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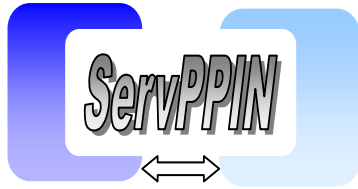
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Public services and the productivity challenge

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Abstract:

This work is devoted to an old question, but which faces a sharp renewed interest: productivity in its relationship with public services. Public services constitute a particularly difficult challenge for productivity (its definition, its evaluation, but also its strategic implementation), insofar as they add to the traditional difficulties induced by the service dimension of the output, other difficulties related to its public (or non-market) dimension. This work aims at accounting, on the one hand, for these analytical difficulties, and on the other hand, for a certain number of measurement experiments (traditional index methods, frontier techniques). It also aims at highlighting the advantage of more critical alternative frameworks, which question the relevance of the productivity concept.

Public services and the productivity challenge¹**Faridah Djellal* and Faïz Gallouj******* University François Rabelais of Tours, Clersé-CNRS and Gercie****** University of Lille 1, Clersé-CNRS****Introduction**

In ‘The Great Hope of the 20th Century’, Jean Fourastié (1949), drawing in particular on the work of Clark (1940), established the concept of productivity as the intrinsic technical criterion that made it possible to distinguish between the primary, secondary and tertiary sectors. Thus Fourastié argued that services were, by their very nature, characterised by a rate of productivity growth that was low in comparison with agriculture and, particularly, manufacturing industry. Although it does not altogether call into question the hypothesis that productivity in services is low, the development of modern service economies does cast some doubt on the ‘naturalness’ or ‘technical nature’ of this low productivity. Other interpretations have also been put forward; in particular, some question the validity and relevance of the traditional methods of measuring productivity, which are regarded as too ‘industrialist’ and unsuited to the distinctive nature of services. Thus, it is argued, productivity in services is not necessarily always low but tends in many cases to be poorly measured, sometimes even in ways that are conceptually inappropriate.

This work is devoted to the question of productivity in public services. This question is not in itself new. For some years now, however, it has undeniably been attracting renewed interest from academics, national and international statistical institutes and governments. The following reasons – some old, some more recent – are generally adduced to explain this interest or revival of interest.

¹ A preliminary version of this work was published in Djellal and Gallouj (2008), *Measuring and improving productivity in services : issues, strategies and challenges*, Edward Elgar Publishers.

1) In all developed countries, public services account for a considerable share of national wealth and employment. Thus any change in productivity in this sector automatically gives rise to a significant change in productivity in the national economy as a whole.

2) Public services contribute to the development of other economic activities. In other words, the performance (productivity) of public services influences that of the rest of the economy. This is particularly the case with education, publicly funded research, health, transport infrastructure, etc. However, it is equally true of the police, justice system, etc. Thus productivity in public services is both an object of concern in its own right (previous argument) and an essential factor in or determinant of productivity in other sectors.

3) Public services funded out of taxation have to be accountable to taxpayers, who are increasingly concerned with rigorous management of resources and increasingly likely to see themselves as customers of government agencies and other public bodies that are nothing more than service providers. Thus the underlying hypothesis is that, unlike their counterparts in market services, public service managers have tended to disregard productivity targets. These new preoccupations have emerged in a context in which certain socio-economic variables are exerting pressure for increased public expenditure; these include an ageing population and Baumol's cost disease (Baumol 1967), for which a cure does not seem to have been found. Nor are they wholly unconnected with the development of certain socio-political variables that are forcing public services, long protected by (natural) monopolies, to confront market principles in one way or another, whether directly or indirectly. Thus high productivity levels are regarded as an indication of sound resource management.

4) The issues at stake in the measurement of productivity in public services (and in particular the choice of the type of indicator to be used) are crucial to service providers as organisations or basic units in the economic decision-making process. After all, these indicators replace price and market-based judgements in assessments of organisations and their managers.

5) Public services, and indeed all services, continue to pose difficult problems not only for researchers but also for national and international statistical agencies. These

problems have not yet been resolved, despite the considerable progress the pioneering studies on the subject made in formulating these difficulties and putting forward certain answers (Fuchs 1969; Griliches 1984; Jorgensen 1995). The problems involved are not just the technical ones of definition and measurement (particularly of output) but also, in some cases, problems with the conceptual validity of the notion of productivity itself and the difficulties of making trade-offs at the operational level between often contradictory objectives (e.g. the deterioration in ‘product’ quality and employee demotivation caused by an excessively intensive productivity strategy).

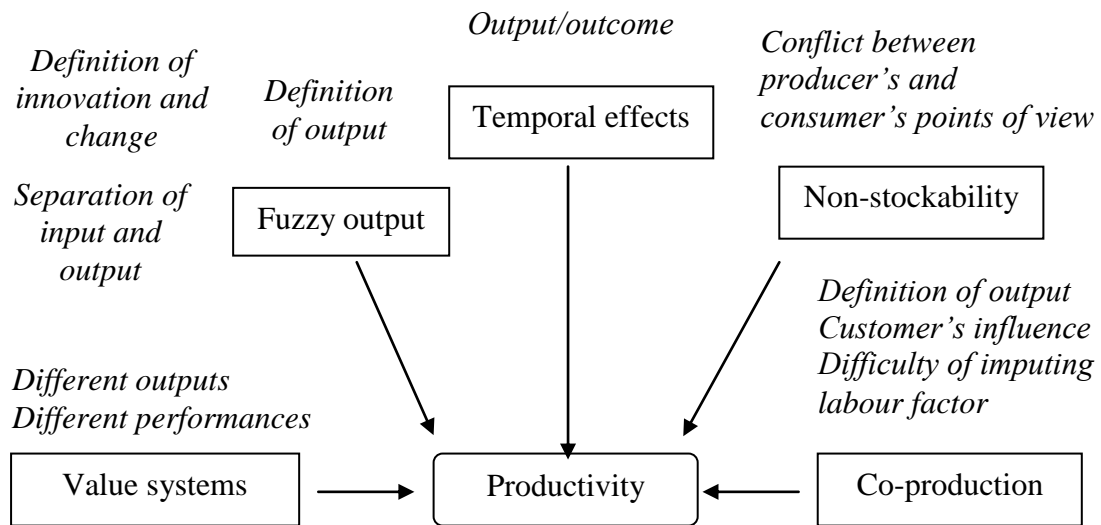
Non-market services constitute a particularly serious challenge to the concept of productivity. After all, in addition to the difficulties posed by the *very nature of a service activity*, they add others linked to the *activity’s public or non-market characteristics*.

We will begin this paper by describing the specificities of public services as services and their consequences for the definitions and indicators of productivity. We will also examine the implications of the ‘public’ nature of such services. We will then account for a number of tools developed to measure productivity in this sector making a distinction between traditional index-based methods and frontier techniques. In the last section, we will examine more critical alternative frameworks, some of which go so far as to question the very relevance of the notion of productivity.

1. The specificities of public services as services and their consequences

The literature on the economics and management of services has identified certain specific characteristics that are of undeniable value in any attempt to tackle, in an analytical and simplified way, certain theoretical and operational questions raised by services, whether they concern marketing, human resource management, innovation and R&D or, of course, quality, productivity and performance more generally (De Bandt 1991 ; De Bandt and Gadrey 1994). These characteristics, which are summarised in Figure 1, do not exist independently of each other. They are presented separately, sometimes artificially so (in spite of some possible redundancies), in order to link together the sets of indications relating to their consequences for the notion of productivity.

Figure 1 : The specificities of services and their consequences for the definition of productivity



1.1 Output is fuzzy

Services are generally characterised by a relatively vaguely defined, intangible and unstable output. The process of producing a service does not culminate in the creation of a tangible good. Rather what is produced is a ‘change of state’ (Hill 1977 ; Gadrey 1996). The product is an action, a treatment protocol or a formula – in other words, a process and a way of organising that process. In many cases, it is difficult to map the boundary of the service.

This first characteristic has several consequences for the definition and measurement of productivity.

1) It is always difficult in services to identify the output (or the unit of output), that is the numerator of the productivity ratio. Thus a computer manufacturer’s unit of output is a computer, but what is the unit of output of education, hospital services, R&D national defence (especially in times of peace), police or the administration of foreign policy? This does not mean that there is no answer to this question; rather, there are numerous, contradictory answers, each one as legitimate as the next.

2) It is difficult to separate this output from the factors of production used (in other words, the output from the process). Incidentally, this is why certain well-known

theoretical models, such as that of Baumol (1967), advance the hypothesis that the output can be regarded as identical to the factors of production (and more precisely, in this particular case, to labour). It was this hypothesis that national accountants used until recently to measure the output of certain services, particularly public services. It is still being used for some services.

3) The ill-defined nature of the output also complicates any attempt to identify innovations and improvements to service quality (Djellal and Gallouj 1999). However, it is essential that innovations and improvements to the output should be taken into account in any measure of productivity.

1.2 Output makes its effects felt over time

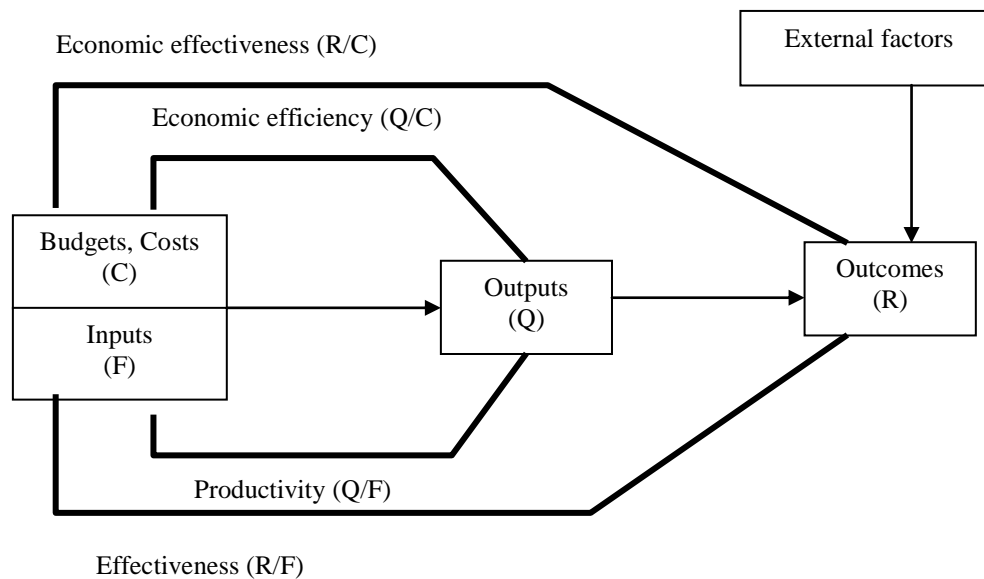
Any definition of services must take account of the temporal variable. After all, it is important to distinguish the immediate aspect of a service (the acts involved in providing it) from its effects in the medium and long term. Thus in the English-language literature a distinction is made between output and outcome (the long-term result). Retaining the word output for both cases, Jean Gadrey (1996) proposes that a distinction be made between the *immediate* output and the *mediate* output. In a way, the immediate output equates to what lawyers call the best endeavours obligation, while the mediate output equates more to a contractual obligation to produce a particular result. In the case of a hospital stay, for example, the immediate output consists of the various procedures carried out, while the mediate output equates to the change in the patient's condition, to his or her subsequent state of health or even the additional years of life made possible by the treatment. Table 1 provides other examples of this distinction.

Table 1: Some examples of output and outcome indicators in public services

Public service activity	Output indicator	Outcome indicator
Health	Number of treatments, number of bed days	Additional years of life (QALY : quality adjusted life years) Life expectancy
Education	Number of students, number of hours' teaching	Investment in human capital calculated on the basis of lifetime earnings Education level of the population
Police	Number of fines, number of arrests	Reduction in crime rate
Justice	Number of trials	Reduction in crime rate
Prisons	Number of prisoners	Reduction in crime rate
Fire services	Number of fires put out, number of people rescued	Reduction in damage caused by fires

Whatever the terminology adopted, this distinction is fundamental to the notion of productivity. Distinguishing between input, output and outcome, as well as taking account of the initial budget (cf. Figure 2), opens the way for performance to be defined in several different ways.

Figure 2: The various forms of performance



Productivity, in the traditional sense of the output produced by the factor(s) of production (or productive efficiency), reflects the relationship between (immediate) outputs and inputs (Q/F). The relationship between outputs and costs (Q/C) reflects what is generally known as economic efficiency (or cost efficiency). A reduction in costs does not necessarily indicate a gain in productivity. The quest for productivity gains cannot be confused, as it often is in companies and other organisations, with the drive to cut costs.

The outcome of a service also gives rise to two different concepts of performance. The ratio of outcome to inputs (R/F) equates to what we will term effectiveness, denoting the more or less long-term result of the inputs deployed. The ratio of outcome to costs (R/C) expresses the economic equivalent. In both cases, both the measurement and the interpretation of it can be distorted by the intervention of external factors. In the case of

health services, for example, the performance of healthcare expenditure as reflected in improvements in lifespan (R/C) or its technical equivalent (R/F) can be blurred by individual risk behaviours. In the case of fire fighting, the outcome (reduction in the damage caused by fire) may possibly be explained by factors unconnected to the firemen's output, such as improvements in building materials, the installation of smoke detection systems, etc. Similarly, a student's examination successes cannot be wholly explained by the output of the education system, since there are other contributory factors, such as parental assistance, use of the Internet and public libraries and so on. A decline in criminality, finally, may not be imputable solely to the activities of the police force and the justice system. Other factors play a not insignificant role, including civic education in schools, use of local leisure facilities etc.

These various concepts of performance are often used (wrongly) as synonyms, which is a source of errors, particularly in the strategies developed to measure or improve them. This applies, for example, to a so-called productivity improving strategy based on a drive to cut costs. A strategy of this kind certainly reduces costs but does not necessarily improve productivity. However, these concepts may also be in competition with each other, with the actors regarding one as more legitimate than the others. Thus, for example, performance judged in terms of outcome might be regarded as more legitimate than performance judged in terms of output, particularly in public services. What matters fundamentally, after all, is not the number of days' stay in hospital, hours of teaching, arrests made or judgements handed down but rather the reduction in mortality, the unemployment rate, crime rate etc. Another difficulty, which applies to attempts to measure performance in terms of outcomes, is linked to hysteresis, that is the time lag between the improvement in the outputs made possible by the inputs and the improvement in the outcomes. In general terms, this (more or less pronounced) delay may encourage agents to favour more visible short-term solutions over more radical long-term solutions.

At the macroeconomic level (although the argument could be transposed to the microeconomic level), the ratio C/Q is undeniably of value, for public services for example. It measures the cost per unit of output. It is sometimes known as the 'implied deflator' (Pritchard 2003). Nevertheless, it should not be confused with a productivity indicator. It tells us nothing about the efficiency with which resources are transformed into outputs. After all, since it is expressed in money terms, it reflects both a

productivity effect (efficiency with which inputs are transformed into outputs) and the effects of variations in input prices. This means, for example, that an increase in the ratio (i.e. in the cost per unit produced) may be perfectly compatible with productivity gains.

It should also be noted that outcomes, to an even greater extent than outputs, are multidimensional and difficult to measure. It is no easy task to add them to each other (Pritchard, 2002).

1.3 Output depends on value systems

This assertion is not independent of the other two. In services, the definition of output is not, one might say, ‘objective’, but subjective. It depends, after all, on the value system or judgement criteria that are favoured, in other words on the output ‘convention’ that is adopted. This is particularly important for public services, where the principles of continuity, equity and equality play a significant role. Thus, unlike a good, a service does not have an independent existence enshrined in its technical specifications. It is a *social construction* (reference world) that exists in various ways in *time* (time horizon) and in the *material world* (degree of materiality or tangibility). public services are more deeply affected than other services by the existence of complementary or contradictory value systems. In the case of health services everywhere, for example, the evaluation of output and performance brings into play two visions that are difficult to reconcile: that of public authorities, with its emphasis on cost cutting, and that of medical personnel, which emphasises quality of care.

The consequence of the ‘socially constructed’ or conventional nature of the output of a service activity is that various types of ‘products’ and different types of performance can be identified, depending on the evaluation criteria adopted. Furthermore, these criteria vary in space and in time. Section 4 of the present paper is devoted to this important question.

1.4 Output is interactive (or co-produced)

The idea that customers or users take part in the production of a service has often been put at the heart of definitions of services. Some authors have even suggested that

customers should be incorporated into the production function as inputs. One such is Oi (1992), who proposed the following production function for retailing: $X = f(L, K, N)$, in which N is the volume of labour provided by consumers. The analysis could be extended by adding the volume of capital provided by customers. After all, particularly in the case of NICTs and networks, consumers use not only their own labour forces but also their own technologies (computers, Internet etc.) in order to co-produce the service. This characteristic has several implications for the definition and measure of output and productivity.

1) The interactive nature of service production is one of the factors that make it difficult to define and identify the output (or the 'standardised' unit of output). After all, the customer's part in the process means that the output is always different, since it adapted to specific needs. This characteristic is not peculiar to high-level services but also affects less knowledge-intensive services. For example, as Hulten (1985) notes, the number of haircuts is not a good indicator of a hairdresser's activity. The first reason is that each cut is different, depending on the customer's wishes and personal characteristics. The second reason is that a purely volume-based indicator takes no account of the customer's perception of the haircut. Broussole (1997), in his comments on this example, rightly states that what matters from the point of view of measuring output is 'the average performance to which producers commit themselves and not the diversity of particular services provided'. In the opposite case, all industrial products (cars, computers, etc.) can be regarded as different from each other, largely as a result of the vicissitudes of the production process (which may impact on its operational life, potential faults, etc.).

2) Customers can have a positive or negative influence on a service organisation's productivity (and, more generally, on its performance). Thus good pupils or students have a positive influence on the productivity and performance of schools and universities, while competent customers can improve the performance of any consultants they might hire.

3) Depending on the type of service in question, various strategies can be put in place that seek either to exclude customers as far as possibly by making available only standard products that eliminate the degree of variability introduced by customers' interventions. In this case, the producer's efforts are focused on the numerator of the

productivity ratio. Conversely, at the other extreme, customers can be made to do part of the work themselves (self-service).

4) This interactivity makes it difficult to impute the labour factor to the production unit (this is particularly true of service relationships with consultants, subcontractors, etc.).

1.5 Output is not stockable

The non-stockable nature of services (i.e. their immediateness) means that they are consumed as they are produced. Since services produce changes of state, such changes cannot be stocked (Hill 1977). This characteristic can be used to understand the nature of the output of service activities. The consumer's point of view (what he or she considers they have consumed) can, after all, be added to that of the producer (what he considers himself to have produced) in order to define the output. These two points of view do not always coincide.

2. The public dimension of public services and its consequences

Public services have specific characteristics that require specific analysis. These specificities relate to their public or non-market aspect. We will begin by briefly outlining the justifications to be found in economic theory for their public or non-market character. We shall see that it is performance (whether defined in terms of efficiency or fairness) that constitutes the basic justification. We will then consider some of the general characteristics of public services and their implications for productivity.

2.1 Market services versus non-market services: a brief detour via economic theory

In economic theory (and particularly in public economics), the existence of public services is justified by two arguments based on performance (efficiency and fairness).

a) The first argument is that non-market services are more efficient than market services in certain specific circumstances known as market failures. These market failures can manifest themselves in the following different forms:

1) High levels of *informational asymmetries* between producers and consumers, which mean in particular that consumers are not in a position to formulate their needs and assess the quality of the services provided. This situation is common in health services.

2) A (natural) absence of competition, that is *the existence of a natural monopoly*, which means that a single company can provide one or more products more efficiently than a number of different companies.

3) *The existence of production or consumption externalities*, which manifest themselves when the consumption (or production) of a good affects not only the consumer (or producer) in question but others as well. For example, a given worker's investment in human capital increases not only his or her own utility but also that of the work group to which he or she belongs. Another example is vaccination, which not only protects the person being vaccinated but also reduces the likelihood that he or she will infect others.

4) When the product under consideration is a '*pure public good*'. A product (good or service) is said to be a 'pure public good' when it possesses the twin characteristics of being non-rival and non-excludable. This means that 1) consumption of the good by one individual does not deprive anyone else of that good (there is no limit to the number of individuals who may consume the good in question simultaneously); 2) nobody can be excluded from consuming the good. Clearly it is difficult for this type of good (national defence, justice system, street lighting, fire service), which is susceptible to opportunistic behaviour of the kind described as 'free riding', to be provided by the market.

Some public services are affected by only a limited number of failures, while others seem to be affected by all of them. It is generally reckoned that the first group (which some people believe could be transferred in whole or in part to the tender mercies of the market) pose performance problems similar to those posed by normal market services, while the second group poses different problems and should be treated differently. Transport, telecommunications, energy and postal services belong to the first group,

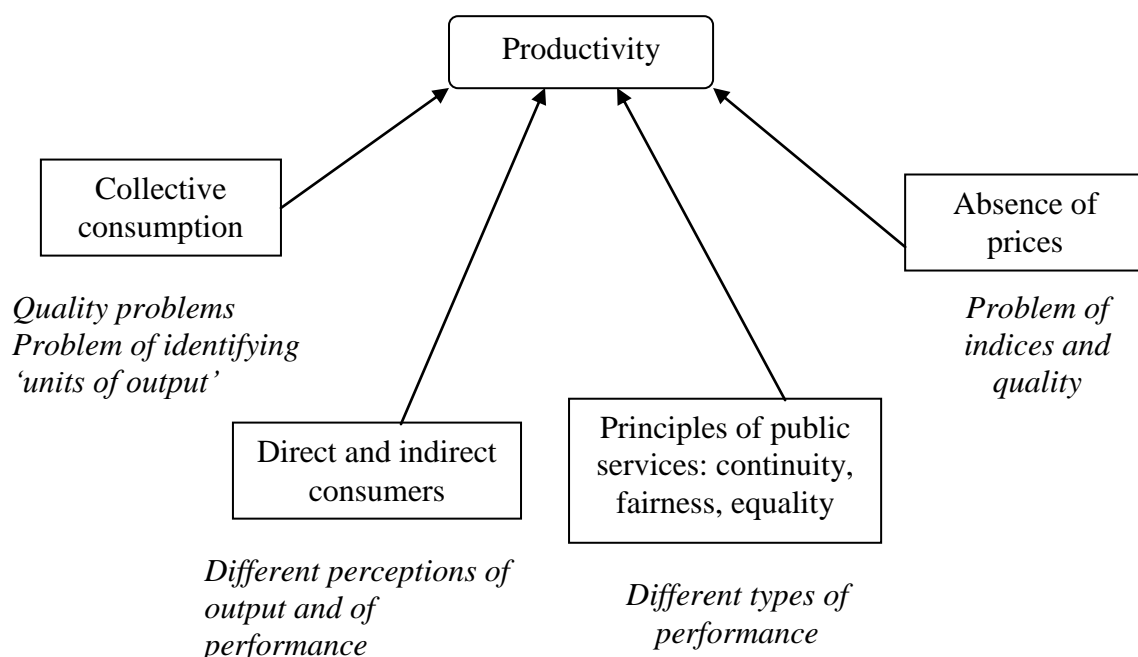
while government services belong to the second group. Health services and education constitute a group apart.

b) The second argument is based on the pursuit of fairness and social justice. After all, the equity principle demands that those who cannot afford to pay for them should not be excluded from certain services that are regarded as basic human rights (education, health, justice etc.). Thus non-market services are more effective than market services when it comes to civic performance.

2.2 The specific characteristics of public services and their consequences for productivity

The characteristics that might be regarded as specific to public services can be summarised in the following three statements (cf. Figure 3) : 1) the output has no price; 2) it is (in certain cases) consumed collectively; 3) a distinction has to be made between direct and indirect consumers; 4) it adheres to the public service principles of equality, fairness and continuity. Our next step is to assess the consequences of these various characteristics for the definition and measurement of public services.

Figure 3: The specificities of public services and their consequences for the definition of productivity



2.2.1 The output has no price

The main characteristic of public services is that they are provided, for the most part, free of charge or at modest prices that do not cover the costs of production. This characteristic has fundamental consequences for the definition and measurement of productivity. In contrast to market goods and services, we do not have a market price that can be used, on the one hand, to measure volumes of output and, on the other, to weight the various outputs in order to calculate an aggregate output when a public organisation provides several outputs.

Irrespective of the usual technical problems of measurement and quality, the absence of prices also makes it impossible to take account of changes in the quality of the output of public services. In other words, the (fundamental) problem of how to take account of quality when measuring productivity is even trickier in the case of these services.

2.2.2 The output is consumed collectively (in some cases)

The non-rival nature of the output of some public services has consequences for the measurement of productivity. For example, if the number of pupils in a class is increased, the teacher's productivity might be said to have increased as well. However, the additional work may give rise to problems with quality, etc.

Of course not all public services share this characteristic. However, those services whose output is consumed collectively are generally those in which productivity is most difficult to measure, since they are the ones in which the 'units of output' are most difficult to identify. Olson (1972, p. 362, after Le Pen 1986), for example, takes the view that 'the fundamental characteristics of a public good that mean that no one can be effectively excluded from consuming it also make it a good whose output does not take the form of divisible units that can be easily counted'. For the opposite reason, it is less difficult to identify the output (and hence to measure productivity) in those public services that are consumed individually.

The various levels of difficulty in defining and denoting output can be revealed by making a distinction between three types of output (Caplan 1998; OECD 1999) :

- services consumed by individuals, such as health, education and certain social services aimed at individuals. They are services for which the market supply is smaller than the non-market supply but is, nevertheless, significant and can, therefore, be used as a reference point for measuring outputs, particularly as far as the prices index is concerned;
- government administrative services (which are held to produce outputs consumed by governments). Examples include administration of the tax system, the central administration of health and social affairs and the provision of advice to ministers. In some cases, when the constituent acts can be identified, the output can be easily defined (for example, the number of tax declarations processed by the tax authorities or the number of beneficiaries of a particular social welfare programme). In others, it is more difficult to identify units of output. This applies, for example, to the provision of advice to ministers and the control and planning functions found in most central government departments. However this maybe, the problem seems to be no different from that encountered in some market services, such as consultancy (which can be used as reference points);
- public goods and collective services (national defence, foreign affairs, environmental protection). These services, which are collectively consumed, are the most problematic from the point of view of measuring output and productivity. The textbook example here is probably national defence, for which it is virtually impossible to establish a unit of output. In this case, the most appropriate approach is to devise a method of measuring outcomes.

2.2.3 Direct and indirect consumers

A distinction is often made between two types of consumers of public services (Greiner 1996): *direct* consumers (those who benefit directly from the service provided, i.e. users) and *indirect* consumers (that is, the public at large, taxpayers, citizens). Although they are ultimately the same group of individuals, their perceptions of the output and performance can be said to be different. After all, direct consumers emphasise the nature and quality of the service provided and its mode of delivery, whereas indirect

consumers are more concerned by the economic and financial aspects (as taxpayers) and the long-term socio-economic effects (as citizens).

This distinction, it should be noted, is not simply a reflection, at the level of consumption, of the distinction between direct and indirect output already mentioned above. Direct consumers can be just as concerned with the direct output as with the indirect output. On the other hand, this distinction reinforces the notion that a number of different value systems exist and may contradict each other. Thus depending on the perspective adopted (consumers as actual users of the services or as abstract entities), the criteria for the defining output and performance differ.

2.2.4 Output consistent with the principles of public services

The principles in question are continuity of service, equality of treatment and financial consistency. These principles are usually regarded negatively from the perspective of the levers of productivity. After all, whether applied to human resources or to investment, they are the basis for very precise rules and a high degree of centralisation, which may serve to make procedures more cumbersome when the drive for productivity gains demands rapid and flexible responses. However, as far as defining output and performance are concerned, which is our focus here, these public service principles may, on the contrary, be interpreted very positively. After all, this public dimension (embedded in the principles of continuity, fairness etc.) is reflected in the production of *value added*, which might be described as *social* or *civic*, which is not usually included in any measures and is often regarded as a cost or an additional cost, particularly (and increasingly) in public service enterprises. The great advantage of the worlds of production framework, which we will introduce in section 4, is that it also includes this social or civic value added and the corresponding performance.

3. Measures of productivity in public service

Compared with other activities, fewer attempts have been made to measure productivity in public services, whether by national or international statistical institutes or academic researchers. In this regard, therefore, we are in a pre-paradigmatic phase, in which various approaches are being tested without any one methodology being regarded as superior to any other. This also means that comparisons of public service productivity in

time and space are often relatively risky. It should also be noted that not all public services are treated in the same way. There is, after all, a relatively well-established tradition of studies of productivity in health or education services. The same does not apply to other public services, particularly government services.

However that may be, in reviewing the main methods used to measure productivity in public services (or the attempts that have been made to do so), we will make a distinction as before between non-parametric (index-based, DEA) and parametric (econometric) methods.

3.1 Index-based approach

The indices used in public services and particularly in government services, which involve measuring output in terms of input, are particularly questionable. Nevertheless, they are still widely used. In the absence of any more direct indicators of output, strategies have been developed for replacing output-based measures with measures based on activities.

3.1.1 Measuring output in terms of input

In the absence of market prices and given the impossibility of constructing volume indicators (and faced with the theoretical hypothesis that services can be reduced to the deployment of human resources), statisticians for a long time measured the output of services in terms of the inputs. It was only relatively recently that they stopped doing so, and indeed still use this method for some services. Thus the output of public administration was evaluated by summing the production costs at current prices (labour costs, intermediate consumption and capital amortisation). In order to obtain an estimate of output at constant prices (in volume terms), the various costs are deflated. Clearly, this is not a satisfactory way of estimating output, since it means that the same value figures in both the numerator and denominator of the productivity ratio. It is hardly surprising that this method shows no variation in productivity, since that is the implicit hypothesis on which it is based. Statisticians have begun to abandon this approach, which is known as the input approach.

3.1.2 Measuring output in terms of activities

The idea that output indicators based on inputs should be abandoned in favour of more direct output indicators is the subject of an ongoing debate. Advocating such a shift amounts to calling for the standardisation of output and productivity measurement methods, on the assumption that, with the exception of collectively consumed services, public services differ little from market services. The international statistical institutions have been notably vocal in advocating this approach. Chief among them have been the OECD (1999), whose Statistics Directorate and Committee for Public Management (PUMA) have put forward ideas for improving the measurement of output and productivity in public services, and Eurostat (2001) which, concentrating on health and education services and general public administration, has proposed ways of improving price and volume estimates for non-market outputs. The European Commission, through the ESA (European System of Accounts) 95, has also advised national accounting offices to adopt output indicators for public services.

Despite these general positions, attempts at national level to measure productivity in public services are still few and far between and diverse in nature. The OECD (1999) and Handler et al. (2005) have both conducted preliminary assessments. The results are as follows. Most countries have only very recently introduced output indicators into their national accounting systems, and some have not even begun to introduce them at all. Some countries, such as the UK, where output indicators were introduced as early as 1986, are exceptions to the rule. Most of the measures introduced relate to a small number of public service activities, among which health and education feature very frequently. Some countries, such as Finland for example, have covered virtually all public services (including collective services). In all countries, strategies are being developed with a view to gradually incorporating new sectors. Government services are often among the last on the lists. Consequently, it is for these services that output indicators are, for the moment at least, scarcest and least unanimous. For example, it was not until 1998 that the UK, despite being one of the leaders in this area, stopped measuring output in terms of input in most government services (Ashaye 2001). When countries have not (yet) succeeded in defining a unit of output, as is the case, for example, with certain collective services such as national defence, the old method, in which output continues to be identified with the volume of inputs, is still applied.

To summarise the efforts made to date in the various countries (particularly the UK, the Netherlands, Australia and the USA) to implement this general strategy of adopting methods based on output indicators, they can be said to have consisted of the following steps (Fisk and Forte 1997; Baxter 2000; Ashaye 2001; Northwood et al 2001 ; Pritchard,2003): 1) compiling lists of the main activities in the various types of public services under investigation ; 2) identifying a volume-based measure for each type of activity (for example, the number of incidents or cases in a given period) ; 3) identifying a weighting unit in order to be able to aggregate the various volume-based measures. In the absence of prices, the relative production costs for each type of activity in a given reference year are generally used, it being assumed that the weightings must be proportional to the production costs for each activity. One commonly used method of carrying out this weighting is to calculate the cost of one case for the reference year and then multiply it by the number of cases in that year. This general process is described in the UK as the construction of a cost-weighted activity index (CWAI) for each sphere of public services. Although it does not claim to be exhaustive, Table 2 shows some examples of output indicators used very recently for various types of public services in the UK.

Table 2 : Examples of output indicators used for public services (adapted from Handler et al 2005)

Type of public service	Output indicators used
Health services (Caplan 1998; Pritchard 2002, 2003)	Identification of 14 types of activity: number of treatments provided for patients for each type of activity Weighting: relative cost of the various activities
Education (Caplan 1998; Pritchard 2002, 2003)	The basic unit of output is the lesson given to a pupil. Thus a class of 30 equates to double the output of a class of 15 (assuming the quality is unchanged)
Local personal social services (Caplan 1998; Ashaye 2001)	Three activities: 1) residential homes for the elderly; 2) home help services for the elderly; 3) children's services. Number of activities carried out for clients Weighting: cost of each activity.
Social security (Pritchard 2002)	Payment of benefits: number of applications of each type processed and payments paid Weighting: relative cost by type of application
Police (Pritchard 2003)	Number of crimes cleared up by type (degree of seriousness)
Prison (Baxter 2000, Pritchard 2003)	The basic unit of output is the custody of one prisoner for one day. It is planned to identify different categories of prisoner at a later stage.
Justice (Baxter 2000 ; Pritchard 2003)	Courts: number of cases processed by type of court Legal aid: identification of 10 types. Number of cases by type.
Fire service (Ashaye 2001; Pritchard 2003)	Three activities: 1) fire fighting, 2) fire prevention, 3) special services (not linked to fire fighting/prevention). • Fire fighting: number of fires (of different types) and false alarms. • Prevention: number of hours spent on various prevention activities (inspections, training, etc.). • Special services: number of road accidents and rescue operations etc. Weighting: average number of hours' work for each type of incident.

Despite their numerous shortcomings, these experiments, which have involved identifying the output of public services, constitute significant steps towards a method of measuring productivity, particularly when they are compared with input-based methods.

However, the indicators used are indicators of the *activity* (intermediate stages or components of the final output) of public services and not of their *output*. Although activities are an appropriate approximation for output, ultimately it is output itself that ought to be measured. After all, counting up activities can give rise to obvious misinterpretations. For example, if a hospital introduces a technique that reduces the number of days' stay, the relevant activity indicator (number of days' stay) will show a decline in productivity, which does not reflect reality. Similarly, when the crime rate falls, police productivity can only decline if it is defined by the number of arrests made. However, it is true that the dividing line between activities and output is not always very clear. The definitions of activities and output that are adopted obviously has significant consequences for the evaluation of output and of productivity.

Moreover, another major difficulty has to be resolved, as the Atkinson Report suggests (Pritchard 2004). The problem in question is how to identify the equivalent of value added, as in other activities. No such notion of value added is visible in the output indicators used, whether it be the number of pupils receiving a lesson or the number of patients treated in a hospital. However, this is an absolutely fundamental notion and is an important area of research for the future.

3.1.3 The headache of variations in quality

The main methods of taking account of variations in quality are based on price, on the assumption that, in a situation of perfect competition, differences in price between products reflect differences in quality (that is differences in the products' characteristics). In other words, a higher price indicates higher quality. In the case of tangible goods and market services, this is always a difficult exercise, as we have already noted. With computer systems, for example, it is not unusual for a system of significantly higher quality than previous systems to be sold at a considerably lower price.

When it comes to non-market services, the difficulty is increased by the absence of market prices. In the light of these difficulties, The Eurostat Handbook on Price and Volume Measures in National Accounts (Eurostat 2001) identifies three methods of adjusting for quality:

1) *Direct measurement of the quality of the output itself.* This measurement is carried out by means of regular surveys of the quality of public services. These surveys (for example, regular reports of schools inspections) give some idea of the variations in quality over time. Their main limitation is that the information thus gathered tends to reflect the quality of the production process rather than the quality of the output and is often subjective and not necessarily consistent over time or between units.

2) *Measuring the quality of the inputs.* The hypothesis on which this method is based is that ‘the quality change of the inputs leads automatically to a quality change of the output’. In this case, of course, it is the labour input that is the object of the principal measurements. Thus differences in employees’ pay are held to reflect differences in the quality of the work force, which have to be included in the volume component.

3) *Using outcomes.* The hypothesis underlying this type of method is that the quality of the output lies in its results, i.e. in the outcome. The most appropriate way of adjusting for quality, therefore, is to investigate changes in outcome indicators. Thus all things being equal, the quality of police output is reflected in a fall in the crime rate and the quality of university output in an increase in the number of graduates while the total number of students remains unchanged. This method of adjustment has obvious difficulties, which have already been mentioned. Firstly, it is difficult to ‘neutralise’ the exogenous factors (it can hardly be claimed that the quality of university output has improved if universities have lowered their standards). Secondly, there may be a time lag between the change in output quality and its results (outcomes). For example, an improvement in the quality of police output is not immediately reflected in a fall in the crime rate.

3.2 DEA approaches

Non-parametric (frontier) techniques are frequently used to compare the efficiency and productivity of different organisations or, in the words of Charnes et al. (1978), of different “decision-making units” or DMUs. They are used mainly in academic studies, but national statistical bodies and, on occasions, firms also use them. More rarely, they may also be used to conduct international comparisons at an aggregated level. We shall confine ourselves here to outlining briefly the general principles of the most frequently used of these non-parametric methods.

By far the most commonly used non-parametric method is so-called data envelopment analysis (DEA). Based on linear programming techniques, the DEA method involves the construction of a production frontier equating to best practices in matters of technical efficiency. The efficiency level of the other organisations is valued by comparison with this empirically established ‘frontier benchmark’.

The DEA method has been applied very successfully to public services. The main reasons for this success are the following ones :

- 1) It is particularly well suited to analysis of organisations using many inputs to produce many outputs.
- 2) Its use does not require a form of the production function to be expressed a priori.
- 3) It does not require information on prices either (which is obviously an advantage in public services, where such prices do not exist or are not significant).
- 4) Efficiency is not assessed relative to an average performance (as is often the case in econometric techniques) but rather relative to the best performances observed.

Without carrying out any bibliometric studies, it can be said with absolute certainty (although the same applies regardless of the method used to measure productivity) that health services and then education are the areas in which the DEA method is most commonly applied. However, it may be applied to any public service activity (and at various levels of aggregation), as Table 3 shows.

Table 3: Some illustrations of the application of the DEA method to public services

Type of public service	Reference and perspective adopted
Health	<ul style="list-style-type: none"> - Hollingsworth et al. (1999): survey of non-parametric methods and their applications - Maniadakis et al. (1999): Impact of the internal market on hospital efficiency, productivity and service quality - Ouellette and Vierstraete (2002): technical change and efficiency in the presence of quasi-fixed inputs: application to hospitals
Universities	<ul style="list-style-type: none"> - Worthington and Lee (2004): efficiency, technology and productivity in Australian universities - Johnes and Johnes (1993): comparison of the research performance of UK economics departments
Justice	- Lewin, Morey and Cook (1982): comparison of the efficiency of courts
Post offices	- Tulkens (1986): definitions and methods of measuring productive performance: application to the Belgian Post Office.
Public enterprises in general	- Young-Yong et al. (2000): the impact of competition on the efficiency of public enterprises
Vehicle inspection services	- Odeck (2000): the increase in productivity and efficiency in vehicle inspection services in Norway
Airports	Sarkis (2000): comparative efficiency and productivity of the principal American airports
Central banks	- Gilbert et al. (2004): evolution of productivity at the American Federal Reserve
Police	- Drake and Simper (2003): a comparison of several parametric and non-parametric methods of measuring police force productivity
Local government	Stevens (2005): comparison of DEA and SFA
Public library	Hammond (2002): efficiency of the public library system in UK
Public administration in general	Yaisawarng (2002): Development of strategic plans for improving performance

3.3 Econometric approaches

In an article published more than two decades ago, Le Pen (1986) reported on the development of a new and promising approach to the measurement of productivity in non-market public services, namely econometric analysis. In doing so, he was drawing attention to the work of Scicluna et al. (1980) on the productivity of police services in Canada. This study used a sample of 99 local authorities as the basis for estimating a multi-output production function for municipal police forces, linking the factors of production used to outcome indicators ('offence rate for crimes of varying levels of severity, ranging from violent crimes to infringements of the highway code'). As Le Pen (1986) notes, the value of this econometric approach is twofold. Firstly, it is concerned with outcomes and not activity, as is often the case when productivity in public services is investigated. Secondly, it is capable of determining the proportion of the change in the crime rate that can be attributed to the factors of production used by the police (police officers, equipment etc.) and the proportion that can be attributed to factors in

the social environment. It can be regarded as a relatively satisfactory measure of productivity.

Since then, the econometric approach to the analysis of productivity has spread to all public service activities. Given the scale of this expansion, here too we can do no more than provide some illustrations, listing the services covered and, where possible, the types of questions investigated (cf. table 4).

Table 4: Some examples of the application of econometric methods to public services

Type de public service	Reference and perspective adopted
Urban transport	Karlaftis and McCarthy (1999): effect of privatisation on productivity and costs in urban transport ; Farsi et al. (2006): efficiency of regional bus companies; Roy and Yvrande-Billon (2007): the consequences of ownership structure and contractual choices on efficiency in urban public transport sector in France.
Health	Menon and Lee (2000): The effects of IT and regulatory changes on productivity; Rosko and Mutter (2008): Analysis of 20 SFA studies of hospital inefficiency in the USA.
Education	Stevens (2005): Efficiency of 80 English and Welsh universities as suppliers of teaching and research.
Fire services	Jaldell (2005): fire service productivity and performance
Police	Drake and Simper (2003): study of police force productivity that compares the results of several measurement methods (both parametric and non-parametric)
Airports	Oum et al. (2003): comparison of the productivity of the main international airport from a benchmarking perspective
Local government	Stevens (2005): comparison of DEA and SFA
Tax offices	Barros (2005): SFA to benchmark the tax offices
Telecommunications	Nemoto and Asai (2002): Economies of scale, technical change and productivity growth in local telecommunications services in Japan
Electricity	Coelli (2002): comparison of different methods of measuring productivity (DEA, SFA)

The econometric approach to productivity has certain advantages (OECD, 2001). In particular, econometric techniques can be used to take account of the adjustments costs and of the variations in capacity utilisation. This is advantageous, since the cost of these variations depends on the speed with which resources are deployed. Furthermore, the econometric approach can be adapted to any hypothesis concerning the form of technical changes, whereas index-based methods depend on the hypothesis that technical progress is neutral, as in Hicks' definition of the term (in which the factors of production are each reduced to the same extent). However, this econometric approach also has certain disadvantages (OECD 2001). Firstly, the refinement of the solutions provided for complex technical problems casts doubt on the validity of some of the

results. For statistical institutes, furthermore, these econometric methods require the deployment of significant resources in terms of data, updating of equation systems and training for users of statistics. It should be noted that econometric studies focus less frequently on measurements of productivity than on analyses of the relationship between productivity (measured, for example, by a ratio of the total factor productivity (TFP) type) and the explanatory variables. This emphasis fits better with the second part of the book, in which we examine the determinants of productivity.

4. Beyond productivity : performance ? beyond measurement : evaluation ?

In the light both of the sometimes insurmountable measurement difficulties examined above and the particular nature of public services, a pluralist approach to performance seems even more essential in public services than elsewhere. Here more than anywhere, the notion of performance is (or has to be) a social construct, a convention subject to debate. A pluralist approach to performance should not be regarded simply as an epistemological choice. As we have observed on several occasions, it is technically necessary given that, in some cases, the concept of productivity has become meaningless.

As Gadrey (1996) notes, the framework based on the work of Boltanski and Thévenot provides a useful heuristic for examining performance in public services. By way of illustration, we will look at the case of business incubators, which are often service organisations set up by local authorities.

4.1 A multi-criteria framework for evaluating output and performance

We hypothesise that the various purposes or ‘outputs’ of service activities can be linked to different ‘worlds’ (that is sets of outputs or of concepts of outputs and criteria for evaluating those outputs). Drawing freely on the work of Boltanski and Thévenot (1991), it is suggested that services can be defined and evaluated on the basis of different sets of justificatory criteria, which equate to the following six worlds:

- the industrial and technical world, the outputs of which are described and estimated mainly in terms of volumes, flows and technical operations;

- the market and financial world, the ‘output’ of which is envisaged in terms of value and monetary and financial transactions;
- the relational or domestic world, which values interpersonal relations, empathy and relationships of trust built up over time and regards the quality of relationships as a key factor in estimation of the ‘output’;
- the civic world, which is characterised by social relations based on a concern for equal treatment, fairness and justice;
- the world of innovation (the world of creativity or inspiration);
- the world of reputation (the world of brand image).

Table 5 illustrates this framework, which does justice to the multiplicity of service ‘products’ or ‘outputs’ by combining space-time analysis with symbolic space. This digression on product diversity is intended to highlight what is our primary concern here, namely the diversity of performance. After all, if the ‘generic outputs’ are different, and given that *performance is defined as the improvement in the ‘positions’ or ‘operating efficiency’ relative to the various outputs*, it is not difficult (at least in theory) to accept the existence of a plurality of (generic) performances associated with (generic) outputs considered in their two facets (‘volume’ and quality).

Just as with outputs, therefore, several types of performance can be identified, depending on the ‘families’ of criteria adopted for the purposes of definition and valuation: industrial and technical performance (in which the main criteria are volumes and flows), market and financial performance (in which the emphasis is on monetary and financial operations), relational performance (in terms of inter-personal ties), civic performance (in terms of equality, fairness and justice), innovation performance (in terms of the planning and implementation of innovative projects) and reputation performance (in terms of brand image). The question of performance can also be considered in terms of the time frame of the evaluation (short term, long term) or even from the point of view adopted in making the evaluation (the user’s or the service provider’s).

Contrary to certain prejudices, civic, relational, reputational and innovation performance are not immune to all forms of quantification. True, it may seem paradoxical, for example, to consider social or civic relations (which are generally associated with disinterested attitudes or the gift/counter-gift principle) in terms of performance (a

notion with strong technical and commercial connotations). The intention is not of course to measure relationship intensities, particularly since sociologists have drawn attention to the composite nature of the service relationship, which is regarded as a locus for the verbal exchange of technical and market information and signs of civility and mutual esteem (Goffman 1968). On the other hand, there is no reason why the length of time spent in the relationship or even, once the content has been examined, the quantity of relations of each type cannot be measured. Thus improvements in (internal or external) customer satisfaction indicators and reductions in user turnover can be regarded as indicators of relational performance, while the evolution of the production and share of social quasi-benefits make it possible to some extent to monitor the evolution of civic performance. Similarly, the rate of (incremental) innovations introduced and the resolution rate for problems encountered during the test phase of an innovative project or even the share of solutions codified (routinised) and transferred to a generalised application can serve as indicators of innovation performance.

Table 5: A multi-criteria framework for analysing service output and performance (After Gadrey 1996)

	Industrial and technical world	Market and financial world	Relational or domestic world	Civic world	Innovation world	Reputational world
Direct output (short term)						
<i>Performance relative to direct output</i>						
Indirect output (long term)						
<i>Performance relative to indirect output</i>						

Table 5 depicts twelve different concepts of performance, which may mutually reinforce each other or, conversely, contradict each other, or at least may do so once a certain threshold has been crossed. For example, an increase in technical performance may give rise to an increase in market performance. It is likely, therefore, that an increase in the number of accounts opened per employee in a bank will be accompanied by an increase in net banking income per employee. Similarly, an improvement in relational performance (manifested, for example, in an increase in the customer retention rate)

may have a positive influence on market performance. These different types of performance may also be negatively linked, since individual pairs of them may clash with each other. For example, a good civic performance (high rate of social quasi-benefits) may lead to a deterioration in a competitiveness or productivity (technical performance) indicator. Similarly, an improvement in technical performance may impact negatively on market performance. The phenomenon may occur, for example, when bank cards are issued as a matter of course (volume effect) without regard for certain 'security' conditions.

Such a multi-criteria framework is particularly important for public services. After all, to a greater extent than in any other economic activity, the qualities of the output are justified (reference worlds) on a number of competing and frequently ambiguous registers.

4.2 Output and performance of business incubators

This framework for analysing product and performance has been applied within our team to several sectors : 1) the postal services in their mail and financial dimensions (Gadrey et al. 1999) ; 2) the French national employment service ANPE (Delfini 1999); the French family welfare offices (Adjrad, 1997). We will confine ourselves to the discussion of a recent application to business incubators.

Business incubators are organisations set up, usually at local level, in order to encourage and support start-up companies. For more than 20 years now they have been an important tool in policies designed to assist the regeneration and strengthening of local economic systems. These organisations can be classified as service providers since they provide their 'customers' (individuals seeking to set up their own businesses) with material and human resources in a number of different ways.

These organisations are neither static nor homogeneous. They have developed in the course of their history. Today, therefore, they differ in various ways, including the identity of their sponsors, mode of organisation and funding, the nature of the services they provide and the type of clients or projects in which they specialise. If we confine ourselves to these last two criteria, business incubators can be said to provide both simple and high-level services, that is material processing services (real estate, catering

and reprographic services, for example) and knowledge processing services (various types of advice, training, etc.). There are also generalist incubators and specialist incubators (concentrating, for example, on particular industries, types of clients or stages in the business start-up process). Those that promote entrepreneurship in the Schumpeterian sense of the term (i.e. the establishment of a company in order to introduce an innovation) are important actors in local innovation systems or what is known as the interactive innovation model, that is assisted by a service provider (Gallouj 2002).

As for most other service activities, it is difficult to define and measure the output of incubators. Any investigation of this output has to take into account a number of different time horizons and worlds of production. It is a social construct, embedded in a space that is not only physical but also symbolic and temporal. Thus the output is a construct based on convention.

Table 6 sets out a framework that takes account of the diversity of ‘outputs’ of incubators by combining space-time analysis with symbolic space. As far as the temporal dimension is concerned, it can be assumed that the short term (i.e. the period of time required to provide the direct output) equates to the company’s time in the incubator, while the long term (indirect output) begins when the company leaves the incubator.

Table 6 : A multi-criteria framework for analysing the output and performance of business incubators

	Industrial and technical world	Market and financial world	Relational or domestic world	Civic world	Innovation world	Reputational world
Direct output (short-term) during a company’s time in the incubator	<ul style="list-style-type: none"> - accommodation (office provision) - basic services - advice, assistance, training - market visibility? 	<ul style="list-style-type: none"> - services at reduced cost - access to finance - turnover managed during time in incubator 	<ul style="list-style-type: none"> - individualised answers - interpersonal arrangements - trust - personalised advice - breaking down of isolation - integration into internal network - integration into external networks (consultants) - one-stop shop 	<ul style="list-style-type: none"> - support for particular populations or industries 	<ul style="list-style-type: none"> - addition of new (innovative) services - support for innovative projects 	<ul style="list-style-type: none"> - short-term image of the locality, department or region

<i>Performance relative to the direct output</i>	<ul style="list-style-type: none"> - productivity gains - economies of scale - improvement in industrial quality - incubator occupancy rate - failure rate 	<ul style="list-style-type: none"> - improvement in 'financial health' indicators - competitiveness relative to rival organisations (cost of creating one job compared with other organisations) 	<ul style="list-style-type: none"> - improvement in organisation's relational qualities (service relationships, integration into networks) 	<i>Improvement of civic qualities</i>	<i>Improvement of innovation quality</i>	<i>Improvement of reputation and image</i>
Indirect output (long term) on exit from incubator	<ul style="list-style-type: none"> - company formation - creation of direct and indirect jobs 	<ul style="list-style-type: none"> - generation of turnover (direct and indirect) - generation of wages (direct and indirect) - generation of local taxes 	<ul style="list-style-type: none"> - establishment of loyalty to local area 	<ul style="list-style-type: none"> - regeneration of disadvantaged areas - redeployment 	<ul style="list-style-type: none"> Creation of a local innovation system Creation of an entrepreneurial culture 	<ul style="list-style-type: none"> - long-term image of the locality, department or region
<i>Performance relative to the indirect output</i>	<ul style="list-style-type: none"> - improvement of contribution to (local, national) economic growth - evolution of number of business start-ups - evolution of the number of jobs created - evolution of the quality of these jobs - rate of surviving companies after x years 	<ul style="list-style-type: none"> - improvement in the generation of the various types of revenue 	<ul style="list-style-type: none"> - consolidation of a local system or network of services (long-term integration into this system) 	<ul style="list-style-type: none"> - long-term improvement of civic qualities 	<ul style="list-style-type: none"> Consolidation of local innovation system and long-term integration into that system 	<ul style="list-style-type: none"> Long-term improvement of reputation and image

Judged by the industrial and technical criteria, an incubator produces certain direct outputs, such as accommodation, advice and training. These direct outputs are intended to generate indirect, long-term outputs, such as company formations and job creation.

Judged by the market and financial criteria, incubators can be said to offer access to services at lower cost (shared costs) and to sources of finance. In the long term, the various actors foresee the generation of income: turnover and profit in the case of companies, wages in the case of employees and local taxes in the case of local authorities.

As far as the relational or domestic world is concerned, incubators can be regarded as loci for the establishment of formal and informal relations that are consolidated over time (trust relationships, empathy, integration into internal and external networks). These types of relations help to generate loyalty to the local area.

From the point of view of the civic criteria, incubators provide support for particular (socio-economically disadvantaged) populations or geographical areas. They also

contribute to long-term civic outputs, which can be described as social cohesion, regional development, etc.

The innovation world encompasses a number of outputs, such as the introduction of new services by incubators and support for innovative projects. The establishment of a culture of entrepreneurship and innovation and the consolidation of local innovation systems are examples of this world's indirect outputs.

From the point of view of the reputational world, finally, incubators produce an output best described as the image of the locality, department or region in question, whether in the short or long term.

These different 'worlds' of outputs have their corresponding 'worlds' of performance. Table 6 identifies and illustrates twelve different concepts of performance, which may mutually reinforce or, conversely, contradict each other, at least from a certain point onwards.

Conclusion

When applied to services, the notion of productivity comes up against certain analytical difficulties. In some cases, particularly when it is possible to identify relatively homogeneous units of output that are only weakly interactive, these difficulties can be resolved technically and the concept remains relevant. Thus when a firm focuses its efforts on delivering standardised products, its strategy can be said to come to the rescue of the concept. In other cases, it is debatable whether the concept should be retained, either because a particular indicator is taken – wrongly – to represent productivity, even though the technical solutions adopted mean that it falls outside the scope of that concept, or because continued use of the concept is tantamount to keeping alive an invalid indicator. In both cases, particularly when measures of productivity are required for strategic purposes, a cautious approach makes multi-criteria evaluations of performance mandatory.

When it comes to public services, that caution needs to be redoubled, since the general difficulties that apply to services are further compounded, in this case, by the specific difficulties associated with the characteristics of public services.

Thus in the absence of market prices, national accountants and statisticians have shown little reluctance to measure output in terms of input, confirmed in their actions by the theoretical assumption that the output of services can be reduced to labour. For want of any better solution, they continue to use this approach for certain government services, while at the same acknowledging its vacuity. Given the nature and objects of the public service relationship, not only is productivity difficult to measure but it also conflicts with other concepts of performance. In this area more than in others, the distinction between output and outcome or, in Claude Rochet's words (Rochet 2002), between 'doing things well' and 'doing the right things', seems to be absolutely fundamental. It is probably in this area that multi-criteria analytical frameworks based on a definition of output as a social construct turn out to be most promising.

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