, 1776). In other words just splitting bigger production entities into smaller vertically linked specialized units is misleadingly interpreted as a transition into the service economy.

Second, so called network industries, transportation and communication and utilities are inseparable elements of the social infrastructure, which serve mostly necessary public needs. Moreover, most professional services are in fact providing goods and, like other business services, they are contributing to manufacturing processes (Sayer and Walker, 1992). While the neo-Marxist interpretation clearly utilizes the definitional freedom discussed above, it also illuminates functional differences of service industries in a broader context.

Indeed, the neo-Marxist criticism is partly justified, since the discussion has predominantly centred on issue whether industries converge or diverge. A central impetus to these considerations was the seminal work of Porat (1977) who, in his analysis on US information society, introduced a four class categorization of economic functions. These functions are: 1) primary raw material producing functions, 2) raw material handling functions, 3) information functions and 4) service functions.

If the relative importance of these functions change, is it relevant information in first the place? According to De Brandt and Dibiaggio (2002) the answer is yes and no. Misleadingly, the main focus is geared on the distinctions and relative changes between the primary, secondary and tertiary sector i.e. the functions 1, 2 and 4. However, it is the information function 3 that really counts in the current transition towards knowledge based economy. Knowledge co-production, interactive problem solving and learning in the complexity of networked economy are the key elements in on-going industrial evolution.

2 Service Productivity

Introduction

Like service, discussed in the previous section, productivity is a context specific, loosely used concept in the common language. In common language productivity refers in a positive spirit to any activity, performance of which is regarded superior to other possible outcomes. More specifically, preferred outcome should also be achieved with a minimal use of scarce resources. If set as an explicit objective, higher productivity within any field of human life necessitates improving innovations.

Within the realm of economics and industrial activity the origin of productivity and its measurement dates back to emergence of industrial capitalism at the turn of the 19th century. Productivity was to capture the technical efficiency in transforming capital, labour, energy and intermediate products into marketable end goods. Improved productivity was enabled through series of innovations which mechanized manufacturing processes and made them less labour intensive.

For the corporate management productivity offered a tool for benchmarking and improving efficiency over similar manufacturing units and within an individual manufacturing unit. Hence, productivity growth i.e. a higher physical output relative to the amount of productive resources was set as a major objective to increase profits and personal wealth of industrialists. Soon it was realized that productivity growth enabled and led to higher income for workers too, which in turn indicated an increased national well-being. To date, higher productivity of manufacturing and services driven by entrepreneurial innovation is a key policy objective in all market-based economies.

Theoretical discussion on the nature of economic productivity is closely related to the assumed differences between manufacturing and services, as well as the level of economic activity. For the highest level of aggregation productivity is a composite indicator of the performance of the economy. For individual industries productivity reflects technological opportunities and constraints characteristics of the production processes. Finally, companies use productivity in assessing the efficiency of internal functions and strategic business units. In the following subsections productivity is addressed through the lenses of main theoretical schools, while keeping emphasis on the company level of services activities.

2.1 A Conceptual Digression

Technical efficiency

In technical terms productivity and its growth can be illustrated by a simple production function shown in Figure 2. The best practise frontier describes the maximum amount of output available given the quantity of inputs and the production technologies. So, all points along the frontier are by definition, operationally, or technically efficient (Van Ark, 2006).

Similarly, the points below the frontier are operationally inefficient but less so the closer they are the best practise. In this setting productivity can be increased by two ways; by reducing operational inefficiency and moving up to the best practise or through technological innovation which shifts the frontier outwards as shown by the picture. If industry-wide, the shift makes the former efficient points where some firms locate, inefficient.

Note that productivity concept here refers implicitly to manufacturing which is characterized by continuous and repetitive production processes. For these processes the best practise technologies and the quality are relatively easy to define and they are embedded in the tangible products. In particular, as quality is fixed and determined ex ante by the production function the customer has also a limited number of choices among products of differing qualities. In case of services things are usually more complicated. Quality can be more varied by customer specifications but also the uncertainty in reaching the agreed specification is higher.

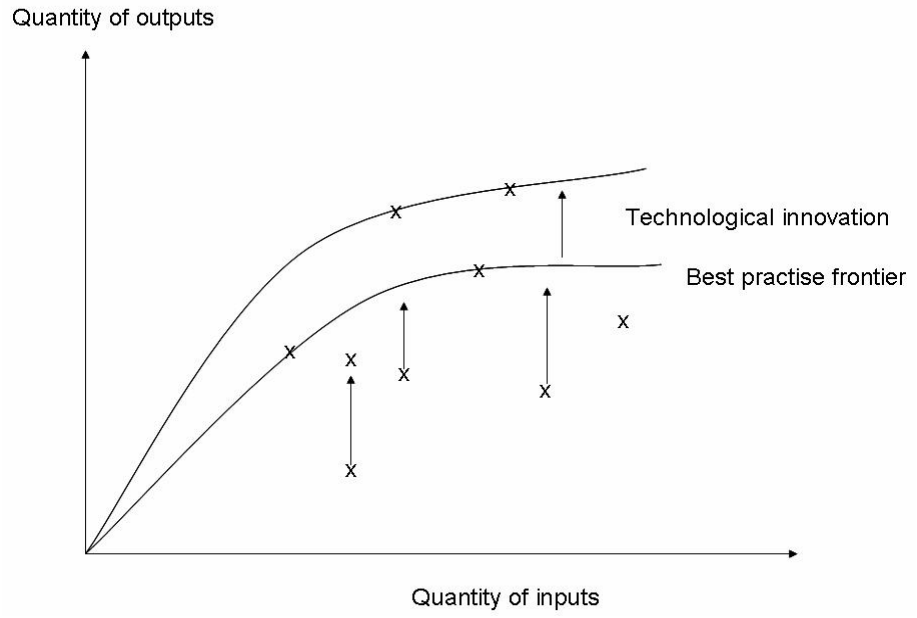

Figure 2. Productivity and operational efficiency (Van Ark, 2006)

Since production process for services is usually discrete and non-repetitive the production function is more obscure or it simply does not exist in a definite form. Gadrey (2002) notes however, that most services can be analyzed in terms of production function as a combination of three sets of functions each being associated with different types of technologies, organizations and efficiency criteria (Gadrey, p. 39).

Informational functions appear as direct components of the delivered service or internal management function. This recognizes the fact that information and knowledge is an essential ingredient of service output and input for business services, in particular. Nevertheless, internal knowledge management is difficult to assess separately from other functions and knowledge customers are provided with.

The functions of material logistics are by assumption more characteristic of labour and capital intensive services and than professional services. In fact material logistics is a distinctive function in manufacturing where it supports the subsequent manufacturing process. In this regard material logistics bridges the gap between manufacturing and services.

The direct service function defined by Gadrey refers to classical service similar to that of Hill (1977). In this context however, service function should be interpreted a bit differently as it concentrates on the maintenance of customer relationship. Like information functions relationship management is difficult to separate from other functions and the delivery of service.

Efficiency vs. effectiveness

Keeping in mind the specific nature of service functions, productivity management and marketing literature has adopted a more specific productivity concept to account also for discontinuous processes and customer specifications. For this concept which is depicted by Figure 3 productivity is a function of resources, activity and outcome. In this construction the design of service process starts from the outcome stressing the link from the activity to the results. Service outcome in turn determines the effectiveness of the service offering.

Effectiveness is, by definition, the degree to which end results are achieved relative to the required standard (Johnston and Jones, 2004). It is a matter of how well a service activity is performed that determines quality of the service outcome for the customer. The link from resources to activity determines the efficiency of the process, and it asks how much.

As with technical efficiency shown in Figure 2 the best practise is usually known here too, given the specification of effectiveness in the service contract. As there usually exists a trade-off between efficiency and effectiveness, the economic problem of the producer is to find balance between resources and activity, and activity and results to maximize long term profits. This optimum balance yields in theory, the maximal productivity (McGeee, 2007).

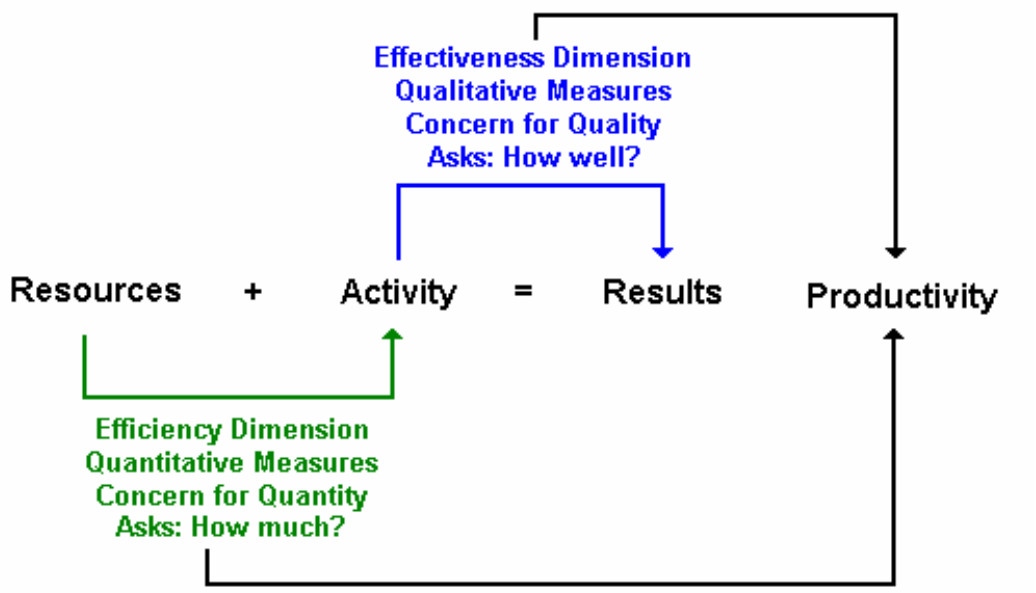

Figure 3. Productivity as a sequential process (McGee, 2007)

Service transformation

If the exact form of production function is not known or does not exist - as it is often the case with services - production can be mapped by actual transformation of inputs to outputs. In this regard transformation is an irreversible process both for manufacturing and services. For the tangible goods in manufacturing the transformation is inherently physical leading a new tangible outcome

In contrast, what is transformed in services is an existing object, physical or non-physical, resulting in an improved state of the object[4]. To delineate a picture of service transformation its key components have to be defined accordingly. To start with the objects Gadrey (2002b) identifies four types of objects in service transformation[5]. They are

- *Goods and other technical systems* owned by customer that provider is supposed to repair, transport[6], maintain, secure and so on.
- *Coded and standardized information* (including money in its pure symbolic form) that provider must transfer, process or manage on behalf of the customer
- *The customer himself,* for certain of his dimensions: body and health, intellectual capacities, spatial locations.
- *Organization their collective knowledge, competencies or structures,* the provider is supposed to analyze, transform or improve under the request of the customer, and often with his participation.

For the service provider the primary value of the transformation is the revenue depending on the price the customer is willing to pay. An additional provider´s value is the permanence of the customer relationship in the future. These both are determined by the value of the transformation to the customer, namely *quality*. Quality can be assessed objectively by comparing the specifications of the delivery written in the contract, and realization of the service outcome. In this sense the quality is simply the degree of fulfilment of the specifications of the contract. In economics this is also called *efficiacy*, the effect in absolute terms, neglecting resources spent[7]. Objective quality assessment is a common practise for standard business services and product-related consumer services.

In case of subjective quality assessment the customer has certain expectations and he compares them with the actual service delivered (Sundbo, 1999). This is characteristic of many non-standardized business, and consumer, services with high differentiation among service providers. Subjective quality assessment dominates when neither provider nor the customer can specify quality standards before the delivery. Subjective and objective quality can be approximated by a theoretical utility coefficient which relates the realized utility to the customer expectations or contract specifications. With coefficient values between 0 and 1 the customer is not fully satisfied while for values exceeding 1 the customer is satisfied more than agreed on the contract or expected by the customer.

With the specifications outlined above it is possible to construct a transformation model applicable for all categories of services. The model is depicted in Figure 4. The object of transformation, which can be physical - the customer or his property - or non-physical organizations such as companies, are characterized by their *state* at the moment of the contract. The service process to which the customer participates by varying degree is augmented by factors of production available for the service provider. These factors are labour, capital and information which, utilized together with external inputs, define an intangible service production technology.

[4] More specifically, a distinction has to be made between transformations which restore the original but weakened state, and those which improve the original state. Examples of the former are health care and maintenance services while the latter is the purpose for number of knowledge based professional services.
[5] Transformations executed by the customer are excluded from the list. In other respects the typology covers all service industries.
[6] In particular, transportation and communication can be understood as transformation over space.
[7] In many cases there are only two consequent states, success or realized utility or failure implying no utility increases for the customer.

The output is an improved state of the object the value of which is reflected in the quality, subjective or objective, or both. Finally, the realized quality (coefficient) determines total value added to be distributed between the provider, customer and the society (Sundbo, 1999). The realized quality influences the probability of the continuation of the service transaction relationship, which is included as discounted value added of future service transactions distributed by the parties.

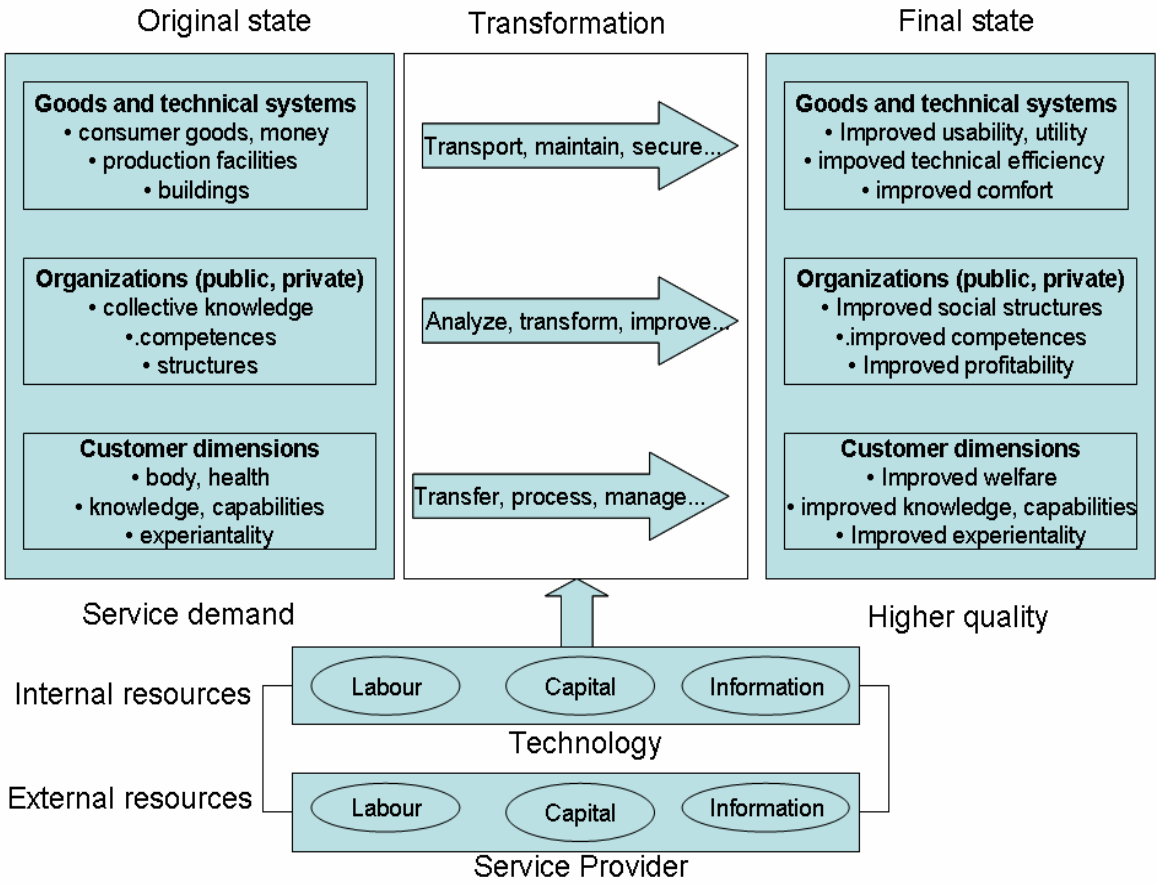

Figure 4. Service transformation process (Modified from Gadrey, 2002b).

Note that transformation of information as defined by Gadrey, is excluded from the model outlined here. This is because selling of information is comparable to selling products and it cannot be separated from the final outcome which is the improved knowledge base of the customer. Hence, knowledge transformation is implicitly improving the state of individuals or organizations.

Note on measurement

In policy context, productivity is considered synonymous with competitiveness of firms, industries and economies. In this regard, comparisons of productivity across countries and industries should indicate strengths and weaknesses of the economy. To enable such quantitative comparisons output of different activities needs to be transformed into a uniform scale. This makes technical productivity useless and necessitates the use of financial performance as proxy for the output. The most common proxy for the output is value added of companies and their business units which can be aggregated to get the industry level measure for productivity.

Value added corresponds to the total work done, through the direct expenditures of factor services of physical and mental energy by people, or through the application of inanimate energy through the use of machines (Metcalfe & Miles, 2006). In its simplest and most common form productivity is measured partially by relating value added to the amount of inputs used in the production process. In a dynamic form it measures change in the economic value created relative to the change in amount of inputs used.

While value added is widely recommended indicator for international productivity comparisons of manufacturing and services (OECD, 2007), country differences in basic calculation and adjustments made on the components of service productivity, make reliable comparisons difficult. Moreover, there is a more fundamental debate among scholars on the appropriateness of value added to capture correctly the production of services. These issues are tackled from a more practical perspective in the subsequent sections.

Theoretical schools

In general, research on service activities falls within number of socio-economic disciplines. If the scope of research is narrowed to service performance, i.e. innovation and productivity, two distinct schools can be identified. To follow the terminology of Metcalfe and Miles (2006) and Salter and Tether (2006) these schools are called *assimilation* and *demarcationism.* While the former is quantitatively oriented and relies heavily on the value added approach, the latter makes a strong case for qualitative methods.

Before 1980s the research on service performance was almost non-existent, as the Smithian notion that only manufacturing matters, still dominated economic thinking (Smith, 1776). Impetus for the growing academic interest for services was the decline of the manufacturing since the mid-1970s in the OECD countries and similarly, the growing share of services in the GDP. This phase of research, as noted by Salter and Tether (2006), was essentially characterised by the attempt to study innovation in services using the conceptual tools developed to understand (technological) innovation in manufacturing. As such this can be seen as an attempt to assimilate, or integrate, services into the wider fold of innovation research (Salter and Tether, p.5).

Accordingly, assimilation school draws on a central assumption that most of the economic attributes of services are similar to those of manufacturing. This is not to argue that industries are convergent as pointed out some authors. Rather it means that both service and manufacturing can be effectively analyzed and statistically documented according to the methods and concepts developed originally for manufacturing businesses (Metcalfe and Miles, 2006). If this is the case with the innovation processes, as indicated by industry taxonomies (See Section 3), this should implicitly hold for productivity too. This means that statistical value added is an appropriate measure for service production.

In contrast, demarcation approach argues that service activities are highly distinctive from manufacturing. Since features and dynamics of services are poorly understood, novel instruments and theories on service innovation and productivity are required. This line of reasoning came to the prominence since the mid-1990s. Demarcation, also called as socio-economic approach, focuses on organizational innovations where the role of tangible technologies is less prominent as for manufacturing. As people and interactivity are the keys to understand the processes of innovation, service productivity should be analyzed as a result of human interactive process. Accordingly, statistical value added gives a too narrow approximate for service production and productivity.

2.2 Macroeconomic Approach

The assimilation approach asserts that the economic performance of all business activities can, and for the sake of comparability, must be analyzed within a common theoretical framework. Like technological innovations this holds for the analysis of factor productivity, which was originally to measure the efficiency of manufacturing activities.

Among scholars assimilation is also called manufacturing or macroeconomic approach (Brax, 2006; Gadrey, 2002b) which derives from the high level of industry aggregation in making productivity computations[8]. Being the mainstream in comparative productivity analysis macroeconomic approach utilizes quantitative methods based on national industry statistics.

From the analytical perspective the term macroeconomic is a bit misleading, since the theory behind the approach is inherently microeconomic. In fact a more illustrative is to use term *neoclassical school*, given the underlying production theory and its assumptions on markets and economic behaviour. The assumptions of neoclassical analysis are derived from the general equilibrium framework which, for its static construction, is questioned by the institutional and evolutionary disciplines in economics (Williamson, 1985) [9].

The basic assumptions

This and the subsequent sections will demonstrate that the dichotomy between neoclassical and competing schools is pervasive in the analysis of service productivity too. In particular, the assumptions of the neoclassical theory constitute a useful point of reference since theoretically they define the first best framework conditions and economic outcome compared with the more realistic equivalents of the socio-economic and neo-institutional theories. The central premises of neoclassical analysis are the following (OECD, 2001):

- The physical transformation and technology of a firm is presented by a production function. Production is *technically* efficient i.e. the use of inputs in the transformation yields always a maximal output. The production is characterized by *constant returns* to scale excluding the option of scale economies.

- Firms and economies are *allocatively* efficient, which means that resources are deployed in production of goods and services for the right people at right prices. As a corollary, there are no market imperfections, and marginal cost of production and marginal productivity equals the unit price of the output.

- A *technical change*, through an exogenous innovation, may lead to increase in the output with a given quantity of inputs, labour and capital. Such an increase in productivity is technically more efficient, but it does not necessarily bring any change in allocative efficiency.

It is easy to see the real world looks something quite different. Nevertheless, in a relaxed form, the assumptions provide essential information on the areas and opportunities to increase productivity at a company or an industry level. Consequently, given a more realistic circumstances of imperfect competition and information, productivity can be increased by combined effects of improvements in technological efficiency (doing the things right), allocative efficiency (doing right things), technical

[8] This results mainly from the deficient data in industrial statistics.
[9] A closer treatment of the neo-institutional economics is left for the coming research report.

(disembodied and endogenous) change and economies of scale (OECD, 2001). Other residual factors may include improved capacity utilization and improved measurement techniques (See section 2.3).

Level accounting

Though its theoretical basis, neoclassical framework is readily applicable to comparative analysis across countries and industries. Based on statistical data maintained by national and international statistical offices, comparisons can be made both for the levels of productivity and productivity growth. The enabling techniques are called level accounting and growth accounting, respectively.

For the level accounting the value of output, approximated by the value added and often adjusted by purchasing power parities, is related to a chosen category of inputs, most often labour services (e.g. Mankinen & al, 2003). In cross-industry comparisons the partial productivity level indicators reflect mainly technological differences while in international context they also indicate country specific performance differentials within an industry (Mankinen et al, 2003).

For instance the Finnish data shows that manufacturing and service industries are evenly distributed between high and low productivity groups of industries (Viitamo, 2005). This finding rejects the general argument that services essentially lag behind the manufacturing in productivity. Country comparisons at the industry level are hampered, however, by the lack of robust techniques to transform the values of production into a uniform comparable scale (Inklaar et al, 2006)[10].

For a higher level of industry aggregation instead, the effects biases are smaller and some guiding conclusion from the productivity levels can be drawn. For instance based on the EU KLEMS data the level indicators show that the productivity lead the US economy possess relative to the EU has increased since the end of the1990s (Van Ark, 2006). Furthermore, the data shows that the gap is, by and large, caused by diminished productivity of the market services in the EU compared to the corresponding productivity growth in the United States (Van Ark, 2006).

Growth accounting

A more informative field of analysis is productivity growth comparisons which avoid the inherent problems of adjusting the value added levels. The starting point here is the neoclassical production model suggesting that the growth of output (value added) within a certain period of time, is induced either by the increase in amount the productive services of inputs, most notably capital and labour, or an increase in the total factor productivity (TFP), or both. A technical corollary of the basic model is that labour productivity (value added/labour services) can be increased either by increase in TFP or substituting capital for labour[11] or both.

Growth accounting framework treats total factor productivity growth as a residual factor comprising technological change and the joint effects of productive inputs not specified by the production function. In this formulation TFP is linked with the concept of operational efficiency discussed above. That is, induced by innovations in processes, products, organizational structures, TFP growth shifts the frontier of operational efficiency outwards (See Figure 2). This explains why TFP

[10] The diversity of methods, i.e. the use of purchasing power indices, generates usually ambiguous results.
[11] This is called capital deepening,

is regarded by many authors as the only meaningful indicator for productivity growth and competitiveness (OECD, 2005a)[12].

In principal, multifactor productivity measures reflect output per unit of some combined set of inputs. A change in multifactor productivity reflects the change in output that cannot be accounted for by the change in combined inputs. As a result, multifactor productivity measures reflect the joint effects of many factors including new technologies, economies of scale, managerial skill, and changes in the organization of production[13].

In the context of productivity growth accounting the time series of nominal outputs, i.e. values are deflated to get approximates for the annual changes in the real outputs. Keeping in mind the potential biases associated with different deflators, it can be shown however, that TFP really matters (See Figure 5). For instance, in comparison of the aggregate growth in labour productivity in the EU and the USA, the declining of effect of TFP in the EU and the equivalent increase in the USA seems to be the major cause for the superior performance of the US economy. In the case of market services, and distribution services in particular, this is even more prevalent (Van Ark, 2006). For the Finance and business services the contribution of TFP in the EU has been negative.

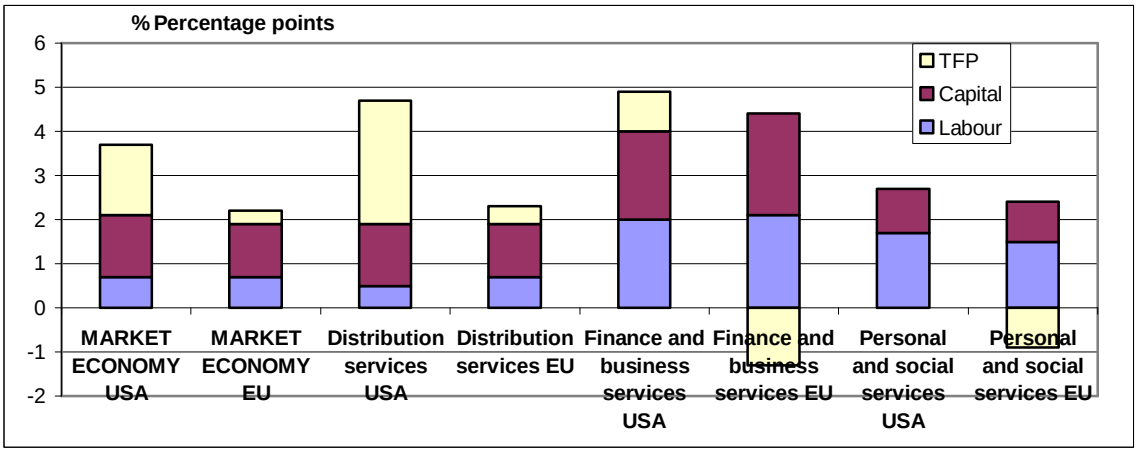

Figure 5. Decomposed contributions to value added growth in 1995-2004 in the EU and the USA, (EU KLEMS database, 2007)

Based on firm level data, an illustrative variant of the standard growth accounting model is decomposition of productivity growth to sub-categories of productivity impacts. For example MFP growth of an industry can be decomposed to productivity growth within each company, the productivity impact induced by reallocation of production among incumbent firms and the productivity impact of *Scumpeterian creative destruction*. The latter refers to the productivity gains generated by the exit of inefficient firms and entry of new and more efficient firms into an industry (OECD, 2003). Empirical studies demonstrate, that, by varying degree, all these components matter for the industry specific productivity growth (OECD, 2003).

The black box -character of TFP has provoked number of econometric studies to identify the exogenous factors explaining TFP growth. For example the growth project conducted by OECD found out that the main drivers explaining TFP growth are inherently microeconomic. According to

[12] In the context of neoclassical production function TFP captures technological and all other effects outside of capital deepening, enhancing labour productivity.
[13] See e.g. http://en.wikipedia.org/wiki/Multifactor_productivity.

the final report these drivers are: 1) the benefits of information and communication technology (ICT); 2) innovation and technology diffusion; 3) human capital and its potential; and 4) firm creation and entrepreneurship (OECD, 2005a). In making technical change endogenous econometric studies are manifestations of so called endogenous growth theory (e.g. Romer, 1986).

Without further explanatory information, comparisons of intangible and residual TFP across countries or industries provide little added information. From competitiveness point of view a more conclusive way is to look into the variations in labour productivity growth and its main determinants i.e. capital deepening, TFP and the quality of labour services. This is the major line of analysis with several variants of the standard growth accounting framework[14]. In Table 2 capital deepening is decomposed further into ICT and non-ICT components, while labour quality refers to the educational level of the work force in the industry.

	Australia	Canada	France	Germany	Nether-lands	United Kingdom	United States
1995-2003							
Market services (excl. ICT services)	2.8	2.4	0.9	0.9	1.1	2.2	2.7
contributions from:							
ICT capital deepening	0.9	0.5	0.5	0.6	0.9	0.9	1.3
Non-ICT capital deepening	0.1	0.2	0.0	0.3	0.4	0.6	0.4
Labour quality growth	0.2	0.1	0.2	0.0	0.1	0.2	0.1
TFP growth	1.7	1.4	0.1	-0.5	-0.4	0.5	0.9
Reallocation of hours	-0.1	0.1	0.0	0.5	0.0	0.0	-0.1

Sources and notes: see Table 1

Table 2. Input contributions to labour productivity in the market service sector, percentage points (Inklaar et al, 2006)

Again, the main focus in comparisons is geared to the divergent performance of the EU and the United States. The main conclusion provided by the data is that the contribution of market services to the increase in the productivity of the total market sector is much higher in the United States than in the EU[15] (Inklaar et al, 2006). Moreover, the manufacturing sector outperforms markets services in the productivity growth in most OECD countries. As this seems to be persistent trend, the services have been labelled as the laggards or the stagnant sector. Finally, as illustrated by ICT capital deepening in Table 2, US services have been more successful in reaping the benefits from the ICT investments compared to the European counterparts.

Productivity paradox

Several questions arise from these findings. Assuming that the measurement of service productivity is unbiased, what should explain the observed stagnancy? More strikingly, the statistics show that ICT investments are more extensive in market services than in manufacturing, and the labour force in the services is, on average, more educated than in the manufacturing sector (Wolff, 2002). For the industry policy, especially at the EU, this has been a major puzzle, and explanations for the poor performance have been sought from weak competition, regulation, cultural diversity etc.

The dilemma has provoked two lines of explanations. First, the so called Baumol´s cost disease story takes the inferior productive performance of services as given (Baumol, 1967). As technical progress often provides services of far higher quality than in the past, which is the progressive side of the production, the lack of substantially labour saving technology condemns their cost to rise

[14] The models differ by the extent of decomposing the growth determinants.
[15] More broadly this holds for the comparison between Anglo-Saxon countries and countries in the continental Europe.

continually and persistently far faster than costs in other sectors of the economy (Baumol, 2002). Slow productivity growth and high costs associated with a growing share of aggregate production of the services should eventually run developed economies to stagnancy.

There exists various views on Baumol´s argument but it seems to have gained wide support in the EU, which is demonstrated by a large number of initiatives for policy reforms and development programmes to boost service productivity. For instance, what is called as perverse combination of high productivity level and slow growth, characteristic of many European countries, may be caused by excessive regulation and consequent capacity underutilization in consumer service markets (Inklaar et al, 2006). As Inklaar and van Ark note, *these observations raise new questions of the old debate on the need to adjust productivity measures for user's convenience and adjustment for inputs for utilization rates* (Inklaar et al, p. 20).

Related to Baumol´s key arguments there are other explanations why extensive ICT investments and high level of human capital in the service businesses do not transform into higher productivity growth. First, it is possible that utilization the ICT with fierce competition has lead to more heterogeneous products the amount and quality of which are hard to measure (Gadrey and Gallouj, 2002). Second, innovations in some services may be industry-wide, which results in a new technological regime of service production[16]. This may in turn lead to higher service quality, the benefit of which is appropriated by consumers and customer industries. Finally, instead of boosting productivity growth ICT may have encouraged to service diversification, which is an important strategy for the value creation process (See section 2.4).

Measurement biases

Another line of explanations for the stagnancy points to the apparent biases in the productivity measurement. This is supported by the fact that high GDP share of services is positively correlated with the level of national income in the OECD countries (OECD, 2005b). Doubts on measurement are also fed by long standing zero or negative productivity growth rates for some service industries[17]. Hence, the observed under-performance of the market services seems to result from the biases in computing the components of service productivity indicators (Wölfl, 2003; Griliches, 1994). The possible sources of biases are the ways input and value added is calculated and, hence, the resulting contribution of services to the GDP.

On the input side a specific source of computational problems is part time labour, which is characteristic of many service industries. More importantly, the way how constant price value added is derived influences the productivity of services and their contributions to the GDP (Wölfl, 2003). Compared with manufacturing it is difficult to isolate the price effects that are due to changes in quality or mix of services from the pure inflatory effects (Wölfl, p 26). Depending on the deflator used the productivity growth paths show high variance for the market services.

Assessment

To sum up, neoclassical approach is logical construct which generates easily interpreted results in a comparative setting. The neoclassical framework is also a useful point of reference for a deeper analysis on service productivity. Contrasting the assumptions of the equilibrium world with the equivalent imperfections of the real life reveals a spectrum of sources for productivity growth. In

[16] For example the introduction of CAD and CAE in technical engineering and architectural services brought about a radical change over the whole industries.
[17] Such services are e.g. hotels and restaurants, renting and leasing and other business services.

particular, the equilibrium conditions which the neoclassical approach draws on are important since they help guide measurement of parameters that would otherwise be difficult to identify (OECD, 2001).

The central shortcoming of the equilibrium assumption is its contradiction with the sources of economic growth and productivity. Of this there is a general unanimity even among the neoclassical scholars themselves. As stressed by neo-institutional economists economic growth and productivity is driven by innovation and technological change which is possible only in the presence of scale economies and information asymmetries. That is, market imperfections are necessary conditions for any innovations and productivity growth to take place (Nelson and Winter, 1982; Dosi et al., 1998).

Within the neoclassical framework technological innovation, as it occurs, is only exogenous, and affects instantaneously the whole industry. In reality, this is only seldom the case. To repeat, growth accounting ignores firm specific advantages and monopolistic competition which are underlying sources of growth (OECD, 2001). These deficiencies have been mitigated by the endogenous growth theory which has demonstrated the interdependence between TFP and the quality of the business environment.

Based on growth accounting techniques empirical analysis suggests, however, qualified support for the productivity trap of the market services. Baumol´s disease -hypothesis finds some support when manufacturing and services are compared at the sectoral level and in the EU, in particular. The conclusions are weakened however, by the apparent measurement biases of service productivity. In this regard the debate and strive for improved modelling continues.

Strengths	**Weaknesses**
Sound theoretical basis	Supply and technology orientation, a closed transformation process
Simplicity and consistency between assumed causes and effects	Productive activities are black boxes characterized by production functions
A good fit the theory and empirical data	Equilibrium assumption is inconsistent with dynamics of innovation
High comparability across industries and countries (first best)	Inability to explain MFP in a credible way
High potential for development in modelling and increase of the quality of data	High level of aggregation and measurement problems especially for quality
A uniform and quantifiable measurement of competitiveness	Ambiguity in interpreting the inconsistent findings

Table 3. Strengths and weaknesses of the neoclassical productivity analysis

Finally, high variance in productivity performance (level and growth) within manufacturing and market service may indicate that service-manufacturing dichotomy may be less viable issue in the productivity analysis than generally thought (see Section 1). In this direction points also the observation that those service industries which are closely linked to manufacturing show similar productivity patterns as the manufacturing industries[18].The strengths and weaknesses of the neoclassical approach are listed in Table 3.

[18] These services are either manufacturing-like activities or services with supporting functions in the manufacturing clusters. Some examples of them are infrastructural services and services supplying standard commoditized services, e.g. transport, communication, banking, insurance and distribution.

2.3 Socio-Economic Approach

Setting the stage

As pointed out by Metcalfe and Miles (2006) demarcationism rejects most of the neoclassical reasoning. Accordingly, service industries should be explored separately from manufacturing by methods taking into account of the uniqueness of service functions. In its extreme expressions demarcationism disputes the very essence of contemporary economics. This is because the change from the era of mass production towards knowledge economy and flexible production modes has not seen the prerequisite shift in the paradigm in the mainstream economics.

Instead of stressing the necessity of scale economies and valuing activities separately by efficiency criteria, the new paradigm should model increasing variety, product innovations that reduce product life cycles and, the introduction of individualised or "customised" products and service-product packages (Gadrey, 2002b). Substitution of standard quality for customized quality with a high variance means a gradual obsolesce of supply based efficiency and productivity concepts. Consequently, the key in assessing human well-being is the effectiveness of products and services to in the generation of benefits which they are expected to yield.

According to Gadrey, “if the main pillars of contemporary developed economies are services, permanent innovation, knowledge and the new information and communication technologies, it requires us to move away from the economic growth paradigm towards a new paradigm based on the evaluation of economic and social development…we need to shift away from the economics of measuring flows and costs towards the socio-economics of judging improvements in state, quality and individual and collective well-being”. Hence, proper analyses of the effectiveness of the actions and services through which these improvements are achieved, is called for.

As with the neoclassical efficiency domain, the awaited new paradigm in Gadrey´s domain of effectiveness represents a hypothetical optimum which has to be relaxed in applied analysis. For instance effectiveness of improved products and services cannot be assessed in absolute terms, independently of their pecuniary value and costs (Grönroos and Ojaniemi, 2004). Rather, the question is whether and to what extent do the actual improvements meet the contractual specifications and the value of money paid for it.

Demarcationism should not be seen as a monolithic approach. It consists of several qualitative disciplines of business economics stressing a company view and need for re-conceptualization of service productivity. With a rough categorization the main disciplines are service management which deals with competitiveness and organizational issues and service marketing, which focuses more on the customer-provider interaction. These disciplines align more or less with the propositions characteristics the neo-institutional economics[19].

The basic model

The point of departure of the productivity analysis is the distinctive features of classical service; intangibility and customer involvement in the production, which cannot be captured properly by standard neoclassical framework. Due to the impossibility of partition service into units, service output is not quantifiable. This is why technical productivity for a classical service is regarded as an

[19] As noted in Section 2.2 a closer treatment of neo-institutional economics is left for the coming research report.

absurd idea at the outset. It should be stressed that the supply-based neoclassical productivity[20] is not principally denied, but the value quantification, i.e. transformation of current price value added into quantities by deflating, does not make any sense for productivity. Artificial quantification is also biased since quality changes of service outputs are then disguised.

Supply oriented productivity concept is also insufficient, since the production of classical service is an open system implying active customer participation. Co-production is however, a source of two measurement problems. First, input calculus should embrace all the productive resources provided by supplier and customer in the transformation process. Typically, the contributions of the client are not accounted or compensated but they affect as negative utilities, or sacrifice for the client (Ravald and Grönroos, 1996). Similarly, the total service output consists of the benefits gained by both parties.

To bring the reasoning a step further, service processes may link several contributors and beneficiaries, which are not compensated for their inputs or charged for the gained benefits and spill-overs. These effects are at core of the socio-economic thinking. To conclude, there exist a number of hybrid organizations (networks) which are open by varying degree, and they provide flows of services beyond the official book keeping of the participating companies. In a "cost-less" world research may concentrate more on the patterns of social interaction among the participants rather than economic calculus.

It is worth stressing that the degree of customer participation in the service production determines the degree how closed the production system is. It is known from the discussion in Section 1 that for manufacturing-type services like transport and distribution, the system is also closed and the seller's productivity is easy to define. Theoretically, for all cases with some degree of co-production by independent actors, the system is open and supply-based productivity concept is then deficient. However, at the other extreme where customer produces the service in the back office by himself, the system becomes closed again.

An illustrating and often cited service productivity model is the construct of Parasuraman (2002). Here the supplier's productivity - operational productivity (Johnston and Jones, 2004) can be expressed by standard neoclassical total factor productivity relating revenues to the inputs in use. The client, which in the model is implicitly assumed as a consumer, assesses his productivity by relating the effectiveness (quality, satisfaction, utility) of the service to his personal inputs or *sacrifices* (Ravald and Gröroos, 1996). The total (social) productivity of an individual service is by definition the sum of seller productivity and the customer productivity[21].

The central point stressed by the demarcationism is that changes of productivities of the seller and buyer are correlated, and negatively so (Grönroos and Ojaniemi, 2004). If the seller raises his productivity the buyer will suffer and vice versa. Parasuraman also assumes that there exists a substitution effect between inputs. As customer input increases the resources of the provider channelled to the production process diminishes, and vice versa. This is the effect 1 in Figure 6.

[20] That is the value added – inputs ratio.

[21] Note that partial productivities of an individual service can also be interpreted as contribution to, or effectiveness on the total productivity of the seller and buyer. From the seller's point of view the productivity of a specific service delivery yields a partial contribution to his total productivity. Similarly, a purchase of a service yields a partial contribution to the total productivity of the customer.

More importantly the quality of the service increases with higher provision of seller's resources resulting in higher output for both parties (Parasuraman, p.7). This in turn should lead to higher productivity for the customer, while the effect for the seller remains indeterminate in the model. Obviously, it depends on the relative increases in his resources and gained revenues not specified here.

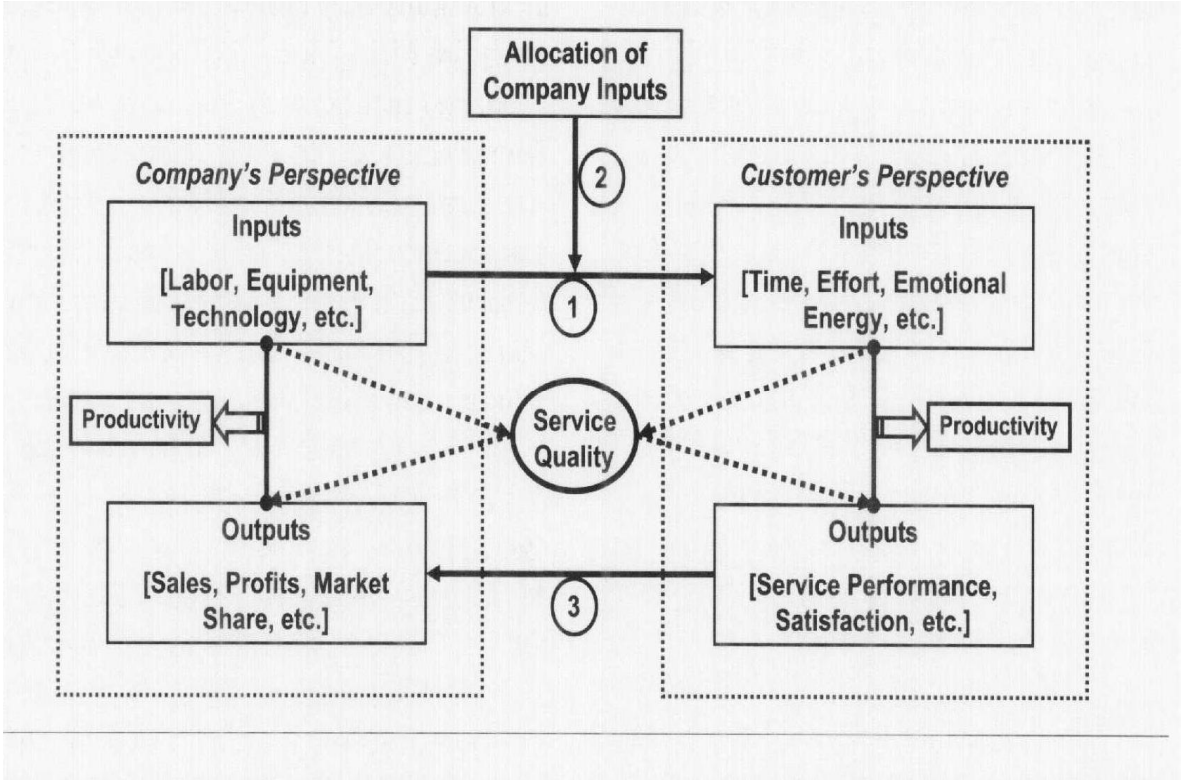

Figure 6. Service productivity framework of Parasuraman (2002)

The manner how the resources of the service provider are allocated bears essentially on the productivity outcome. If his resources are increased but allocated inappropriately the customer input would decrease less than if resources are allocated optimally. In other words, effectiveness - doing right things - plays a decisive role in boosting the overall productivity growth. This triggering effect on customer input is labelled as effect two in Figure 6. Finally, the effect 3 says that higher quality of the service brings higher revenues to the seller.

Hence, if the seller aims to increase his productivity by substituting customer's inputs for his own the quality will go down and the customer will probably switch over to another service provider. While intuitive the model of Parasuraman fails to indicate whether it pays for the seller to increase resources in a hope of higher productivity and profits. Similarly, higher quality is always preferable to lower but usually quality upgrades take place only with higher cost incurred by the provider.

Quality counts

The reason why quality matters for service productivity is demonstrated e.g. by Gummesson (1998). To quote "quality, productivity and profitability are triplets; separating one from the other creates an unhappy family" (Gummesson, 1988). By definition "quality is doing things right from the beginning and doing the things that customers need and want. When function and reliability improve, they boost the image in the market and customer retention." (Gummesson, 1998).

According to Gummeson (1988) “these changes stimulate sales volume growth, differentiate a provider from the competition and make the provider less dependent on price competition...Accounts receivable go down because payment comes earlier and less payment is delayed because of complaints; and reduced processing time requires fewer resources…As the cash flow becomes faster, the money can be used elsewhere and capital costs are reduced. Improved productivity becomes an antecedent to profitability”.

In such a virtuous cycle profitability derives essentially from relationship marketing (Ravald & Grönroos, 1996) which stresses loyalty, customer retention, and long-term relationships as keys to success. The longer the customer stays with a supplier, the better the profitability. Keeping in mind the components of productivity this means that if farsighted, the provider should give up some part of current operational efficiency to guarantee sufficient effectiveness and quality for the customer. From accounting perspective the discounted cost of efficiency loss should be less than the discounted future profits generated by the customer relationship. This relates to the value creation approach dealt with in the Section 2.4.

Composition of seller output

In making sense of service output and productivity Gadrey (2002a) makes a distinction between *quantity of cases* and *case-mix complexity* to approximate the direct service output variation (p. 44). As the former relates simply to the number of clients served within a unit of time the latter accounts for the degree of the complexity of a problem to be solved in each transaction. These conceptual indexes together capture the variation in the quantity of service offering.

So, instead of pursuing economies of scale (cost strategy) based on high customer flow, the seller output can be increased by solving more complex problems (value added strategy). Note, that pursuing the latter strategy is not necessarily, like cost strategy, inconsistent with increasing customer productivity and overall social performance of services. In the optimum seller can differentiate between customer preferences and select a mix of complexity which corresponds to specific capabilities of the service provider.

Gadrey also distinguishes a third element, *service intensity* or quality per case, which is a residual index consisting of the dimensions not captured by complexity index. In general, service intensity refers to the amount of resources devoted to “face-to-face interaction” with the customer and, together with the first two indices it determines the total output of the seller. Note that none of the components alone is equivalent to effectiveness, which is of the highest importance for total service performance (Gadrey, 2002). Effectiveness or the extent, to which the problem is solved, should be included in the Gadrey´s definition as a fourth component of service output.

Learning-induced productivity growth

From the perspective of productivity and industrial economics the closest link to the service management and marketing literature can be found in the neo-institutional economics, which also rejects the restrictive assumption of the neoclassical paradigm. The link between the first two disciplines is demonstrated by Figure 7 below which is a general description of the *evolutionary* processes enhancing service productivity (Grönroos & Ojasalo, 2004).

The starting point of the Grönroos-Ojasalo model is also the notion that effectiveness of service declines as the operational efficiency of the service production is increased. In particular, this

should occur in a situation where the input mix of the production process is changed towards a higher the capital-labour ratio. In this case the quality deterioration perceived by the customer stems from the diminished physical interface with the provider and the shift of the emphasis from service process to service outcome. This suggests that traditional technological innovation, applicable in manufacturing, is not necessarily supportive for service productivity. Rather, the key to improved productivity lies at organizational innovation and interactive learning in the service delivery process.

At the outset there may be bidding market with high number of anonymous sellers and buyers. The impetus to an evolving business relationship is mutual learning of behavioural codes in the pursuit of common goals and the continuation of the transaction relationship. As the customer learns what competencies are needed to participate effectively in the service production, and the provider becomes more familiar with buyer and his competencies, the customer participation in the service production can be intensified. Contrary to the assumptions made by Parasuraman, higher customer involvement can be channelled to improved operational efficiency and effectiveness simultaneously.

In this setting productivity consist of internal efficiency, which is equivalent to cost minimization, and external efficiency, which is equivalent to total revenue maximization (Grönroos & Ojasalo, 2004)[22]. Compared to the model of Parasuraman the parties of service transaction behave more interactively and their contribution to the quality is more symmetrically treated. Moreover, there exist no specific productivities for the seller and buyer, which make the production system more open-ended[23].

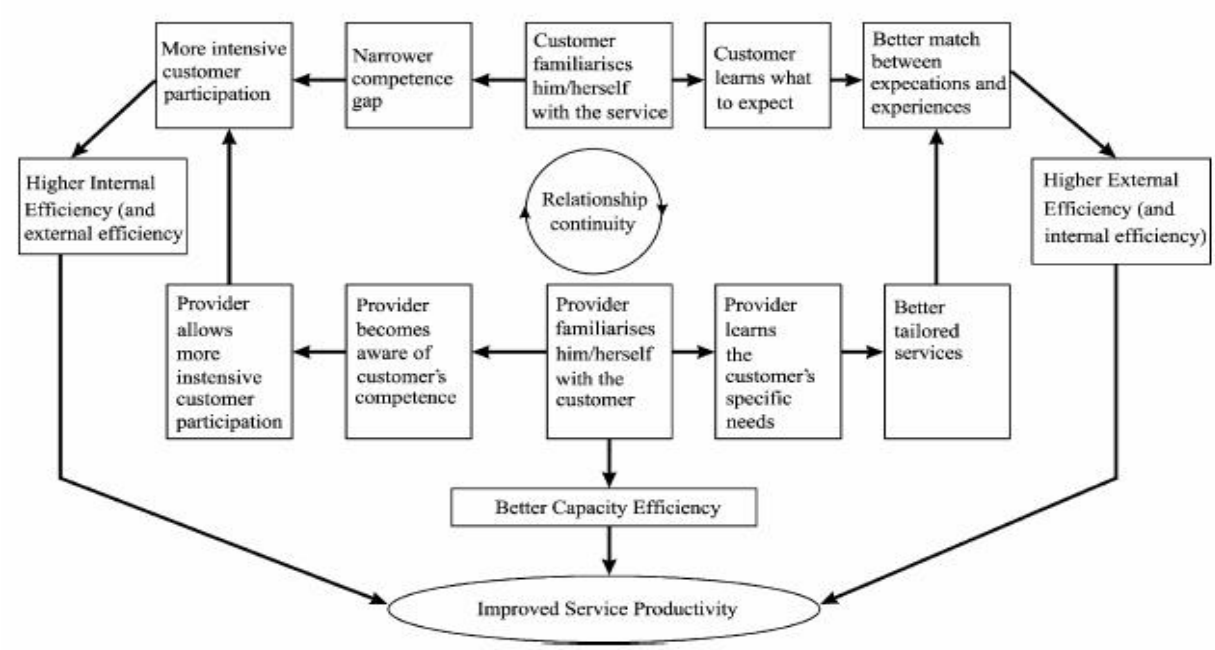

Figure 7. Determinants of service productivity growth (Grönroos and Ojasalo, 2004)

[22] The difference may be explained by the assumption that customer effort in this case is not only a cost factor but also a contribution to the service output. This is the case in number of business services.
[23] In general, the higher the degree of vertical integration or mutual dependency, the more closed the production system will become.

Another learning process relates to information on customer needs, which is by assumption incomplete for both parties. Accumulated information on customer preferences and objectives, combined with the past experience, enable improved match between customer expectations and quality provision. This also contributes to the internal and external efficiency and hence, higher productivity. As a result, the learning process, if virtuous, replaces a competitive bidding market by evolving contractual relationship which is a new governance mode to facilitate service transaction and productivity (Williamson, 1985).

With the internal and external efficiencies the productivity model of Grönroos and Ojasalo includes a third exogenous variable, degree of capacity utilization (See Figure 7). This is of particular importance for services, since their storage is by nature, an excluded option. The issue of capacity utilization relates to business cycles which artificially influence productivity performance. Though recognized within the growth accounting approach too, the challenge for measurement caused by business cycles are not solved satisfactorily.

Assessment

As demonstrated above the main credit of demarcationism is the genuine strive for realistic definitions of service productivity and its growth. The common element here is the dual approach of the provider and seller. Though the theoretical advances, or perhaps due to it, there are overwhelming difficulties in operationalization of the productivity for the needs of research and strategic management. This is manifested by rich of detailed qualitative descriptions of the determinants influencing the productivity, and scarcity of formal mathematical expressions[24]. While the stories seem to be as intangible as the object itself, they help understand the complexity of real world.

Naturally much of assessment of the socio-economic approach is centred on the relation between operational efficiency and effectiveness. The contradiction between them is evident in situations where operational efficiency is pursued by labour based mass production. Decreased effectiveness results from the attempts to increase the number of transactions or increase in customer flow per unit of time (Gadrey, 2002a; Johnston and Jones, 2004). An alternative way to achieve an equivalent growth in efficiency is higher capacity utilization in capital-intensive service production. In this case the significance of service process is diminished and emphasis is transferred to service outcome.

Hence, if the effectiveness is to decline in the cases discussed above, the decline may hit quality dimensions differently. For labour-based mass-production increased customer flow may decrease the effectiveness of the processes and outcome in the form of defects. In case of increased capital-intensity the nature of the process may change dramatically so that it is difficult to compare with the original technology. As the outcome becomes more standardized its effectiveness may decrease but at the same time it is more predictable. In other words the net outcome is contingent on how the customer values different quality components.

To conclude, as the-trade off between the two productivity components is intuitively appealing it should not be taken as a universal rule. In general the argument is more appropriate for consumer services and for cases where the service process lies at the core of perceived service quality. More generally, the socio-economic models implicitly analyses consumer services. If the business services are concerned, productivity concepts and objects of the seller and buyer may converge and

[24] Interestingly, there are serious attempts to quantify service productivity by specific resource accounting models but in most cases the focus is on internal efficiency of the service operations (See e.g. Klassen et al. (1998).

then operational productivity counts more. Consequently, higher emphasis is given to the productive outcome rather than the process, which should leave more room for technological flexibility.

In case of consumer services the trade-off is particularly sensitive to the dimensions of quality (Parasuraman, 1998). The message for corporate strategy is following: if operational productivity leads to lower perceived score in one quality dimension e.g. intensity in service encounter that may be more than compensated by a perceived score in other quality dimensions such as certainty and speed of the delivery. This leads to a more general issue on the capability to serve different customers segments with differing quality perceptions and needs.

The discussion of internal and external efficiencies brings the reasoning of Grönroos-Ojasalo model closer to the standard microeconomic analysis. Given the production technology and costs the transaction system tries to maximize effectiveness, or given the effectiveness, agreed ex ante, the system tries to minimize the production costs with an optimal technology. In this regard contractual arrangement may ideally work as a firm pursuing profit maximization. In practice however, objectives may differ which necessitates coordinating mechanisms and negotiation to balance between internal and external efficiency.

In other words, learning-induced productivity growth reflects an optimistic view on aligned objectives and the power of trust (See Table 4). This may be well justified for business development. Things may become complicated if the parties have other motives than a common good, i.e. they are inclined to opportunistic behaviour (Williamson, 1985). How to safeguard against shrinking and possible changes in market incentives is not a central issue for socio-economic approach. Moreover, service companies are usually supplying a number of customers. This is why customer relations cannot be managed separately, and in multi-client cases possible scale economies have to be taken into account, too.

Related to scale economies two remarks on capacity effects and business cycles are in place, too. First, business cycles as such, do not affect either the technical efficiency or the effectiveness at the micro level. This is worth stressing since the socio-economic productivity models are intrinsically microeconomic. Second, the degree of resource utilization or underutilization depends on the capability of the firm to adapt and reallocate if demand in a specific customer segment turns down. The ability to reallocate depends ultimately on asset specifity and managerial skills.

Strengths (reality)	**Weaknesses (impracticality)**
Management-orientated approach	Descriptive and dispersed theoretical basis
Positivist view on the development of business relations	Positivist view on the development of business relations
Emphasis is on the effectiveness of services activities	Modelling is implicitly focused on consumer services
High potential for more systemic modelling	Limitations in quantitative and comparative analysis
Genuine pursuit to realistic productivity conceptualization	Poor operationalization of productivity concept

Table 4. Strengths and weaknesses of the socio-economic approach

Antecedent to the industry taxonomies investigated in Section 3 is the notion of constant quality assumption in productivity of the manufacturing sector (Grönroos and Ojasalo, 2004). That is, for

the production of tangible goods changes in input mix and scale to improve operational efficiency, does not alter quality which, in the case in services, most often leads to quality losses.

It is hypothesized here that the degree of quality change and closeness of the production processes are continuous variables characterizing all industries and economic activities. In this regard they are measurable by indices which vary between zero and one. In particular, "service processes where the provider more or less only provides customers with a highly standardized infrastructure, such as telephone operator, and where customers interact only in this environment, the service provider comes close to a closed production system resembling manufacturing" (Grönroos and Ojasalo, p. 416).

Theoretically, socio-economic analysis shows a straightforward link to transaction cost economics and the evolutionary theories of the firm. In particular, the issue investigated here is equivalent to the problem of deciding between markets and hierarchies i.e. hybrid forms of service governance modes. The virtuous cycle discussed above corresponds to what Oliver Williamson calls fundamental transformation caused by increased asset specifity and lock-in effects (Williamson, 1985). Similarly, the impacts of learning, capabilities and experience within a contractual relationship find their counterparts in the neo-institutional analysis on routines, tacit information and knowledge which explain the existence and competitiveness of business firms (Nelson and Winter, 1982; Penrose, 1959; Dosi et al., 1998).

2.4 Value Creation Approach

The key distinction between assimilation and demarcation is the conflicting views on the essence of manufacturing and services. This in turn explains most of the divergent interpretations on service productivity. For the former the computation of productivity draws on standard accounting practises of business enterprises whereas for the latter the actual contributions of the seller and buyer are inseparable which makes standard accounting deficient. Service co-production is a more realistic but, analytically also more complicated assumption to operationalize. Note that neoclassical productivity of business services transactions is measured uniformly by value added-input for the parties. For consumer services instead, customer productivity, which is equivalent to experienced utility, is meaningless.

Conflict or not?

An implicit question is then to what extent these approaches are inconsistent? The answer depends on what further assumptions have to be made. First, it is known that the overall productivity of an economy is expressed by the total GDP per hours worked. It is insensitive to the distribution of actual outputs and inputs within the value chains of commodities and services. In this regard business accounting is just a compromising rule how that division, though a rough approximation only, can be made[25].

In case of business services the productivity concepts are not principally inconsistent. The inputs and outputs of the seller and buyer fall in same statistical categories and it is a matter of deciding how to divide them between internal labour, capital and technologies or externally purchased services and other intermediate products. Moreover, neoclassical TFP of a company is intended to

[25] These biases relate to those analyzed by Wölfl (2003) in the growth accounting framework. For instance, if customer's labour input in service production is bigger than officially recorded, its productivity is lower and supplier productivity higher than statistics show.

capture all the unexplained sources of growth, including external labour and capital of the customers. As conveyed by Figure 6 effectiveness of service, which in this case is equivalent to the partial productivity of the service input to the customer value added, could be included as a component in a disaggregated growth accounting model (Inklaar et al, 2006).

The only important difference relates to the assumptions on rationality and information incompleteness. While the neoclassical model assumes that producers and consumers behave always rationally in maximizing their profits and utilities based on perfect information, this is not the case with demarcationism. For instance, service marketing literature suggests that main objective in service transactions is not the deliberate profit maximisation but enhancing learning process where personal relations play a dominant role (e.g. Bolton and Smith, 2003)[26]. In this constellation it is mainly a matter of assessing whether the transaction relation could be profitable in the long run given the inherent uncertainty.

A bigger shortcoming of the both approaches relates to the measurement of effectiveness of an individual input procured externally. The growth accounting is based on a restrictive assumption of additive contributions of inputs to productivity, i.e. there are no cross effects between inputs other than those lumped in TFP. For the demarcationism the problem is even more aggravated and stems from customer participation. This makes the measurement of effectiveness of inputs virtually impossible. In general, the more intangible and complex the service input is, the more difficult it is to isolate its effectiveness from other effects on the outcome.

A short remark is also in place on the ways how the sources on productivity are treated. Within the neoclassical setting innovations are mostly exogenous industry-wide shocks captured by the TFP growth. This is the major cause of criticism by the neo-institutional school and the endogenous growth theory which draws upon innovative entrepreneur and creative destruction. For the demarcationism innovation is a central topic dealt with in a similar fashion than productivity. Though the extensive literature on service innovation, the link between service productivity and innovation is not yet systematically analyzed. From the discussion on productivity above it is clear that the major agenda for service innovation is essentially managerial; how to balance between internal and external efficiencies with the optimal customer participation.

Towards integration

To conclude the two approaches explored here should be viewed as complementary ways of assessing productivity: “growth accounting and productivity measurement allows one to quantify – in a systematic and consistent way – the proximate sources of growth. It has explanatory power in that it captures the workings of supply and demand for and substitution between categories of measurable inputs. At the same time, growth accounting has to be complemented by institutional, historical and case studies if one wants to explore some of the underlying causes of growth, innovation and productivity change” (OECD, 2001).

For example, an integrated approach may shed light on the neoclassical productivity paradox of services. As indicated by Wölfl (2003), it is possible that the biases in measurement will systematically underestimate the quantity of service output and overestimate the quantity of manufacturing outputs, respectively. In particular, this may be effective in case of business services which are used as intermediate products by manufacturing and other customer industries. Given the

[26] The deviations from efficiency are reflected in the industrial statistics, too.

intangibility, quality and co-production stressed by socio-economists, pricing of services to reflect their true effectiveness, is hampered accordingly.

Pricing in turn determines how the economic benefits are divided between the service provider and customer. In line with Wölfl´s argument there is a good reason to assume that actual effectiveness of business services is under-valued for several reasons. First, if effectiveness of a service on customer´s value creation is difficult to observe, e.g. due to the cross-effects of inputs, the pricing has to be based on criteria other than its productive contribution of the service[27].

Given the inherent ex ante uncertainty of service outcome, a risk premium has to be paid which is negative for the service provider. In a similar fashion the overall impact of a service on customer´s value may materialize long after the service transaction has been completed. The total influence may exceed essentially what has been originally agreed on or expected. Finally, the value-pricing gap may suggest a higher negotiating power of customer industries and fierce competition among sellers, respectively.

Value creation approach

With the prospects of integrated analysis based on assimilation and demarcationism there is an interesting opportunity outside of the mainstream which may be called *value creation* or strategic approach to productivity. While still latent, it draws largely on the dispute discussed above to settle the productivity issue in a holistic setting. It asks the fundamentally, whether and to what extent productivity is prioritized in the firm's strategic objectives. In doing so the value creation approach combines Porterian strategic management school (Porter, 1980; Porter, 1985) and the value theories of a firm (Dobrovolsky, 1971).

One of the earliest expressions linking value creation as a principal objective of the firm to the realized productivity is that of Edith Penrose, (1959). To quote "the productivity activities of such a firm are governed by what we shall call its "productive opportunities", which comprise all the productive possibilities that its "entrepreneurs" see and take advantage of. A theory of growth of firms is essentially an examination of the changing productive opportunities of firms…"

According to Penrose "it is never the resources themselves that are the inputs in the production process but only the services that the resources can render. The services yielded by resources are a function of the way they are used – exactly the same resources when used for different purposes or in different ways and in different combinations with different types or amounts of other resources provides a different service or set of services" (Penrose, pp. 25-31).

Surprisingly, more explicit initiatives of value creation has been taken by the University of Groningen, personification of macroeconomic school (Van Ark and de Jong, 2004), and by scholars representing demarcationism (Grönroos & Ojasalo, 2004; Salter and Tether, 2006). The key assumption proposed here is that the overall objective of the firm is to increase its present value which is a function of discounted future profits or value added[28] (Dobrovolsky, 1971). Hence, the value of a company is determined by managerial effort to increase future profit streams associated with low risks. In this setting performance should be evaluated relative to the stated objectives of the firm and performance of competitors or industry average.

[27] An example is pre-determined hourly tariff.
[28] Long term is an essential condition since short sighted profit maximization may lead to reduced future profits.

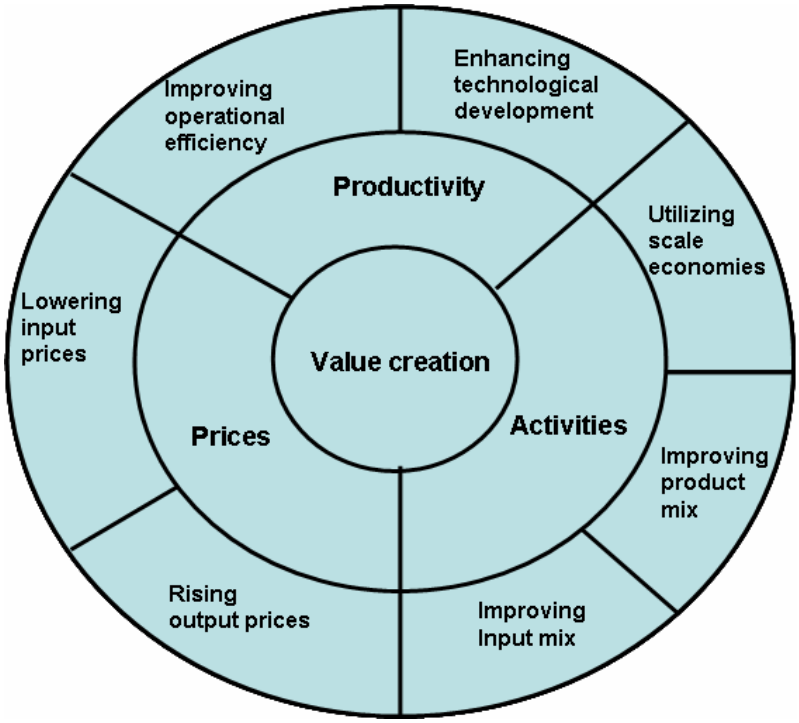

Figure 8. The sources of value creation in corporate strategy (Van Ark and de Jong, 2004)

In pursuit of value increase the firm has three sets of strategic options available. These options and their subcategories are indicated by Figure 8. Productivity is the main determinant of sustainable value creation in the long run. It can be enhanced by improving operational efficiency – moving towards best practise frontier – if not already reached or by improving first best technology, that is, total factor productivity based on new innovations. This strategy indicates, how thing are made. As can be seen effectiveness is not explicitly included here but it can be added as a third element without distorting the main conclusion.

Second strategy indicates what is made i.e. how resources are allocated among alternative uses in a value enhancing way. This includes utilization of scale economies and economies of scope, i.e. diversification (Chandler, 1990) as well as improving input mix. As indicated above by Grönroos and Ojaniemi (2004) input substitution is critical in many services but also restricted by quality implications. Using the terminology of strategic management effectiveness can also be understood as the contribution of each line of businesses to the value increase objective.

A third set of strategy should consider the costs of improved efficiency, effectiveness and product mix. More concretely, it is simply question of selling expensively and buying cheaply. Price-cost strategies have been a largely neglected strategy by the assimilation and demarcationism as it deals with complex issues of quality changes and use of market power in influencing the output and input prices.

Notice that the three single strategies should not be seen as exclusive alternatives but a complementary set of variables the choice of which depends on industry characteristics such as competition and technology as well as innovativeness and capabilities of the firm. For instance selecting a specific product mix means implicitly a commitment to a certain price-cost strategy characteristic of an industry.

The key point however, made also by Grönroos and Ojasalo (2004) is that productivity growth strategy will be pursued to the extent it is profitable for the firm. Within the context of Figure 8 productivity should be of first priority *only if* other strategies based on prices or activities are less effective in value creation. This line of reasoning is also implicit in Gadrey´s (2002b) explanation why ICT investments in service industries are not reflected in productivity growth.

Linking customer value

From the perspective of competitiveness, value creation capability is a more viable concept than the narrow effectiveness. In particular this holds for transaction relations of business services. "Any value adding-strategy should take the objectives of relationship marketing e.g. establishing, maintaining and enhancing relationship with customers at a profit, so that the objectives of the parties are met" (Ravald & Grönroos, 1996).

In the analysis of relationship marketing (RM) the subjective value is defined as a ratio between perceived benefit and perceived sacrifice. In this context sacrifice embraces all disutilities incurred, including the money paid for the service. Hence, if customer satisfaction and effectiveness depends on the value created, then it must also depend on the total cost or sacrifices too (Ravald & Grönroos, 1996).

Compared with the strategy based on technical productivity, value creation approach allows for a broader range of innovative actions for the service provider in solving, and especially, *identifying*, the customers´ problems and deeds. This in turn generates higher discounted cash flow for the service provider. Hence, the matter of service management is to enhance customer value by increased benefits and reduced sacrifices. This can be achieved through the three value creation strategies shown in Figure 8.

The framework suggested here draws conceptually on the strategy models developed by Michael Porter in the 1980s. As noted by Ravald and Grönroos (1996) Porter, in his original works, argues that competitiveness necessitates choosing between cost leadership and diversification, not getting stuck in between. Given the heterogeneity and uniqueness of services, however, strategy mix is not only possible but most often prerequisite to sustain competitiveness of service businesses.

Operational performance index

Given that value creation, in its entirety, is the primary objective of a service company the next question is then, how to measure it appropriately. It is contended here that appropriateness assumes two characteristics, universality and effectiveness. That is, the suggested indicator should enable comparative performance assessment and measurement of doing *right things*. This necessitates a closer look at the operational performance based on real processes, and financial performance based on pecuniary processes (Vuorinen et al, 1998). These interdependent processes are illustrated in Figure 9.

Note that the relations in Figure 9 are consistent with the value creation strategies in Figure 8, which highlights the importance of various strategy mixes on overall competitiveness[29]. The column in the middle, which is determined by real and financial processes, describes the value creation process of the service provider. In case of business services identical flows are effective on

[29] The processes in Figure 9 are applicable for the combined business activities of a firm or a segment of business portfolio.

the client's side. A plausible performance concept for this framework is economizing in which real and financial productivity domains are merged (Pass and Lowes, 1993).

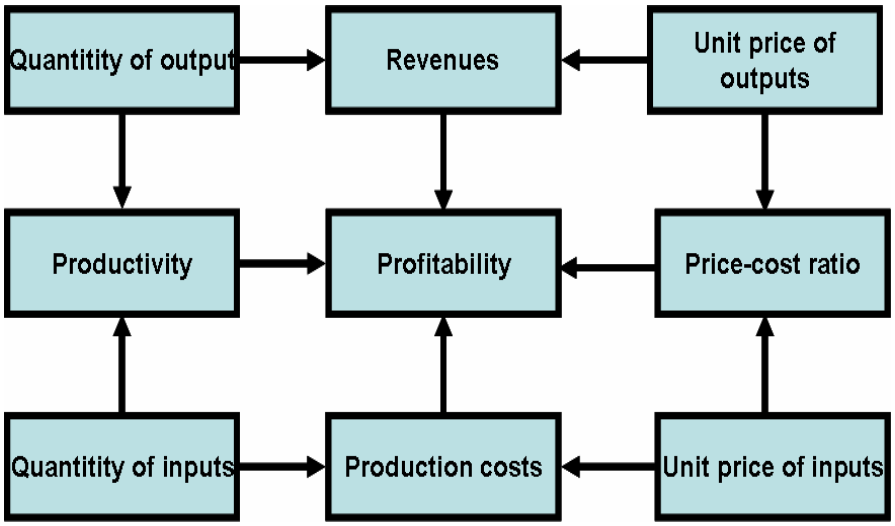

Figure 9. The linkages between real and financial processes (Brax, 2007)

Keeping in mind Gummesson´s argument that the *triplet* of service productivity, quality and profitability are all ingredients of the economic result of the organization (Gummesson, 1998; Grönroos and Ojasalo, 2004), an appropriate construct of service productivity indicator can be formulated. As indicated by the discussion above technical productivity of real processes alone is insufficient. Nevertheless, we can assume that the technical productivity, though its intangibility, is a viable concept especially for back office activities supporting front office service processes.

It is also clear that efficiency of pure financial processes is not a sufficient for service productivity, either. This is because it neglects the essential impacts of real process and may be just the result of market arbitrage and monopoly power. However, to quote Grönroos and Ojasalo (2004, p. 421) "financial measures seem to be the only ones that manage to incorporate the quality variations caused by the heterogeneity of services and the effects on perceived quality by customer participation in the service processes". In particular "if the service productivity is defined as a function of both internal efficiency and cost effective use of production resources and of external efficiency of and customer perceived quality, financial measures are probably the only valid measures available".

The authors suggest that the most appropriate indicator for productivity of a specific service is the ratio of provider's revenue generated by a service and the provider's total costs of producing this service. Accordingly, customer-specific productivities can be summed up to get the total company level productivity, which, comes very close to the growth accounting formula of the neoclassical approach. In general this is consistent with the reasoning here too, given the inherent *black box* – problems associated with pecuniary indicators. The revenue indicator, based on current prices, captures effectiveness and efficiency of the services while the total cost factor brings the effect of TFP and the quality of inputs, respectively.

The refinement proposed here concerns the nominator of the revenue-cost ratio. If revenues are measured by turnover, the comparability across companies and industries remains low. This is because the size of turnover is affected by the quantity and value of purchased intermediate inputs. For instance, the higher turnover figures of manufacturing compared with services results largely

from the more intensive use of intermediate inputs by the manufacturing sector. Hence, to eliminate this technological bias and to follow the reasoning of value creation discussed above, turnover is replaced by value added index. Accordingly, the following function for service productivity is suggested:

Current value added/total production costs

= f(efficiency of real processes, productivity of financial processes, effectiveness)

In its aggregate form the function defines economic efficiency (Pass & Lowes, 1993) of all activities located within the boundaries of a firm. That is, it includes the effect of product and input mixes and scale economies, i.e. the strategic sources of value creation. The function can be aggregated to industry level to compare not only service industries but the manufacturing industries too. With various planning horizons the relation can be expressed as a present value, i.e. a flow of discounted value added expected in the future relative the corresponding production costs. Accounting for the future business prospects, the discounted productivity index conveys more informative picture on competitiveness of a company.

At industry level things are usually more complicated and productivity comparisons should be adjusted by an index which takes into account of the intensity and nature of competition and hence incentives for innovation. This is because financial processes include the problematic effect of market power which contradicts with economic efficiency. There are several alternative indicators for controlling market competition. One option is to use market entry-exit indicators which is a proxy for Schumpeterian creative destruction, and hence, dynamics of competition. For example, if the productivity indicator suggested above correlates positively with the frequency of entry and exit there is a good reason to assume innovation-driven productivity growth for the industry.

Organizational remarks

From productivity perspective it is also crucial to consider how organizational factors and scale economies enable productivity growth. More specifically, a central issue is the extent to which service production can utilize - or necessitates – an effective division of labour based on team work. In general, team work is a dominant production mode in services when utilization of scale economies necessitates division of labour, and when complexity of customer problems necessitates a combined utilization of specific skills and expertise.

In the extreme case there exist few complementarities in the service production, and clients are served separately by an individual front office employee of the service firm. The *individualist* model is characteristic of majority of consumer services and knowledge-based professional services focused on specific areas of customer problem solving. Note that the individualist service mode can utilize scale economies which are based on improved routines to increase customer flow. According to the main socio-economic hypothesis however, this leads ultimately to a reduced effectiveness of service productivity.

For all services the highest potential for team work exists in back office functions while the customer interface is usually managed more individually. In fact, this relates directly to the managerial problem and skills of balancing between operational efficiency and effectiveness. There are two organizational options for combining them to improve overall productivity. The more front office functions can be standardized and transformed into back office functions, the more front office capabilities can be released for managing customer interfaces and improve effectiveness.

Additionally, as the activities in back office functions increases there is higher potential for increased operational efficiency through reorganization of the current operations and utilization of scale economies.

In principle, there exists potential for operational efficiencies in the front office activities too. These benefits are other than those stemming from higher customer flows in standard services. For the professional services it is technically viable to increase overall productivity by a more effective knowledge exchange and interaction between the front office experts. In many service professions, however, high powered market incentives work against such a productive co-operation. For the obvious reasons Teece (2003) comments, that "coordination must be achieved and conflicts must be expunged since experts are likely not only have strong preferences bur are also likely to be self-confident, possibly egoistical and possibly lacking in good business sense".

For professionals knowledge on markets, customers and own personal skills are accumulated assets which are sources of private competitive advantage. In these circumstances the protection of assets and prevention of any externalities is of higher priority than sharing the knowledge in pursuit for productivity growth and profitability for the company[30]. As a mitigating response, various arrangements to align incentives have been implemented, e.g. employee ownership or other pecuniary incentive schemes (Løwendahl, 2005).

There is an important corollary of the discussion above. In case of intensive team production the marginal products of individual employees (departments) depend crucially on the complementary efforts of other service employees (departments). As it is difficult to assess the contributions of each individual employee to the total output, there exists high potential to improve productivity by new organizational innovations and incentive schemes.

For the individualist service provision such potential does not exist, but in that case each employee's contribution to the aggregate production is more transparent. In this regard there is a interesting analogy with the socio-economic approach which stresses the customers´ contributions to, and the openness of, the production process. The key challenge in both cases is how to reward the labour services the contribution of which is not directly measurable.

Theoretically, this is a coordination problem which is at the heart of the team production theory of the firm introduced by Alchian and Demsetzt (1972). For the authors the existence of the firm as organizational arrangements flows from its ability to co-ordinate and monitor team production which makes it superior to market based self-organizing arrangement. Managers monitoring team behaviour detect shirking, and align reward to performance.

Consistent with the remarks above Alchian and Demsetz are sceptical that professional services can be organized as manufacturing firms because of imperfect monitoring of individual performance. "While it is relatively easy to manage or direct the loading of trucks by a team of dock workers when input activity is so highly related in an obvious way to output, it is more difficult to manage and direct a lawyer in the preparation and presentation of a case"(Alchian and Demsetz, p. 786).

[30] The same incentive problem hampers the modularization of professional services.

3 Service Taxonomies

Following the reasoning of De Brandt and Dibiaggio (2002) in Section 1.2 it is worth considering why it makes sense to explore the differences and similarities of industries. What is the economic or scientific value brought about? For sure there exist a vast number of empirical studies pursuing alternative classifications without consideration this fundamental question. In this sub-section grounds for industry reclassifications will be highlighted. More importantly a new taxonomy based on the critical characteristics service productivity will be developed.

3.1 Setting the Stage

Why to reclassify?

It should be noted that official industry classifications such as ISIC and NACE applied by statistical offices, and derived industry typologies serve basically different purposes. Official classifications are applied for statistical data to show how economic activities are divided across different sub-sectors and how the performance of industries develops relative to each other. Inter-industry data, as processed by statistical methods, generates new knowledge on the current state of the economy and predictions on the future states and trends, respectively.

Basic statistical analyses generate also new industry groupings depending on which properties of economic activities are investigated. It may be simply the volume of production, employment, foreign trade, investments, innovation activity etc. An illustrative example in this case is labour productivity and its growth in the macroeconomic setting. From the discussion in Section 2 we know that there exits two *clusters* of industries, the dynamic manufacturing with rapid productivity growth and the stagnant service sector with weak productivity performance. Or, at least we are supposed to believe so.

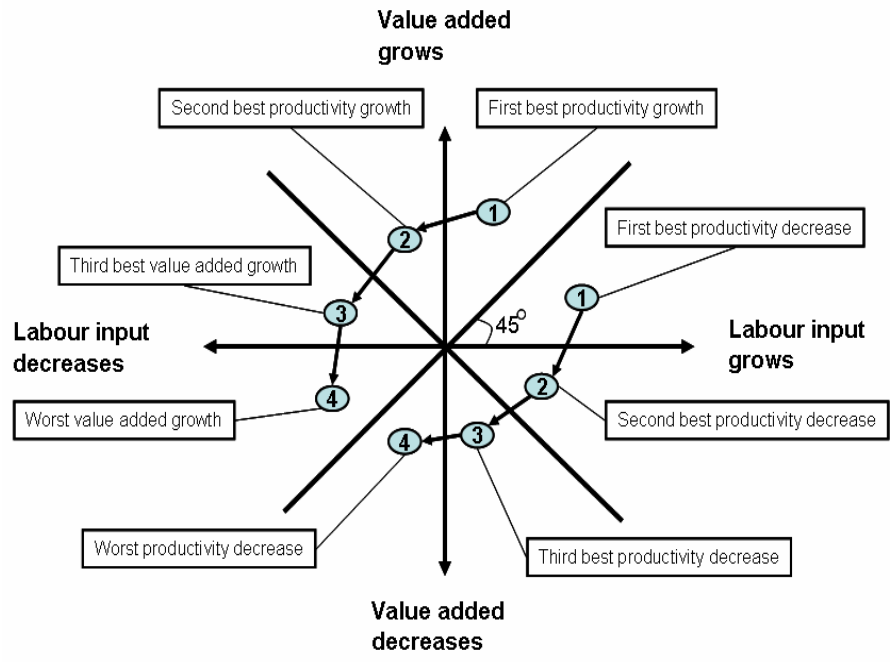

Figure 10. Industry typology based on productivity growth patterns

From the policy perspective a more informative classification would indicate the type of productivity growth or decrease across industries. This is illustrated in Figure 10, which also presents the order preferences[31] for cases where productivity grows – the upper path - and where productivity decrease – the lower path. We know for example that the productivity growth in manufacturing is more based on savings in labour inputs – showing the growth patterns 2 and 3, while most of services locate in segments Decrease 1 and 2. This is to demonstrate that a detailed classification based on official statistics may reveal essential information which may entitle to a new industry taxonomy.

Derived industry typologies which most often are based on the official classifications are in some cases used for same statistical purposes. Their principal purpose is however, to yield essentially new information on the characteristics of industries, which are hidden by the official industry classification. That is, the objective is to find characteristics, which are common to sub-sets of industries called clusters. Examples of derived typologies are explored more closely in the next Section.

In this regard the official classifications are also based on specific criteria how to group industries. As shortly touched in Section 1, the logic is reflective in Porat´s (1977) seminal inquiry into the size and structure of US information economy. A by-product of his study is the often cited sectoral classification based on the principal functions of economic activities. Illustrated with the arrows below these functions also describe the chronology of the evolutionary stages of industrial capitalism. The four economic functions are

- Raw material producing function (primary: agriculture, extraction, forestry, fisheries) →
- Raw material handling function (secondary: manufacture of finished products) →
- Service functions (tertiary: consumer and business services) →
- Information functions (quaternary: producing and handling of information)→ ??

In practise the European industry classification NACE is not equivalent to this division, since information functions are not included as an explicit category in NACE. The NAICS system of USA instead defines information as a separate sector which consists of publishing industries, broadcasting and telecommunications as well as information services and data processing services. NAICS is, however a narrower category than information function in Porat´s classification which by definition embraces also government, culture, libraries, scientific research and education (See e.g. Apte and Nath, 2004)[32].

The different classification criteria applied the statistical offices of the EU and the USA demonstrates the important point made here. With the structural changes in the prevailing techno-economic paradigm there is a growing pressure for adjustments in industry classifications, too. So, the less responsive official classification systems are the higher the demand for derived classification will be. An illustrative example is the industry category of publishing which by

[31] The preference is assessed from the economic policy perspective. Note that the growth and decrease paths are not compared here.

[32] To go a step further, there is a growing interest to define a fifth *quinary* sector which mainly virtual, embedded in the other sectors. This should include individuals of highest levels of decision making in a society or economy. This sector would include the top executives or officials in such fields as government, science, universities, non-profit, healthcare, culture, and the media.

NAICS belongs to the information industries while in the context of NACE it is, together with printing, part of the manufacturing sector.

Implications for services

Industry classifications mould our thinking on the relative importance, strengths and weaknesses of economic activities. Most strikingly, this is apparent in viewing the consistencies and features of the groupings of the market services. As discussed above the service sector has historically treated as a residual net of primary and secondary sectors. Paradoxically, such a monolithic view on services is still characteristic most of policy assessments on e.g. how to develop framework conditions of the service sector.

Reflecting policy discussions, the focus of statistical research has been centred on the aggregate groupings of service sectors and sub-sectors, which embrace vast number often weakly inter-related sub-industries. Table 5 lists the industries making up the market based service sector at the standard two digit level and the associated number of sub-industries at the 5 digit level. The main service sectors of market services are by definition distribution services (50-52), hotels and restaurants (55), transport services (60-63), Post and telecommunication, Banking and insurance (65-67) and Business services (70-74).

Nace group	Description of service business function	Number of Industries
50	Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel	14
51	Wholesale trade and commission trade, except of motor vehicles and motorcycles	81
52	Retail trade, except of motor vehicles and motorcycles; repair of personal and household goods	77
55	Hotels and restaurants	13
60	Land transport; transport via pipelines	7
61	Water transport	4
62	Air transport	2
63	Supporting and auxiliary transport activities; activities of travel agencies	13
64	Post and telecommunications	6
65	Financial intermediation, except insurance and pension funding	7
66	Insurance and pension funding, except compulsory social security	5
67	Activities auxiliary to financial intermediation	5
70	Real estate activities	7
71	Renting of machinery and equipment without operator and of personal and household goods	11
72	Computer and related activities	8
73	Research and development	4
74	**Other business activities**	**40**
	Total	**304**

Table 5. The official classification of the market services and the number of associated sub-industries (EU KLEMS; Statistics Finland).

Needless to say, empirical research conducted at two digit level, which is the standard practise in the macroeconomic approach, provides information of limited use for effective policy design. In particular, this is a problem with distributive services and the other business services (74), or professional services. Interestingly the professional services, treated as a residual, is the most heterogeneous, but also the mot important service category for national competitiveness. Explicitly

or not, the professional services have been regarded as representatives for most of paradoxes and problems of the business services[33].

To conclude, the official industry classification is based mainly on functional approach, to describe which purposes these activities are meant to carry out in the context of the whole economy. This conveys an overall picture and understanding, of the prevailing division of labour between specific industries in a pursuit for growing aggregate product and national income.

Referring to the discussion above, the official classification is not, however reflective of the evolving and differing natures of service activities (see Section 1). More importantly, the official classification fails to distinguish between different production processes, i.e. *how* the service in question is produced and delivered to the customer. As demonstrated in the final Section this provides prerequisite information on the opportunities to enhance service productivity.

3.2 Derived Classifications

Derived industry classifications are used to provide in-depth information on the similarities and dissimilarities of industries on specific dimensions of economic activity. Principally, reclassifications aim to differentiate between dimensions which highlight the forms and extent of competitive performance. In this regard taxonomies generate ordinal, nominal or mixed categories of industry groupings. With the examination on the selected well-known classifications and their implications, the following overview contributes to the construct of the service taxonomy outlined in the following Section.

Sources of innovations

Showing a distinctive analogy with service businesses Keith Pavitt (1984) explores the sources of innovation by British manufacturing companies. Pavitt´s work draws essentially on the neo-institutional criticism on the neoclassical treatment of technological change. To quote “they (neoclassical models) make exogenous the production of technology and innovations. Second they do not reflect the considerable variety in the sources, nature and uses of innovations” .

In stressing the dynamic and cumulative nature of technical change, Pavitt (1984) builds his taxonomy on concept of technological trajectories. As a main building block of neo-institutional paradigm technological trajectories refer to directions of technical development that are cumulative and self-generating, without repeated reference to the economic environment external to the firm (Pavitt, p. 355).

According to Nelson and Winter (1982) the rate and direction of change within a technological trajectory depends on the sources of technology, the nature of user’s needs and the possibilities for successful innovators to appropriate benefits brought about innovations. Based on the empirical data on innovating manufacturing companies in the UK Pavitt´s analysis generates four distinctive grouping of industries and associated trajectories (See Figure 11). The principal source of external technology for each industry category is indicated by arrows.

[33] For instance, while the observed productivity growth of this category has been close to zero, it still consists of the most knowledge-intensive service industries which are major contributors to the innovation activity of modern economies.

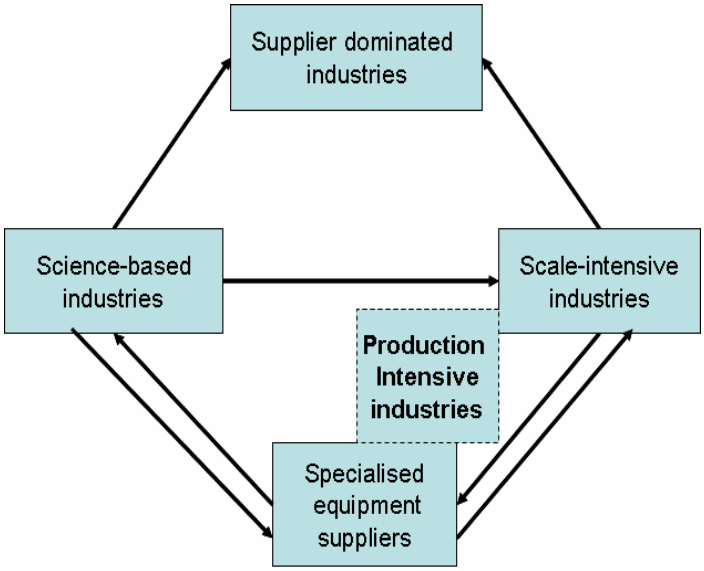

Figure 11. Pavitt´s industry taxonomy based on technological trajectories.

Supplier dominated firms are highly dependent on eternal innovations and purchased technology. Most innovations come from suppliers of equipment and materials, though in some cases large customers and government-financed research and related services also make a contribution. Competitiveness of the supplier dominated industries is less based on technological advantage than professional skills, aesthetic design, trademarks and advertising. Interestingly, equivalent characteristics can be found in number of service industries[34].

The key assets are embedded in human capital while physical production technology such as ICT, which is mainly procured from markets, is not the core of competitiveness. As with services, internal R&D is only occasional and sources of innovations are typically network externalities. Contrary to Pavitt´s classification in which supplier dominated industries are not particularly knowledge intensive, services corresponding to this category may show high knowledge intensity. Typical examples are business and legal consultancy and marketing services.

Production intensive category is made up of traditional manufacturing. Industries included here are based on assembly production lines and continuous production processes characterized by scale economies, as well as production of specialized equipment and instruments for the scale intensive industries. For the scale intensive industries technological lead relies on secrecy, process know-how and lengthy technical lags in imitation, while success of the specialized suppliers depends more on firm specific skills and responsiveness to customer industries´ needs.

For this category it is not hard to find counterparts in the service sector, either. Representatives of scale intensive productions are *flow services;* distributive trade, logistical services and communication as well as capital intensive banking and insurance[35]. Within Porterian cluster framework these core industries are supplied by related and supporting industries such as specialized software designers, engineering houses, maintenance companies and other business services (Porter, 1990). In general specialized suppliers with their customer strategies are text book cases for the socio-economic approach discussed in Section 2.3.

[34] The few service industries included in the survey fall in this category
[35] Note that scale intensity is assessed here in comparison to other services, not to manufacturing.

The fourth category consists of science-based or high-tech industries which operate in a highly volatile business environment with rapid technical change. Hence, competitiveness builds heavily on high flow of investments in internal R&D activities which is complemented by collaboratory research conducted in universities. Appropriability is commonly enabled by patents but also by the other means mentioned above.

At a first glance, science-based category seems to contrast with all services, since they typically lack internal R&D activities. A closer look reveals however, that there are distinctive similarities with some knowledge-based services, such as telecommunication and large multi-product service companies in software production and management consultancy. As noted by Baumol (2002) R&D is essentially service function which is suggested by the category 73 in the industry classification of NACE (See Table 5).

As a response to the need for a broader perspective and structural change Pavitt´s original taxonomy has been modified by introducing a new category of information-intensive industries. They replace the category of supplier-dominated industries (Pavitt & al. 1989). “We have also excluded a "supplier dominated" trajectory since, as Porter (1985) has rightly pointed out, it leaves accumulated technological skills and the strategic initiative with suppliers. Firms intending to move away from this position try to adopt either scale intensive strategies, or information intensive strategies (Pavitt et al, p. 97). Prototypes of information intensive industries are banking and retailing which are supplied by software services.

To confirm the analogy with services discussed above Soete and Miozzo (2001), in their service classification, took Pavitt’s original taxonomy as their starting point and added the category called network-based industries. It covers two subgroups, scale-intensive industries based on physical networks (transport, wholesaling) and industries relying on information networks (finance, insurance, communications). These industries draw heavily on information and communications technologies. The close mapping between Pavitt’s original taxonomy and that of Soete-Miozzo is shown in Figure 12 below.

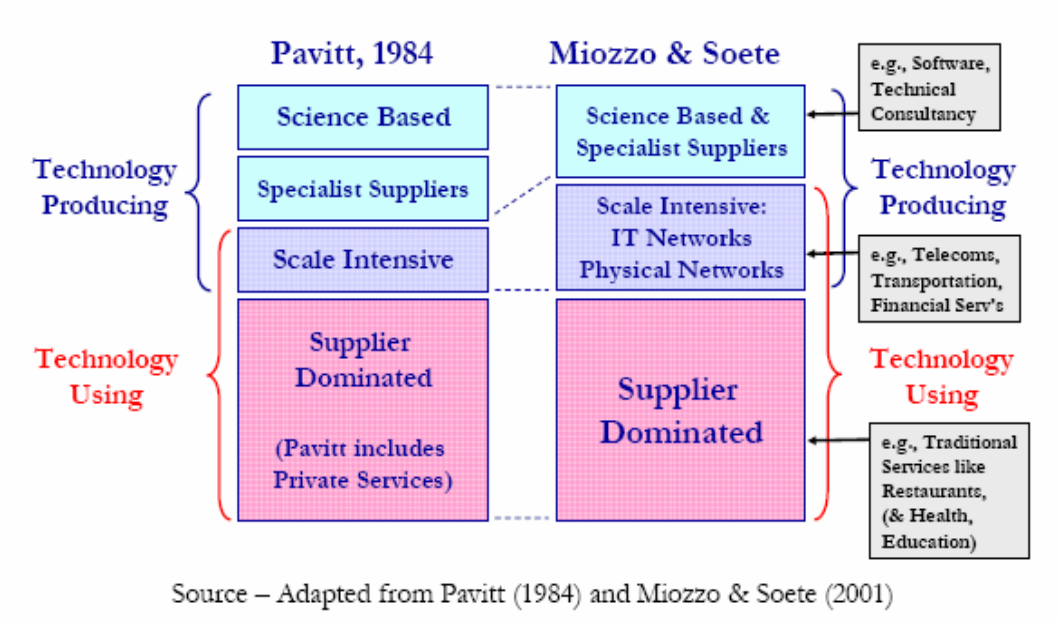

Figure 12. Miozzo-Soete taxonomy of innovation and technology trajectories (Salter & Tether, 2006)

Technology levels

Another often cited taxonomy of the manufacturing industries is that of the OECD (Hatzchronoglou, 1997), which ranks industries ordinally by the degree of technology intensity. The logic behind the technology approach is the stylized fact that technology is a key factor in enhancing growth and competitiveness of industries. "Firms, which are technology-intensive, innovate more, win new markets, use available resources more productively and generally offer higher remuneration to the people that they employ. High technology industries are those expanding most strongly in international trade and their dynamism helps to improve performance in other sectors" (Hatzchronoglou, p. 4).

Without a closer assessment of the argument above Hatzchronoglou uses two indicators in defining technology intensity of industries. The direct intensity is measured by the ratio of R&D expenditures to total production (value added) while indirect intensity measures how much R&D is embodied in the intermediate and capital goods purchased by an industry from supplying industries. This effect is obtained from the inverse of input-output matrix. Based on the values of the R&D intensities, derived from input-output tables of selected OECD countries, industries are grouped into four categories as indicated Table 6[36].

Category	**Representative industries**
High-technology industries	Aerospace, ICT, drugs & medicine
Medium-high-technology industries	Instruments, motor vehicles, non-electrical machinery
Medium-low-technology industries	Shipbuilding, metal products, rubber, petroleum
Low-technology industries	Paper, printing, textiles, food, wood products

Table 6. Technology-based industry classification (Hatzchronoglou, 1997).

A comparison reveals that Pavitt´s technology flow approach is highly consistent with the OECD´s technology intensity classification. Being quite obvious, supplier dominated industries are mainly those belonging to the low-tech category. Similarly science-based industries are more or less equivalent to the high-tech category. A bit weaker consistency prevails between specialized suppliers and medium-high technology industries and scale-intensive and medium-low technology industries.

Related to the implications for competitiveness and productivity, the degree of technology intensity has a counterpart in the service industries, too[37]. In this regard, an increasingly popular topic of research is so called knowledge intensive business services (KIBS), regarded as the main facilitator in transmitting innovation externalities throughout the economy. In the academic literature knowledge intensity is typically assigned as a general feature to a specific category of services without an explicit criterion for the knowledge intensity. KIBS category is discussed in more detail below.

Another implication for services is the notion that nature of technology matters for competitiveness. As observed by Viitamo (2003) business services are characterized by two types of technologies.

[36]The overall technology indexes for countries are produced by weighing each technology class by its share in the total production of the manufacturing sector. The resulting taxonomy ranks the OECD countries competitiveness by the degree of technology intensity (See e.g. Viitamo and Lipponen, 2003).

[37] That is, the productivity growth should be, on average, faster in the high-tech industries compared to the low-tech industries. Empirical evidence however, provides only mixed support for the proposition (EU KLEMS, 2007).

First, all service production is based on industry specific basic technologies, e.g. vehicles in transport service or shop facilities in trade and distribution. Competitiveness and productivity is essentially affected by supporting technologies - ICT and knowledge - which are complementary and enable more efficient exploitation of basic technologies. Innovativeness and technological trajectories of service activities determine the extent to which supporting technologies can be effectively utilized.

Intangibles matter

A third example of the manufacturing typologies offers a methodological excursion that bears significantly on service industries, too. Strongly influenced by Michael Porter's seminal work on competitiveness of industrial clusters, Michel Peneder, has given further insight to competitiveness by co-application of the statistical and economic cluster analysis. In particular, he criticizes the arbitrariness of cut-off classification methods and the negligence of multidimensionality of industrial competitiveness. For the author this is the main justifications for the use of statistical clustering methods (Peneder, 1995; 2001).

In short, statistical cluster analysis is a method used to arrange multidimensional data with vast amount of observations to discern patterns of similarities and dissimilarities between the units of observations. In doing so, the cluster algorithm solves a simple double maximization problem conveyed, e.g., by Sharma (1996): "Cluster analysis is a technique used for combining observations into groups or clusters such that:

- Each group or cluster is homogenous or compact with respect to certain characteristic. That is, observations in each group are similar to each other, and

- Each group should be different from other groups with respect to the same characteristics. That is, observations of one group should be different from the observations of other groups" (Sharma, p.185).

As with the other classification methods discussed above there is a sound economic proposition behind the taxonomies of Peneder, too. The point stressed here is that intangible assets are of central importance in assessing the entrepreneurial competitiveness and its diversity. In a spirit of neo-institutional and Austrian school of economics Peneder argues that investments in these firm specific assets and the consequent spillovers can sustain growth and increasing returns to scale even in mature industries.

Peneder´s idea is to capture simultaneously exogenous and endogenous effects on growth and industrial competitiveness. That is, the chosen variables should track a) comparative cost advantage stemming from exogenous and location specific factors such as relative endowments of capital and labour and b) firm-specific advantages stemming from targeted investment in intangible assets such as advertising and R&D (Peneder, 2001).

The corresponding indicators, applied in the hierarchical clustering procedure, are labour intensity (the ratio of wages and salaries to value added), capital intensity (total investments to value added), advertising-sales ratio and R&D-sales ratio. Based on US industry data at 3-digit level the cluster analysis generates five distinct groupings of industries depicted in Figure 13. Of these clusters the mainstream manufacturing is a residual, which does not show any specific character. Nevertheless, there is a clear correspondence with Pavitt´s original taxonomy and hence, implications for service industries.

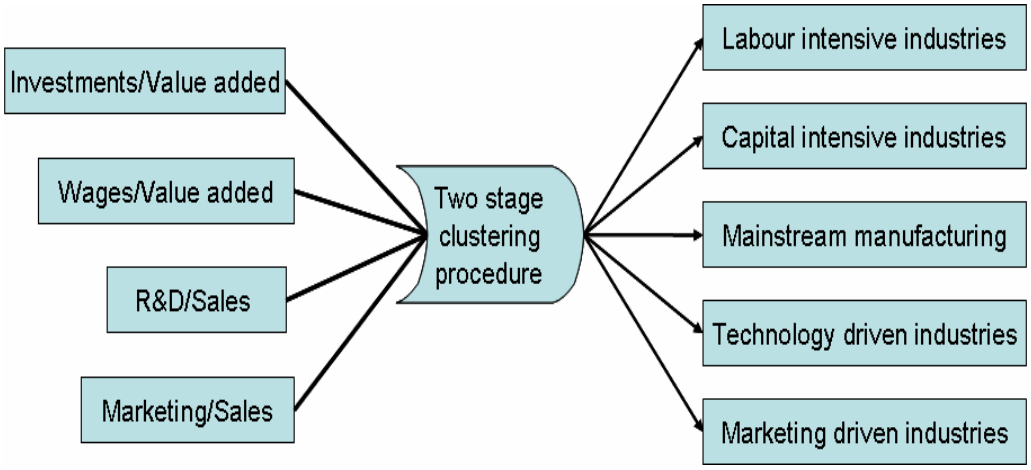

Figure 13. Peneder´s taxonomy of the manufacturing industries

Service innovation

Peneder´s clusters and associated correlation analysis with skill levels represents a highly advanced methodology to produce derived industry classifications. Interestingly, there is a growing interest for similar experiments in the service industries too. In this regard the cluster analysis of Heinz Hollenstein (2003) on Swiss service sector deserves a closer look. In general the analysis in this context has two major characteristics.

Contrary to the mainstream analysis the explicit objective here is not to rank the units of analysis but to provide unordered categories of innovation modes. Second, in contrast to previous examples the unit of analysis here is a company, not an industry. This is of central importance since grouping of industries implicitly assumes that industries are homogenous with respect to the investigated properties, i.e. innovativeness in this case. Company perspective instead tracks the possible variations within industries. The data was collected by questionnaire on 900 service companies that participated in the survey on the Swiss service sector. Innovation activity was measured by 17 indicators on the supply and demand factors, as well as introduction of new products and processes.

Innovation mode (cluster)	**Dominant (representative) industries and companies**	**Share in the sample**
1 Science-based high-tech firms with full network integration	IT and R&D services, business services, banking and insurance	4,4 %
2 IT-oriented network-integrated developers	Banking and insurance, wholesale trade, IT, business services	4,0 %
3 Market-oriented incremental innovators with weak external links	Sample average, even distribution	21 %
4 Cost-oriented process innovators with strong external links along the value chain	Sample average, even distribution, big companies	63 %
5 Low-profile innovators with hardly any external links	Personal services, real estate, hotels & restaurants, retail trade, transport, small firms	22 %

Table 7. Clusters of the modes of innovation in the Swiss service sector (Hollenstein, 2003)

Though country specific the main conclusions based on Swiss data may yield more general implications too. First, as indicated by the Table 7, clustering procedure generates a taxonomy, which is, unintentionally, an ordered ranking too. As the science-based cluster in the first row shows the highest innovativeness, the fifth, cost-based cluster, shows the lowest innovation intensity. Second, while not stressed by Hollenstein, the distribution of firms among the clusters is biased towards the lower end of innovation intensity. That is, the innovative flag ships in the business services are rare.

The taxonomy also rejects the homogeneity assumption, since firms representing a specific industry can be found in several clusters (See Table 8). The extreme modes, 1 and 5, show some degree of regularity. Namely, flag ship companies are typically IT and R&D services and other business services, which account for 71 % of all companies in that cluster. Similarly, for the mode 5 transport, hotel and restaurants, distribution account for almost 60 % of companies, respectively. It is noticeable that banking and other business services do not show any particular affiliation to certain innovation modes[38].

Industry	Cluster					Total
	1	2	3	4	5	
Distribution of firms by industry (%)						
Innovativeness above average	95.0	83.2	73.8	72.6	67.5	73.0
IT and R&D services	33.3	16.7	5.1	3.9	2.8	5.5
(Other) business services	38.3	16.7	23.2	18.3	15.7	19.6
Banking/insurance/financial services	14.3	22.1	16.2	17.0	15.7	16.4
Wholesale trade	4.7	22.1	24.2	22.5	15.7	20.5
Transport/telecommunication	4.7	5.6	5.1	10.9	17.6	11.0
Innovativeness below average	4.7	16.8	26.2	27.4	32.5	27.0
Retail trade	0.0	5.6	14.1	13.0	16.7	13.3
Hotels, restaurants	4.7	5.6	9.1	12.2	11.1	10.7
Real estate	0.0	0.0	1.0	0.9	1.9	1.1
Personal services	0.0	5.6	2.0	1.3	2.8	1.9
Total	100	100	100	100	100	100

The innovation modes are: (1) "science-based high-tech firms with full network integration", (2) "IT-oriented network-integrated developers", (3) "market-oriented incremental innovators with weak external links", (4) "cost-oriented process innovators with strong external links along the value chain", (5) "low-profile innovators with hardly any external links"; see description in the text.

Table 8. Industry composition by the service innovation mode (Hollenstein, 2003)

The observed heterogeneity of innovation modes across industries is a fundamental finding and demonstrates that innovation strategies available to companies are not dictated by the industry specific factors to the extent it is usually assumed. Instead, modes of innovation are determined by co-influence of several factors such as accumulated capabilities, firm-specific assets and, firm size in particular (Teece, 1998).

Moreover, given the direct link between innovation and productivity these findings may also indicate that there exist various sources for productivity growth in across service industries. In fact this is what Hollenstein tries to find out in his study. According to his inconclusive findings however, productivity, as measured by value added per employee and sales growth, is not positively correlated with innovation intensity (the modes).

[38] For the other business services this can be explained by the high level of aggregation. As indicated by Table 5 other business services contains 40 sub-industries which apparently follow different innovation trajectories.

The further analysis shows that, only belonging to cluster 2 exerts statistically significant positive impact on productivity. The productivity differentials are explained mainly by physical and human capital intensity, which exert positive impact on productivity (Hollenstein, 2003). To conclude, this supports the heterogeneity assumptions of existence of multiple options in choosing competitive strategy for a service industry. In this regard it also supports the contingency theories developed in the service innovation literature (Tidd & al., 2003).

Another fundamental question raised by Hollenstein is whether and to what extent manufacturing and services differ by their innovation strategies. These assessments are based on equivalent study conducted on the Swiss manufacturing sector. Reflecting the discussion in Section 2 on the main schools on service productivity, the dichotomy between demarcationism and assimmilation holds for innovation activity too. The Swiss data and cluster analysis give however, more support to the assimilation approach postulating that there are no major differences between these sectors.

While it is true that R&D activity is more extensive and systematically organized in manufacturing than in services other claimed differences seem to be less obvious. For instance, it is argued that a) human resources, b) high information content and c) non-technological innovations are distinctive attributes of service innovation activity. This may be a deep rooted belief only, since a) and b) are highly important in manufacturing too, and technological innovations are prerequisites for high performance in services as well as in manufacturing. To quote "we are rather inclined to support the hypothesis put forward by among others Coombs and Miles (2000) that differences between the two sectors have been blurred in recent years and are now one of degree rather than substance" (Hollenstein, p. 860).

Knowledge intensity revisited

The industry taxonomies investigated above draws on a specific theories and methodologies designed to construct business groupings in a systematic way. There is another line of research putting forward business service taxonomies too, but it is more based on qualitative and ad hoc methods. Conceptually is derives from service marketing which stresses the uniqueness of services compared to manufacturing (See Section 2). In this setting the primary purpose of the taxonomies is to support strategic planning at company level and competitiveness of national economies (Wemmerlöv, 1989; Brax, 2007; Miles, 2003).

A sub-group of the business services has been identified as knowledge-intensive business services (KIBS) which has attracted a growing interest of scholars (e.g. Miles, 2003; Den Hertog, 2002). KIBS or more generally KISAs (OECD, 2006)[39] are characterized by high knowledge content of inputs, i.e. labour, as well as outputs. This implies high innovation potential for the service providers themselves as well as the customer industries through positive externalities (e.g. OECD, 2006; Leiponen, 2000; Gallouj, 2002).

While conceptually appealing KIBS face some fundamental problems which impede their full operationalisation. First, there are diverse definitions on KIBS that are partly inconsistent (Toivonen, 2004)[40]. Second, it is not specified what dimensions of knowledge are the decisive

[39] KISA is an abbreviated from Knowledge-Intensive Service Activities. They consist of internal and external knowledge service activities used by a company. To illustrate, the growth of KIBS and their markets are boosted by outsourcing of KISAs in manufacturing and other sectors.

[40] While some definitions embrace financial services and real estate services and all other business services, some do not. For instance the other business services include also less knowledge-intensive industries such as industrial cleaning and security services.

determinants over the range of knowledge-services. Third, related to these problems no attempts have been taken to define the degree of knowledge intensity of the services eligible for the definition. As with the majority of industry taxonomies it is implicitly assumed that specific industries under the definition are homogenous with respect to knowledge-intensity.

Jon Sundbo and Gallouj (1999) have provided a pragmatic solution to the aforementioned problems. Related to their research on manual services they define the opposite as knowledge services, the residual of manual services. Manual services are practical or physical activities such as handling things or persons such as cleaning, transport, repairing and health care. Knowledge services in contrast, handle information and focus on the creation of knowledge. Knowledge services present solutions to customer´s needs and problems (Sundbo, 1999). As the manual service may also involve a significant knowledge component, what they do for the customer is practical or physical handling. Hence manual services present solutions to the customer´s physical needs and problems (Sundbo, 1999, p. 11).

This conforms to the definition of KIBS by Toivonen (2004): "the core of their service is their contribution to the knowledge processes of their clients, which is reflected in the exceptionally high proportion of experts from different scientific branches in their personnel" (Toivonen, 2004, p. 36). Also the industries Sundbo refers to are by and large identical with the KIBS defined by Toivonen. To alleviate the definitional inconsistencies associated with knowledge-intensity a more appropriate term for the KIBS would be knowledge-based services.

This leads the discussion back to measuring the information economy, the pioneering work of Malchup (1962) and Porat (1977) and NAICS classification discussed in Section 3.1. For Porat there are *two* distinct domains of economic activities, the one which transforms energy and matter from one form to another and the other which transforms information from one mode to another (Porat, 1977). In the latter case the outcome is knowledge which is the key determinant of economic growth in the global economy. Note, that both sectors defined by Porat consist of manufacturing and service industries, the productivity of which is boosted by knowledge accumulation.

	Products	**Delivery form**	Services
Material	Machines, Chemicals Automotives Fashion Goods Consumer Products		Tourism, Retail Transportation Construction Health Care
End product			
Information	Book, Magazines Computers, PDAs Film, Music, ICT Software, Games		Financial Services Radio, TV Telecommunication Legal, Consulting

Figure 14. Material-information taxonomy with representative industries (Kamarkar, 2006)

To date Porat´s work has been continued and refined by several authors, most notably by Apte and Nath (2004) and Kamarkar (2006) and their research fellows. For them information sector consists of "primary information sector" (PRIS) and "secondary information sector" (SIS). The former

includes all business activities which produce goods and services to convey information or are directly used in producing, processing or distribution of information for an established market (Apte and Nath, 2004). The latter accounts for the resources devoted to the production of information services for in-house consumption of private and public organizations.

PRIS and SIS have their counterparts in knowledge-based services, namely KIBS and KISA. In this context SIS can be interpreted as in-house information activities of PRIS[41]. The resulting taxonomy depicted in Figure 14, makes a distinction between *information* and *material* dimensions of business activities, bits vs. atoms (Kamarkar, 2006). In other words, all manufacturing and service functions, which are not fundamentally material fall in the primary or secondary information sector. Based on the figure the authors demonstrate that the contribution of the information services to the GDP of the developed economies is constantly increasing (Apte and Nath, 2004).

3.3 Suggested Taxonomy

As stressed in Section 1 the key dimension of a service is its use either for production or consumption. In the former case service is an intermediate input, the demand of which is derived and conditional on the strategic objectives of the customer firm. Hence, for a *pure* business service the service outcome (*productive effectiveness*) is of the highest priority. For a *pure* consumer service, in contrast, *utility* and *experienced satisfaction of the service process* is the key performance criteria. Consequently, the concept of service productivity is more intuitive in the case of business services.

Given the heterogeneity of production technologies and strategies prevailing in the business services how then, should service productivity be systematized? As argued here the answer lies in industry taxonomies, the diversity of which has been demonstrated in the previous section. In comparison to the examples dealt with here, a workable taxonomy on service productivity necessitates a bit different approach and characteristics of service production. Based on the earlier contributions and their refinements addressed below, a comprehensive framework on service productivity taxonomy will be constructed.

Type of contact and routinization

The study of Urban Wemmerlöv (1989) is one of the first efforts to construct a coherent service taxonomy which combines earlier and new insights on characteristics of service organizations. Interestingly, Wemmerlöv´s paper demonstrates that wealth of the concepts and terminology in the current literature of service operations management is derived from the earlier service taxonomies. Reflecting the demarcationist approach Wemmerlöv´s inquiry is motivated by the assumed differences between manufacturing and services and by the need for more effective decision making for service management. From this perspective the *type on customer contact* and the degree of *routinisation* of service processes are regarded as the main dimensions.

There are three types of contacts between the customer and the service system. For the direct contact there may or may not exist interaction between customer and employees of service company. The latter case is characteristics of self-services. There exist also various forms of indirect contact facilitated by communications technologies and human carriers, and the possibility of no contact at all. In that case all service processes are performed by back-office activities. As

[41] By and large these activities together correspond to what is generally called the ICT-cluster.

noted in Section 2 the division between front and back office functions bears essentially on the productivity potential.

The degree of routinisation in intrinsically continuous variable but for the sake of simplicity only the extreme cases are used here, namely *fluid and rigid* service processes. Since their properties are of central importance, they are looked into in more detail. According to Wemmerlöv rigid processes share the following attributes: low level of task variety, low technical skills, low information exchange at customer interface and low discretion of individual service workers. Moreover, the frequency of transactions per unit of time is high and the customer flow is predictable and controllable by the service provider. Finally, several customers can be handled simultaneously.

The rigid archetype, demonstrated e.g. by amusement parks and movies, corresponds partly to what Sundbo calls manual service in the case of high labour intensity. However, the rigidity also implies a possibility of mass-production based on high capital intensity. Conversely, fluid processes exhibit properties opposite to those listed above. Within Sundbo´s categorization they correspond to the processes found in knowledge-based services. Table 8 draws todether the key distinctions between the rigid and fluid processes.

FLUID SERVICE PROCESSES (FUZZY)	**RIGID SERVICE PROCESSES (STRUCTUTRED)**
…dominate in professional service organizations	…dominate in routine service organizations
…dominate in people-based service organizations	…dominate in equipment-based service organizations
…dominate in services directed to the clients	…dominate in services directed to the customer possessions
…tend to produce customized services	…tend to produce standardized services
…are less amenable to mechanization and automation	…are amenable to mechanization and automation

Table 8. Implications of fluid and rigid processes for service business practices (Wemmerlöv, 1989)

Three archetypes

Wemmerlöv´s theoretical construct has been further developed by Silvestro et al. (1992) who operationalized the attributes applicable to empirical analysis. With a similar aim to draw together the earlier contributions the authors also investigated the mutual dependencies of the attributes based on a small sample of service companies in the UK. As expected, they found a positive correlation between variables measuring the degree of routinisation and the volume of customers processed per unit of time. This is depicted in Figure 15 below.

In their original formulation variables measuring routinisation assumed a discrete form scaled from low, to medium and high. For a better illustration the variables are presented here in a continuous form (Brax, 2007) which does not distort the main conclusion. Of the representative industries in the UK sample the mass services, transport and distribution, which support the logistics of manufacturing, show high capital intensity. With retail banking, also mass production oriented, these services are building blocks of the infrastructural networks.

At the other end of spectrum there are professional business services, which consist of various knowledge-based service activities. For these services employees have high discretion over the

conduct of service process, and the back office functions are consequently few. This implies limited opportunities for team work and hence, utilization of division of labour with scale economies.

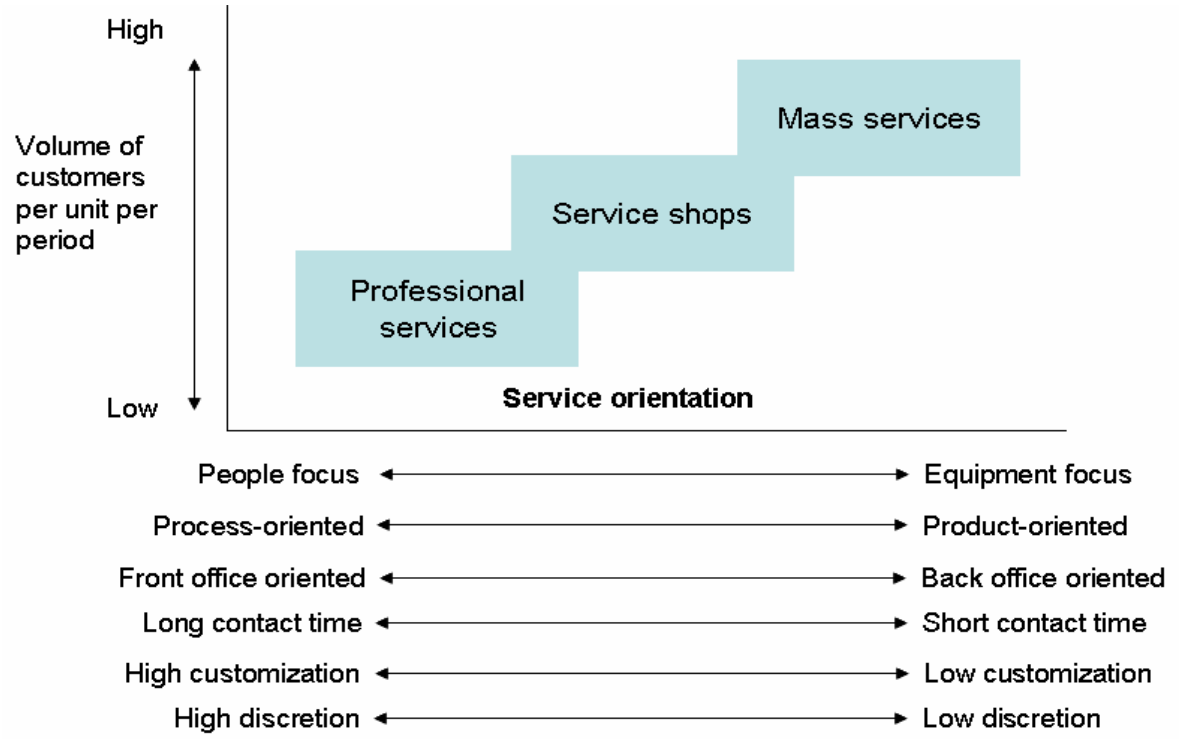

Figure 15. Service dimensions and basic archetypes (Silvestro et al, 1992)

In between there is a category called service shops which share some properties of both mass services and professional services. As they locate between high and low service orientation they possess the highest opportunity for mass-customization discussed in Section 1.2. Mass-customization represents hybrid form of production which attracts both customized service industries and scale-intensive manufacturing.

The three service archetypes in Figure 15 have their counterparts in manufacturing too (Silvestro et al, 1992, p. 76). In this regard the taxonomy conveys implications on alternative service production technologies and hence, opportunities for productivity growth. These issues are discussed in more detail at end of this section.

Complementary dimensions

Next, consider the two-by-two service matrix of Sundbo and Gallouj (1999). As the authors note the service activities in Figure 16 have traditionally been concentrated in two types, A and B of which B is a prototype of knowledge service with an individually advisory character. Category A represents typically mass-produced services, of which many have, in former times, been manual services (Sundbo and Gallouj, p.12). The categories A and B correspond to the main service clusters of Silvestro, too.

Of the four service categories of Gallouj and Sundbo C is also explicitly defined as containing labour intensive manual services. Hence, in this setting the category D, technology intensive customized services, is an undefined residual. However, provided that the four-cluster model is a valid description, it is logical to assume that parts of the A and B should constitute D. The

questions, what these service functions are as well as how to disaggregate the dimensions more systematically, are highlighted in the framework developed below.

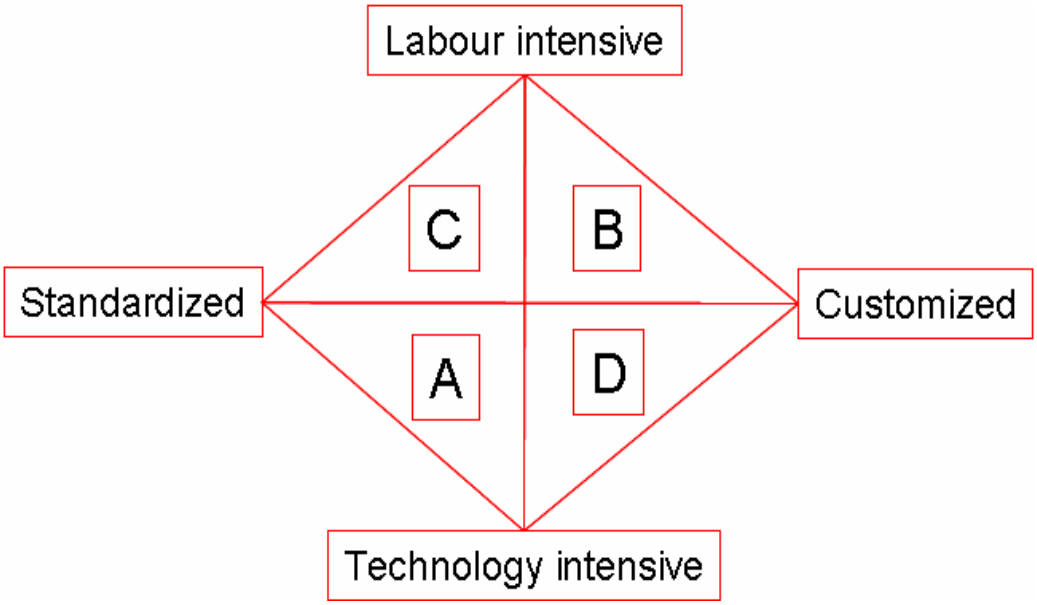

Figure 16. The four service archetypes of Sundbo and Gallouj

Constructing cluster space

Following the neoclassical premises, production technologies with two type of inputs, labour and capital, can be characterized either labour intensive or capital intensive[42]. The most convenient way to measure input intensity would be their relative shares in the total production costs. Direct cost shares do not indicate however, which of the inputs actually plays a dominant role. Within the framework developed here, high capital intensity for example means, that the principal resource in production and delivering the service is technological capital, human or non-human, which is assisted by labour input. This accounts for the relative importance of the actual services provided by the inputs (Penrose, 1959).

To proceed further, a reference is made to the manufacturing taxonomies of Hatzichronoglou (1997), Peneder (2001) and Neven (1995). With slight modifications of the technology classification of Hatzichronoglou (1997) the main distinction for capital intensive service production can be made between high-tech and low-tech service processes. As several technology levels or their embedded combination, may occur simultaneously in capital intensive service production, there exists a relative dominance of either low or high technologies. For its appearance technology level – sophistication - define a continuum ranging from tangible machines and equipment of low complexity to more complex technologies with a growing component of intangible know-how.

The production of low-tech services is based on standard machinery and equipment (Viitamo, 2000) which enable the utilization scale economies characteristic of basic manufacturing activities. For low-tech services both the process and the outcome are more tangible than for the other service types. For higher-tech services production is more based on supporting technologies (Viitamo, 2000), most notably ICT, and the processes as well as outcome are more intangible. The highest

[42] A third alternative is a balanced use of both inputs.

degree of intangibility and complexity is shown by technological knowledge developed and processed by professional service employees.

Similarly, labour intensive services have been classified by Peneder (2001) and Neven (1995) into high and low skill level categories. As skill levels of labour intensive production draws mainly on the level of educational attainment, it is not a fully consistent with parallel dimension of capital intensity and the degree of technological complexity. For labour intensive production instead, it is more appropriate to look into information content of the employee skills which characterize labour input.

This emphasizes the degree to which service production is based on manual skills or intangible information processed and provided by service employees. Services based on manual skills can be reproduced in a codified form, which enables the utilization of scale economies to the extent repetition does not lower the quality. Equivalent to high tech services, labour intensive services with high information content show high intangibility of processes and service outcome. Following the logic above the degree of information intensity is defined as a dominance of intangible information over manual skills.

Hence, there are two continua of characteristics for high labour intensive service processes and high capital (technology) intensive service processes. These two characteristics show an opposite value for capital-labour ratio, which is a continuous variable as well. To demonstrate their differences further, capital intensive processes relies upon technological assets and capabilities in service production and the creation of value added for the customer.

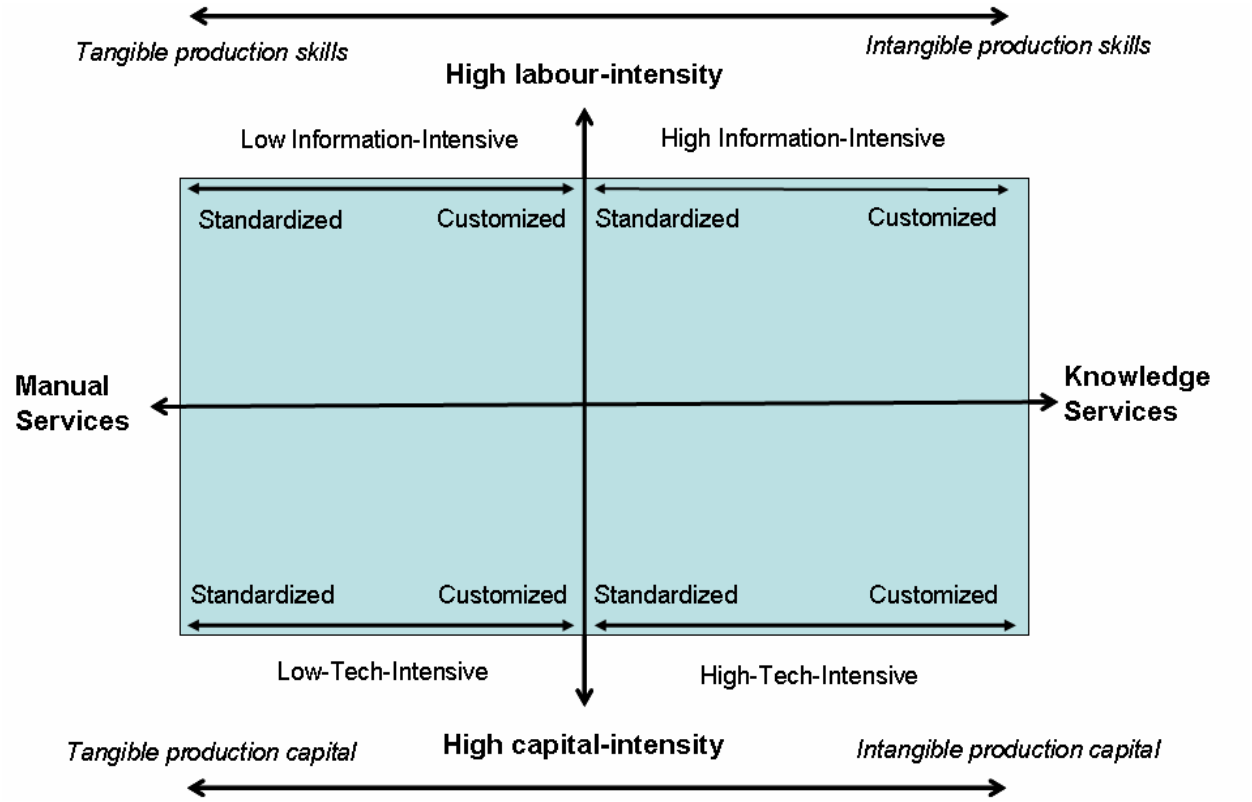

Figure 17. Suggested three dimensional space for service clusters

In contrast, labour intensive processes are based on non-technological assets and capabilities consisting of specialized human skills, expertise and talent. While a close proximity and interaction

with the object of service - most often people and organizations - is required for the production and delivery of labour intensive services, this is less imperative for capital (technology) intensive services, which are more focused on client's processes.

Generic service clusters

The two dimensions of service characteristics are illustrated by the box in Figure 17. As the vertical dimension measures the capital-labour ratio the horizontal dimension highlights the degree of tangibility and complexity of the service processes. At the left end of the box locate so called manual services (Sundbo, 1999) which, by nature are *doing things.* At the right end locate knowledge based services, or professional services, which show high knowledge intensity in their processes and outcome. In contrast to manual services, professional services tell *how to do* and *why things happen* (Johnson et al., 2002).

Following the grouping of Werner (2001) professional service can be divided into technological (T-KIBS) and non-technological sub-categories, which conforms to the reasoning here too. The non-technological KIBS consists of advisory services such as management consulting, legal and accounting services and marketing for which tacit information in solving customer problems assumes a central role. Example of T-KIBS are, technical engineering, computer services and R&D services which relies more on codified information in solving customer problems.

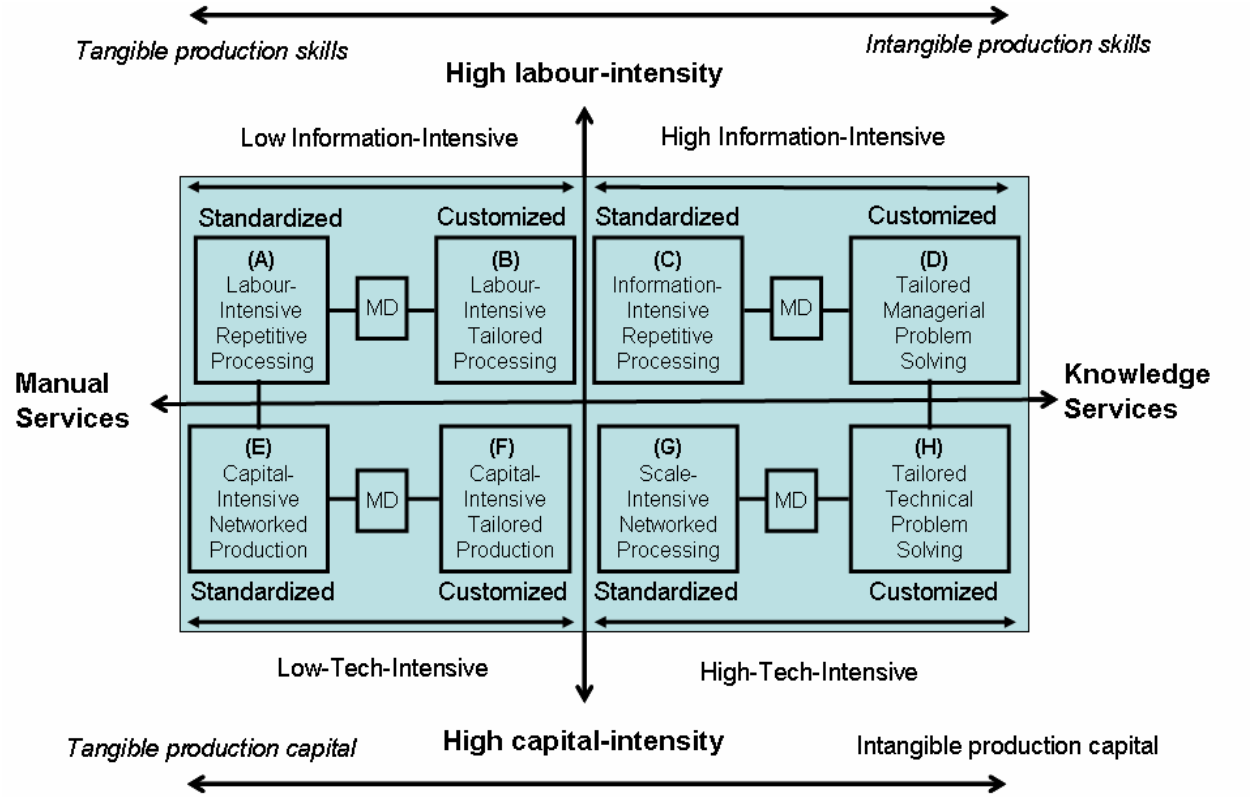

Figure 18. Eight cluster archetypes for service processes (**MD = modularized**)

The third most relevant dimension for service characteristics is the degree of customization enabled by production technology and implemented in corporate strategy. This is highlighted by the standardized-customized dichotomy in Figure 16 (Sundbo and Gallouj, 1999). Again, it is appropriate to regard degree of customization as continuous variable illustrating the managerial problem of balancing between effectiveness (customization) and efficiency (standardization), i.e.

managing service productivity. The degree of customization is added to all quarter of the box in Figure 17.

Consequently, there exists a three-dimensional space for service clusters defined by three continua: 1) labour - capital intensity, 2) degree of customization and 3) the degree of tangibility of processes and service outcome. Given the critical dimensions for service taxonomy, what can be said on the actual service clusters? Lacking the relevant data at this stage, the answer is, not much. However, keeping in mind that the cluster space is a cube with eight corners it is possible to outline theoretical cluster archetypes with ultimate characteristics. The characteristics of the eight archetypes are presented in Figure 18.

Leaving a through assessment aside here a few remarks on the suggested taxonomy are in place. While the framework introduced here departs essentially from the earlier taxonomies, it is a systematic extension of the contributions and associated concepts discussed above. Second, the taxonomy breaks the traditional industry boundaries since it is only a description of the nature of service activities.

Hence, depending on the homogeneity of service industries, the representative companies may locate in various parts of the "box". This holds for an individual company with a portfolio of service products, too. Finally, the resulting taxonomy can be interpreted as a general mapping of alternative production modes. Hence, with a different composition of industry clusters it is be applicable to manufacturing activities too.

Implications for productivity

The next and final issue is to assess the implications of the developed service taxonomy for the productivity analysis. This is based on the characteristics of the eight cluster archetypes in Figure 18, the theoretical assessment of service productivity in Section 2.1 and conceptualization of service output in Section 2.3. For service productivity the central issues are the relative importance of efficiency and effectiveness and the openness of transformation process. Regarding service output it is critical to assess its three components; frequency of transaction (number of clients served), complexity of the problem to be solved and the amount of service (service intensity) provided (Gadrey, 2002a).

As indicated above capital intensive services show the highest similarities with the basic manufacturing which is characterized by continuous and closed production processes. Within the framework developed here services such as road transportation, railways and wholesale, locate in cluster E, called *capital intensive networked production* (See Figure 18). The term networked here means that service production dispersed geographically units the operation of the "service units" is centrally coordinated to yield scale economies.

For these services the relevant productivity concept is operational efficiency since effectiveness or quality is usually insensitive to the scale of production. With high number of transactions per unit of time (flow) service output (value added) show low complexity and low services intensity (Gadrey, 2002a). With low information requirements the service production is associated with high fixed capital costs and low unit labour costs.

Conversely, professional services with discrete and open processes necessitate high mental skills and information processing capabilities. Consequently, effectiveness is of the highest priority[43]. In an extreme case service transaction is accompanied by high uncertainty on the desired service outcome and the forms of co-production, which makes the effectiveness of the service performance difficult to anticipate. In the absence of cases of reference and routines productivity may be difficult to observe and measure.

The business relations in professional service are, however, inherently evolutionary suggesting high potential o productivity growth of the real processes. Through learning of the capabilities and objectives of the customer, the transaction relations are influenced by fundamental transformation (Williamson, 1985), which changes bidding market to a non-market contractual relationship. As a result of growing mutual trust, routinisation as well as codification of information the contractual relationship may evolve to a firm-like arrangement with two decision making units. Consequently, through effectiveness becomes more easily detected and more emphasis can be put on operational efficiency.

Characteristic of such services is small number of transactions per unit of time, high complexity of the problem and high service intensity reflected by close interaction. Within the suggested taxonomy these services locate in cluster D called *tailored managerial problem solving*. Examples of this archetype are tailored management consulting and juridical services for which fixed costs of capital are generally low while the unit costs of labour are high.

What can be said about the clusters between these *extremes*? Cluster A is similar to E except that A is labour-intensive and based on physical labour. Hence, there are less scale economies to be exploited in actual processing and the increase of number of transactions per unit of time will ultimately lead to lower quality and decreased effectiveness. Similar to low tech services customer participation is minimal and the system is intrinsically closed. Typical services found in this cluster are retail trade, general cleaning, repair and maintenance.

Cluster F is also similar to cluster E but tailored products reduce the potential for exploiting scale economies available for continuous processes. However, the effectiveness is usually well-defined before the delivery and embedded in the process. Compared with cluster E these services show smaller amount of transactions per unit of time, higher complexity and higher service intensity. However, these differences may be marginal when all clusters in Figure 18 are compared with. Representative services here are tailored transportation such as taxi services, machine-based repair and cleaning as well as selling of construction and building materials.

The notions of the relative differences between clusters F and E apply to labour-intensive clusters A and B as well. Obviously, the relative importance of effectiveness for cluster B is more pronounced and balancing between effectiveness and operational efficiency becomes more challenging in managing discrete and tailored processes. This is manifested by increased customer participation in the production process and hence, higher openness of the system. Note, that this is the cluster the activities of which mainly correspond to *classical service functions* such as hairdressing, tailored repair, maintenance and construction.

As a general notion, a distinctive feature of the clusters based on high information-intensity and high technology-intensity and complexity is that the production inputs and processing are close or

[43] According to Løwendahl (2005) characteristics of professional services is altruistic problem solving for the client. This means that in cases of conflict of interests between what is profitable for the supplier and what will be the best solution for client the latter alternative must be chosen (p. 22).

equivalent to what is offered. For instance networked organizations using ICT are the source of scale economies and simultaneously, a quality-enhancing strategy in serving customers in various locations. The same notion applies to information processing and intangible technologies of professional services.

With high capital intensity and networked business structure cluster G is similar to cluster E. The main distinction lies in the technologies which the scale economies derive from. For cluster E, in particular, the coordination of networks and production of the service relies heavily on information and communications technologies, which also enable high self-service content for standardized consumer services. As customer participation in the service process is generally low, the production systems are closed. This applies also to the self-service modes.

From the similarity with cluster E follows that the appropriate productivity concept dictated by the technology stresses simultaneous determination of operational efficiency and effectiveness. Examples of the associated service industries are finance and insurance, telecommunications, chain stores and big software companies offering standardized information products. Service output is thus characterized by high volume of transactions per unit of time with high complexity but low service intensity.

A tailored mode of cluster G is cluster H with high knowledge intensity and intangible technology embedded in the services. The characteristics of business models are similar to those found in cluster D discussed above. However, it can be assumed that effectiveness of the service outcome, while also uncertain, is more predictable ex ante than for cluster D, for which the final outcome is influenced by higher number of unknown parameters and tacit information. That is, technology is configurable sub-category of strategic choices made by corporate management. Typical knowledge services in this category are technical consulting comprising tailored R&D, engineering and architectural services as well as tailored software production.

Finally, there is a service cluster C which is also advisory by nature and characterized by supply of standardized non-technological information to various customer segments. Resulting from standardization, service production can entail significant scale economies in processing high number of customers simultaneously. Effectiveness of services is also relatively well-defined although it often depends of the customer’s absorptive capabilities, i.e. how effectively the service can is used.

As with cluster G high volume of transactions is associated with high complexity with lower service intensity compared with the more customized counterpart cluster D. Representative industries include general management consultancy, training and accounting services. The first two are typically provided in the commoditized packages of courses and lectures. Many segments of business-based health care services belong to this category too.

Table 9 summarizes the main characteristics of the eight service cluster archetypes identified and the key determinants of the associated productivity trajectories. Before closing the section a final note for the further work is in place. As the characteristics explaining service productivity are inherently continuous, the partition of clusters suggested here is inevitably rough and arbitrary.

That is, the taxonomy does not, though intentionally, discriminate between actual differences along the dimensions investigated here. This should be the major task of empirical study supported e.g. by statistical cluster analysis. The exercise clearly demonstrates, however, that the dimensions derived

from the earlier contributions possess high explanatory power in the search for patterns of service productivity.

SERVICE TYPE	CLUSTER DESCRIPTION	PRODUCTIVITY IMPLICATIONS	EXAMPLES
A Manual Low Information-Intensive	Skill-Intensive Repetitive Processing	High volume Low complexity Low service content Closed system Efficiency-driven	Retail trade, General cleaning, Security services Hotels and restaurants, General construction, Repair and maintenance
B Manual Low Information-Intensive	Skill-Intensive Tailored Processing	Low volume Low complexity High service content Open system Efficacy-driven	"Classic services" Hair dressing, Customized repair, Maintenance, Cleaning and construction, Specialized trade
C Knowledge High Information-Intensive	Information-Intensive Repetitive Processing	High volume High complexity Low service content Closed system Efficiency-driven	General or focused management consultancy, Training, Accounting, Business- based health care
D Knowledge High Information-Intensive	Tailored Managerial Problem Solving	Low volume High complexity High service content Open system Efficacy-driven	Customized management and legal consultancy, Tailored marketing, Merger operations services
E Manual Low-Tech-Intensive	Networked Capital-Intensive Production	High volume Low complexity Low service content Closed system Efficiency-driven	Road, rail, air and water transport, Gas, Electricity, Wholesale, Storage
F Manual Low-Tech-Intensive	Capital-Intensive Tailored Production	High volume Low complexity Low service content Open system Efficiency-driven	Taxi services, Machine-based repair and cleaning, Distributive trade of construction and building materials,
G Knowledge High-Tech-Intensive	Networked Scale-Intensive Processing	High volume High complexity Low service content Closed system Efficiency-driven	"Systems services" Banking & insurance, Internet-based services, General software, Telecommunication
H Knowledge High-Tech-Intensive	Tailored Technical Problem Solving	Low volume High complexity High service content Open system Efficacy-driven	Tailored R&D, Tailored process engineering and design, Architectural services, Tailored software (ERP)

Table 9. The archetypes of the service clusters and the determinants of productivity trajectories.

4 Discussion

The essence of "Trinity"

The question *what is service,* has occupied scholars, businessmen as well as and policymakers for decades. The question is now even more pronounced as industries and business models are evolving rapidly and in unpredictable ways. We are also witnessing the surge of information and knowledge as the dominating factors of production and competitiveness. Traditional dichotomy between manufacturing and services is becoming increasingly useless to understand the essence of services, to deal with the question.

Dematerialization of productive activities and consumption has also awaked debates whether productivity as a measure of economic performance makes any sense. As Gadrey (2002) has put it, "we seem to be witnessing diminishing returns of productivity concepts as they are applied to increasingly complex economies". It is tempting to share such a view but it is contended here that service productivity, also in real terms, still counts. Though invisible, it is out there.

The convergence of material and immaterial production pose challenges to classify economic activities in a meaningful way. This does not necessarily mean that industries are loosing their identities. On the contrary, from the policy perspective it is of growing importance to track the characteristics by which industries cluster in a dynamic business environment. Contrary to prevailing policy regime the service sector should not be treated as homogenous residual, but a composite of businesses which follow their distinctive trajectories. Recognizing this is a prerequisite for enhancing knowledge on service productivity and effectiveness of industrial policy, accordingly.

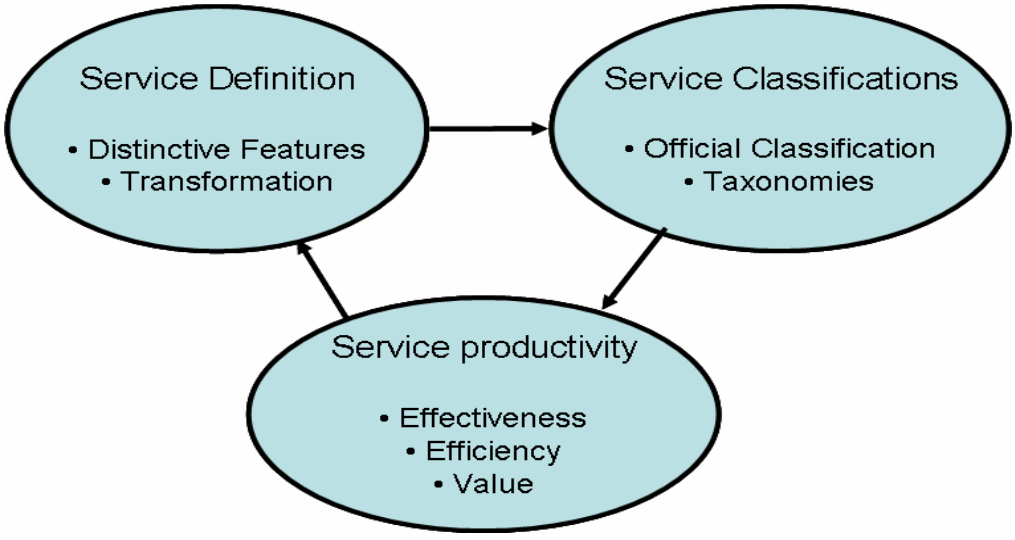

Figure 19. Three pillars of service performance

This paper develops and brings further a holistic view on service productivity which, as assumed here, is an effective strategy to improve understanding of the complex issue. In doing so the analysis draws heavily on the existing contributions on the three complementary topics of research: service definitions, service taxonomies and service productivity. It is argued here that the components are strongly interdependent when making sense of service performance. A workable definition of service enables a consistent classification service activities and businesses. With these

two premises, including the strategic objectives at company level, it is possible to assess the criteria how productivity should be measured. The Trinity is shown in Figure 19.

Evolving convergence

As stressed by Dosi et al (1998) new technological opportunities are shaping organizational structures and strategies of business enterprises. This in turn changes the ways how traditional and new services are produced and delivered. Consequently, many of the premises of traditional services do not hold anymore. The public and scholarly debate is geared around the question whether services are becoming extinct or just adapting to the industrial evolution and changing consumption patterns. In fact both arguments seem to hold.

Those supporting the extinction argument are right as long as service processes are concerned. As digitalization is fading away customer interfaces, service outcome and economic functions it serves, have remained more or less intact. To the extent this change is taking place it also demonstrates that service outcome is becoming more important relative to service process. The same observation concerns outsourced service activities too. Regardless of their growing heterogeneity services still share common features indicated by the four-world-model discussed in Section 1.1.

As the transition towards information economy proceeds, demonstrated by the NAICS classification applied in the USA, marketing and management sciences still emphasizes the dichotomy between manufacturing and services. To be sure differences exist but not in the cut-off fashion maintained by the literature. For instance, in many manufacturing industries customers participate actively in design and production of the intermediate goods they are provided with. In reality most production processes are more or less open.

It is realistic to assume a continuum of industries between traditional manufacturing and pure services, which is also implicit in the taxonomy developed here. An analogy at company level is the observation that companies pursuing increased competitiveness strives for becoming solutions providers by adding services to their portfolio of tangible goods, or vice versa (Neu and Brown, 2005). At one end of continuum is a position at which tangible goods dominate the firm's market offers and services are "add-ons" while at the opposite end tangible goods are "add-ons". This is illustrated in Figure 20 below.

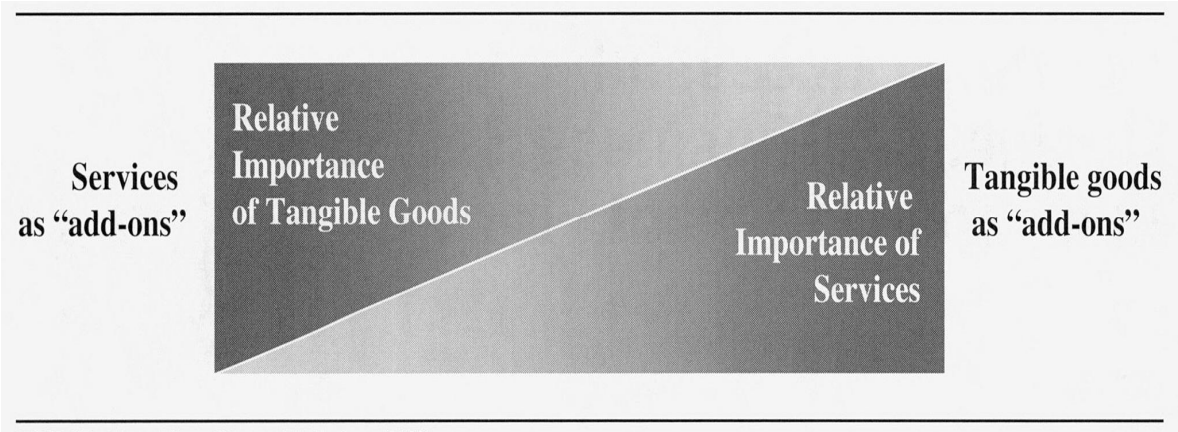

Figure 20. The tangible goods - service continuum (Neu & Brown, 2005)

In this direction points also the tendency towards modularized offerings by the manufacturing and the service companies. For discrete customer-oriented processes modularizations offers a strategy to

give up some part of effectiveness to gain increased operational efficiency, resulting in higher overall productivity. For continuous mass-production the same logic works in an opposite way. More specifically, as the actual effectiveness is reduced in the former case, so does the uncertainty on the service outcome too, which should keep the expected effectiveness unchanged.

Trade-offs in productivity analysis

The debate on the continua of industries is reflected in the interpretations of their productive performance. Originally, productivity was used to measure technical efficiency of machine-based production. To enable cross-industry and cross-country comparisons, a statistical productivity indicator has been established to relate value added of the production per unit of labour input services. As a main indicator applied by the macroeconomic school it seems to underestimate systematically productivity growth of most services.

By the current knowledge this is due to biased indexation of production time series and neglect of effectiveness in the calculus of service output. That is, productivity should be interpreted more broadly to contain both operational efficiency and effectiveness, balancing of which is the major challenge for service management. Outside of the measurement problems Baumol´s hypothesis on limited operational efficiency of services is, however, logical and it seems to find empirical support too.

In contrast to the macroeconomic school, the socio-economic approach shows high reality but low practicality in operationalization of service productivity concept. Quality, effectiveness and customer involvement are essential ingredients in understanding service productivity and innovation but they are hard or even impossible to account reliably for in a comparative analysis. That is, there seems to be a persistent trade-off between the two objectives, which bears essentially on the options in business strategy as well as policy design.

New directions

An alternative approach suggested here is, what can be called value creation approach. With its holistic orientation it acknowledges the pros and cons of the traditional schools and draws more on the strategic goals of business firms. The key assumption here is that the ultimate objective of the owners of the company is to increase the long term value of the company.

With an increased productivity higher value can be achieved through economies of scale and scope and the ability to influence the prices of outputs and inputs. The key message to service management is that the supplier should, as much as possible, contribute to the value creation of customers while simultaneously, reap the correct revenue from the value added, i.e. the marginal productivity of the service contribution.

The choice of value creation strategy is contingent upon the external and internal factors. Of the former is market structure, nature of competition, technologies available as well as other determinants of the business environment. Of the internal factors the most important is managerial capabilities and innovativeness of the service employees and organization.

Given the assumption of discounted value maximization and associated cost minimization, which the value creation approach theoretically draws on, the real and pecuniary productivity processes merge into a single indicator which relates the value added to the production costs. In this regard the use of total production costs is the most realistic proxy for neoclassical multifactor productivity.

As it is obvious the productivity indicator suggested here is a step further away from the original meaning of productivity, and one should be careful in interpreting it[44]. While the productivity indicators of closed and repetitive processes is intended to capture operational efficiency and effectiveness, so the indicator suggested here is a proxy for the combined effects of real and financial productivity.

The productivity of real processes of services is not directly observable but, combined with the financial dimension, which accounts for the quality of inputs and outputs, the indicator is the first best approximate for comparable service productivity. This implies that an appropriate productivity indicator for service businesses is conceptually equivalent to profitability.

Towards a workable taxonomy

The relative importance of operational efficiency and effectiveness varies along the continuum between pure service and pure manufacturing. This means that the service industries show various modes of productivity of their real processes. As argued here the official industry classifications do not satisfactorily capture the critical dimensions of services, still less the productivity patterns across industries. Therefore, the focus of productivity analysis should be centred on new taxonomies that highlight the various modes of service productivity.

The main types of derived classifications, assessed in Section 3, have been applied in the empirical research on innovation and competitiveness of industries. Their comparison shows that industry taxonomies are to a large extent, mutually consistent and applicable both to manufacturing and services. This enables to select the most critical dimensions by which industries tend to cluster. For the manufacturing industries these dimensions are technology intensity and skill levels of employees.

For services the key division is made between manual and knowledge based services and the degree to which services are tailored to customer needs. Labour and capital intensity of production is a central dimension for both services and manufacturing. Like other dimensions, intangibility[45] as a distinct character of services, is defined as a continuous variable accountable for in the service productivity taxonomy.

It is suggested here that intangibility can relate either to the service outcome or the inputs or more generally, production processes. For the service outcome, manual and knowledge services represent the opposite extremes. As the former is processing of goods or people and the latter is processing of information and knowledge. Hence, for the production process there are two continua indicated by high and low capital-labour ratio.

For capital intensive production a distinction is made between the processes based on tangible production capital - low tech – and, intangible production capital – high tech. For labour intensive production an equivalent division is made between processes based on tangible (manual) production skills and intangible, or information intensive, production skills.

Within the framework developed here service clusters locate in three-dimensional space, the corners of which represent eight archetypes of service activities. With their distinctive features these

[44] As noted by Brax (2007) it is questionable whether productivity is an appropriate term for the new value based formulations.

[45] A comprehensive account on intangibility in the context of services and manufacturing is given by Laroche et al. (2001).

clusters show different modes of productivity of the real processes. These modes can be characterized with the concepts derived from the service management and marketing literature.

A closer look at the taxonomy reveals that it is not confined to service activities only, but it can be regarded as a general mapping of market and non-market production activities. For the manufacturing sector however, the mapping is more complex since manufacturing activities are usually integrated inseparably with auxiliary service activities. To conclude, the taxonomy introduced here illustrates the compromising view between demarcationism and assimilation discussed throughout the paper.

The way forward

This paper delineates a theoretical framework how to deal with service productivity. Service productivity is, to a certain degree, a special field of research which necessitates a specific set of concepts and analytical tools. In this regard service productivity locates at the intersection of several economic disciplines, which offers a wealth of analytical tools. To the extent the black box of service transformation can be further opened, it generates, as a by-product, additional information on characteristics of various productive activities as well.

For the further development, theoretical analysis should be complemented with empirical research. In this regard empirical studies should serve three objectives. First, they should bring the missing building blocks to the theory; second they should validate and correct he theoretical arguments presented here; and finally they should provide new information on the economic goals and measurement of performance of the service companies.

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