Prepared for the eGovernment Unit

DG Information Society and Media

European Commission

eGovernment Economics Project (eGEP)

Compendium to the Economic Model

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eGovernment Unit

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1. Economic Study Compendium Presentation

The present compendium synthesises all the supporting work carried out from January till December 2005 in the elaboration of eGEP Economic Study. It contains all the details that for reason of space are left out in the Economic Study final report, but which are cited and referenced in such report.

Section 1 provides a **review of the economic literature** focused on the link between ICT and economic growth. A large debate is still ongoing: this section temporarily highlights the main results summarizing the most common methodologies and approaches so far adopted, while showing how no consensus has so far been reached.

Section 2 focuses on the **theoretical economic model**.

Section 3 deals with the **questionnaire** that we propose as a "self-assessment tool" for every administration, in order to take into account PA's "actual experience", *i.e.* the feedback they receive in providing e-Government services to specific categories of users.

2. Review of the literature on ICT and economic growth

The contribution of Information and Communication Technologies (ICT) to economic growth is a widely discussed topic in the economic literature. The economic analysis of growth and development encompasses different theoretical models: some of them are mutually excluding, some are possibly better suited for the investigation of technological progress than others. In general, it appears that technological progress is one of the main drivers of economic growth. Unfortunately, economists disagree fiercely on the specific models to be adopted, as well as on the more general "vision" of the economic system functioning, leaving a good deal of uncertainty on policymaking. The apparently unending theoretical debate and the puzzlingly productivity resurgence that characterized USA's economic performance during the 1990s - which strangely took place in the middle of an upward phase of the trade cycle- gave rise to a wave of empirical research, which is all but conclusive, though still enduring.

The main hypothesis to be tested is whether expenditure on ICT has some special aspect ultimately leading to a "new economy". However, this is not our main question: even if ICT capital had no peculiarity it could boost economic growth through different channels. Even dissenting on the identification of these channels, the research so far developed seems to suggest that (but this is a provisional proposition) ICT had some (possibly small) role in the economic growth of developed countries.

2.1. How can ICT affect growth?

Prima facie we can distinguish the economic theories to which we referred above between models exhibiting full employment and models with unemployment. In the first case there are two main channels through which ICT could affect economic growth: by constituting a form of investment, it might raise the productivity of workers; amounting to technological progress, it might improve the efficiency of the single firms or of the general economic *milieu*.

The first case is trivial: investment in ICT constitutes provision of more equipment to the labour force (capital deepening). If these new instrumental goods and services are not completely useless, given the number of workers employed, production should grow. Alternatively, these new factors of production might substitute workers in some stage of the production process, raising the productivity of other type of workers[1].

[1] There is a huge literature on the so-called "skill-bias" effect of ICT, but is not considered by our review.

In the second case, ICT could affect economic performance through a reorganization of the production process, a widening of either the scale or the capital intensity of production, an improvement in the firm's technology (the so-called embodied technological progress), or any other effect on the efficiency of a unit of production taken as a whole[2]; or, it could better the business conditions and environment in which the firms operate[3], for example through network and/or pecuniary externalities (e.g. reductions in the prices of factors of production), improvement of human capital, knowledge, education, learning-by-doing phenomena, or personalization and improved quality of products and services.

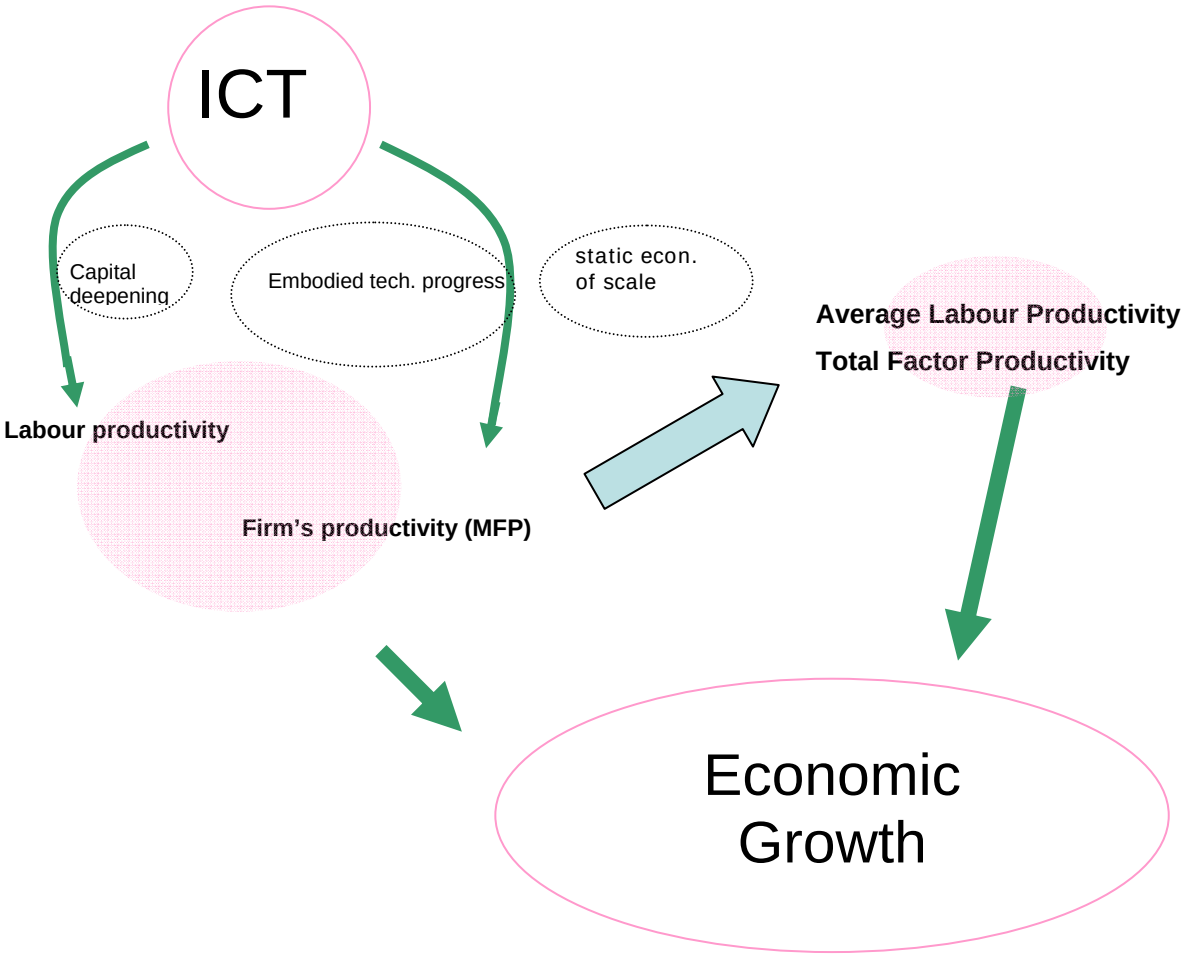

Figure 1: With full employment, ICT affects economic growth by means of capital deepening and improvement in technology.

In either cases, improved productivity, which in a full-employment framework constitutes a raise in demand, might in turn lead to exploitation of static economies of scale, with a higher final effect on aggregate product. Nonetheless, with full employment the effects of ICT on

[2] In this case there would be an improvement in Multi-Factor Productivity (MFP). Given a neoclassical production function, the substitutability relation between two factors can be represented through an isoquant. The observed distance of a firm from the isoquant on which the best performers lie (i.e. the superabundance of inputs required to produce the same quantity of output) is a non-parametric measure of general efficiency of the firm, of its ability to combine the factors of production. An improvement in MFP is a reduction of this distance.

[3] This would constitute a raise in Total Factor Productivity (TFP), i.e. the unexplained "Solow" residual of a growth accounting exercise based on the neoclassical aggregate production function, sometimes considered a measure of general technological progress.

growth are one-shot: one-and-for-all permanent increase in productivity (and capacity), exception made for learning-by-doing dynamics. After the period of ICT introduction, economic growth returns to its long-term level, while at a higher absolute level of aggregate product.

In a context of existing unexploited factors of production, two more channels are added to the previous: a multiplier effect and an accelerator one. The former amounts to recognising that investment constitute demand, i.e. income, and possibly employment. The second effect marks the difference between productivity and productive capacity: the two correspond only if the increase in demand perfectly matches any given increase in supply, instead the accelerator effect measures the increase in productive capacity.

In models exhibiting less than full-employment cumulative phenomena are very likely to be generated: the interaction between multiplier and accelerator effects are an example of taking into account dynamic effects, but there is at least another important one, namely the possibility of exploiting (dynamic) economies of scale. If for any reason the average productivity of labour raises with the dimension of the output market (demand), the increase in employment is a further cause of increases in productivity[4] (the so-called "Smith's effect", which will be treated also in next sections).

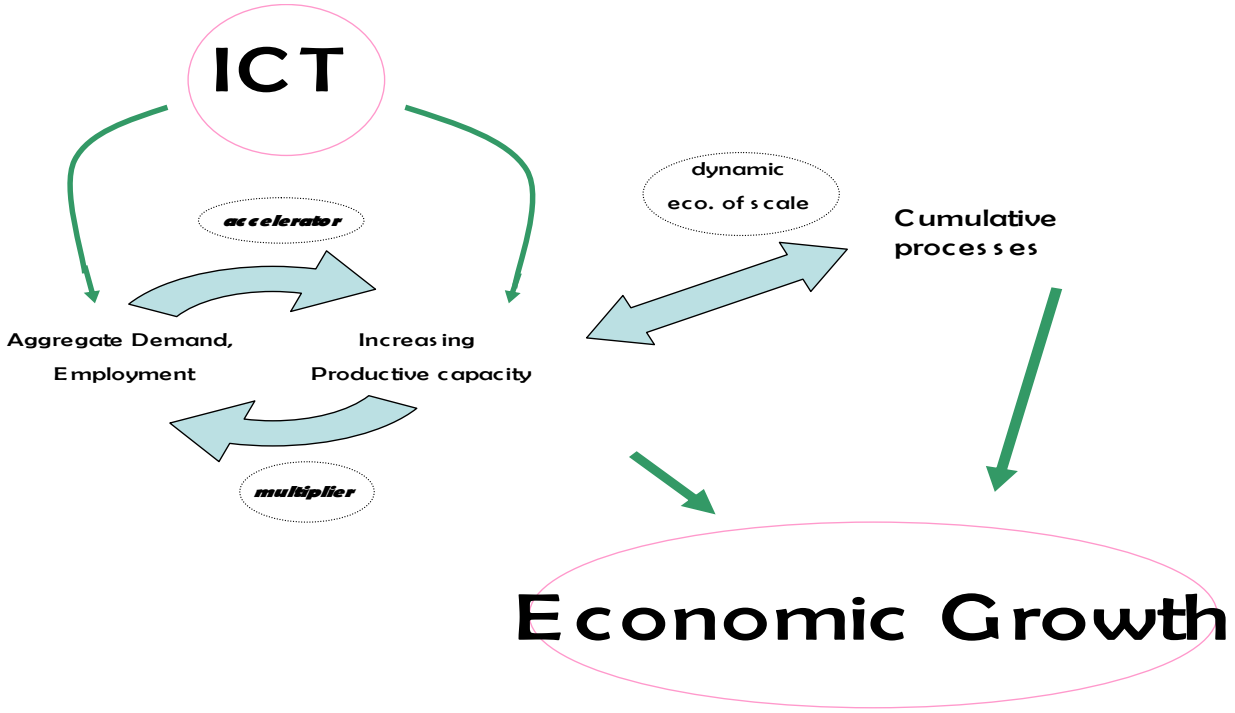

Figure 2: With unemployment, three more channels are added connecting ICT to economic growth.

2.2. How have the empirical studies been conducted?

Empirical investigation of the link between ICT and growth have been based on firm-level data, aggregate or sectoral time series, cross-country or panel data at national level. However, the variety of findings is not only a result of differences in data: many variables, clearly defined in theory, are difficult to estimate in practice (e.g. productivity in the service sector).

[4] Thus, only some kinds of dynamic economies of scale are possible in a full-employment setup.

All these methodologies have their advantages and pitfalls, however they all look at the same indicators: average labour productivity (ALP) and TFP or MFP, and possibly variations in employment. ***It has to be noted that the economic interpretation of these indicators is closely linked to an underlying economic theory, possibly leading to radically different explanations. Thus, TFP and MFP are theoretical tools descendant from the neoclassical production function (see BOX 1), and are therefore not defined within a different approach, such as the dynamic framework presented in next sections, and unnecessary to an empirical assessment related to one of these alternative theorizations. Also, while ALP, together with employment growth, summarize all relevant information (direction and magnitude of the sum of direct and indirect effects), a dynamic framework have time-specific predictions: in many cases it is essential to account for time lags.***

When aggregate time series is considered, it is usual to partition the economy among ICT-producing, ICT-using, and non-ICT industries. Most of the empirical literature focuses on the effects on productivity, possibly because many theoretical models assume full employment, thus ruling out the possibility of an increase of employment, or because direct increases on labour demand (apart from reallocation) stemming from the adoption of ICT seem negligible. In this context, if the relation between ICT and TFP was found not statistically significant, there were risks that the potential efficiency gains from ICT (increases in LP) result in a mere redistribution of resources.

In general, a statistically significant impact of ICT on growth or productivity is more easily found in the USA than in Europe for several reasons, among which the wide variability of productivity in the former and its stagnating dynamics in the latter, the higher expenditure in ICT in the USA, the time lag of the effect on productivity, which is a more severe problem for empirical research in Europe because of the later diffusion of ICT.

Box 1: How many measures of productivity?

This box analyses in more detail the technical aspects and the economic issues raised in section 2. Producing an output (***Y***) implies using inputs (***X_1***, ***X_2***, …): if we **assume** that the technological possibilities, in terms of quantities of inputs required to obtain given amounts of output, can be expressed as a mathematical function which satisfies certain properties (required to guarantee internal consistency to economic theory) we have a "**neoclassical" production function**, which can be summed up as simply as:

$$Y = f(X_1, X_2, \ldots)$$

The partial derivative of this function by one of the inputs is the input's **marginal productivity**. This measure is often interpreted as a rough approximation of the input's **differential productivity,** which is defined as the variation of output arising from the addition of one more unit of input. The difference between the two concepts is that the differential productivity is a net measure: it can be obtained by integrating the additional input (e.g. corn) by supplementary factors of production (e.g. farmers), provided that their respective cost is subtracted from the extra output; by contrast the marginal productivity, being a partial derivative, is computed holding still all other variables. Moreover, marginal productivity is defined only after a production function has been defined, while differential productivity is a generic measure universally pertinent.

In the text, we refer also to a different measure: **average productivity**. As an accountancy identity, total output (***Y***) can always be split into the number of productive workers (***N***) times the average output per worker (π). The latter is called average productivity of labour: it is evident that also this measure can be defined independently of a production function.

$$Y \equiv N \cdot \pi$$

The interpretation of this quantity is radically different from that of marginal productivity: technological or organizational developments improve total output, and this improvement, given the number of workers, is **interpreted** as an increase in average productivity; whereas

expansions in marginal productivity (at a given level of activity) are the specific forms in which these technological developments take place, in a sense they are the **cause** of the increases in output. Therefore, under some specific functional form (i.e., a production function homogeneous of first degree, thus exhibiting constant returns to scale), the sum of the variations in the marginal productivities of all inputs (times their level) amounts to the increase in total output, whereas –given the number of workers- average productivity directly exhibits full proportionality to total output, summing up all relevant information, apart from time lags.

Computations of average productivity are mostly diffused in accountancy and statistical studies, while **estimates** of marginal productivity are more diffused in economic modelling, especially in the field of macroeconomics, when the empirical interest is seen as justifying the use of approximations such as the arbitrary imposition of a specific form for the production function or the partial overlapping of the concepts of marginal and differential productivity. As a matter of fact, the use of average productivity as an instrument for modelling, which was the rule for the "Classical economists", has been reintroduced by those economists who criticize the set of assumptions, necessary to sustain a neoclassical production function, as being too restrictive and unrealistic (for example, they require to exist an infinite continuum of different techniques to produce a given quantity of output, or the inputs have to be infinitely divisible and mutually substitutable, etc..).

Two specificities distinguish the measure of productivity to be chosen in the context of the present study: it is needed an **aggregate measure** (i.e. referred to several outputs concerning different services), it has to be related to the **Public Sector** (PS). Assuming one could define PS's output, an hypothetic production function -characterized by the same properties as the standard microeconomic production function, necessary to guarantee economic meaning- could not take into account all the different inputs, by far too many. A rather common solution in macroeconomics is to assume an hypothetic aggregate (comprehensive) input, called "capital", with a single marginal productivity.

Unfortunately, it is nowadays clear that a generic aggregate input could or could not exhibit any of the "well-behaved" properties which characterize single inputs: it could therefore lack of economic significance. Thus, a similar solution should be regarded as **lacking theoretical foundation**; nonetheless, many empirical authors use an aggregate production function of the following form as a valid approximation, especially preserving simplicity:

$$Y = f (K, L, \ldots)$$

where ***K*** is "capital" and ***L*** labour. Recalling that a neoclassical production function synthesizes all productive possibilities, it is a natural development postulating that an observed growth in ***Y*** is the consequence of a raise in ***K*** or ***L*** (multiplied by the respective marginal productivity). Such a source of growth is often called **capital deepening** because it just replicates at a higher scale the current technology. For this reason, it is conceivable that an observed higher growth could arise from technical or organizational developments which "escape" the production function formulation because they constitute new possibilities not available before. This is the approach behind the **Total Factor Productivity** (TFP) index: after estimating "capital", labour and their marginal productivities, summing their variation, TFP is computed as the difference between this sum and the observed growth of national product. Growth accountants call this empirical measure **Solow-residual** (after Robert Solow), to emphasize its derivation as an unexplained variable, "a measure of our ignorance" (when measured on the metre of the production function).

Among the methodologies adopted in the literature on ICT and growth presented in this section and the two annexes, TFP has often been chosen as a synthetic measure of technological progress. Most of these studies develop econometric interpolations of this variable through indicators of ICT adoption and production. As the estimated TFP is the residual of a previous regression (usually of GDP on capital and labour) this procedure is legitimate only under the assumption that this second set of explicative variables is independent of the first one.

The economic interpretation of TFP as a measure of technological progress has been challenged in the context of the literature on "Real Business Cycles". Many economists object that as an unexplained residual, the proper interpretation of TFP cannot extend much further than an evaluation of the inaccuracy in passing from theory to reality, a cost of the necessary approximations. In particular, it has been stressed, since in many years TFP assumes negative values, that its reading as a measure of technological development would actually imply technical regress.

As highlighted above, the debate on the economic literature is not yet conclusive, nor concluded. At present, it appears that the empirical methodology based on TFP is questionable on the theoretical grounds, but the conclusion that it is not fully legitimate cannot be but a temporary one. At any rate, but -again- only provisionally, these criticisms and those directed against the aggregate production function do not apply to methodologies relying on average productivity, for their origin being an accountancy identity, a simple truism. For this reason, this other measure allows economists to build models without entering –or being affected by- the most debated, and until now unsolved, theoretical issues.

2.3. What are the main results?

In the case of USA, Stiroh (2002b) finds that ICT-intensive industries faced a higher labour productivity growth than the other sectors, but according to Stiroh (2002a) the same effect on TFP is statistically significant only in ICT-producing industries. Also, no relation is found at aggregate level (Stiroh 2002c). Two direct effects on LP and TFP are regarded as relevant -a *using effect* (ICT-capital deepening) and a *production effect* (increase in efficiency in ICT-producing industries)- by Jorgenson and Stiroh (2000). Instead, Oliner and Sichel (2000) stress the increasingly productive use of ICT goods and services in the other industries, while Mun and Nadiri (2002) claim that the monetary spill-over arising from the dramatic fall in prices (for a given level of quality) of ICT products and services is the most significant indirect effect.

Gordon (1994, 2000, 2004) opposes that since only ICT-producing industries exhibit an increase in TFP, ICT can not be considered as one of those great inventions which caused technological revolutions changing the standard of living of the whole society. Apart from the different results, Jorgenson and Stiroh reply that the stagnation of TFP in the rest of the economy is not necessarily due to a stagnation of any single industry, since it may be the result of compensating increased and decreased TFPs.

See Annex A and B for a detailed comparison of results.

2.4. What about Europe?

Empirical evidence on Europe is different. At the sectoral level, Inklaar *et al.* (2003), using panel data from France, Germany, The Netherlands and the United Kingdom, find significant efficiency gains in ICT-producing industries and a positive ICT-capital deepening effect on TFP in ICT-using sectors. Van Ark (2000) and Van Ark *et al.* (2002) confirm the common result that the effects on productivity varies substantially in the different countries within the EU, but they also show how the contribution of ICT on average labour productivity was not very different from the levels reached in the USA. Therefore, they maintain that differences of the overall effect on economic growth have to be attributed to differences in the growth rates of ICT-related industries as a share of GDP, and the seemingly difficulty of the new economy to generate new employment. Similar conclusions are reached by Daveri (2000) on the influence of ICT on TFP.

Schreyer (2002) highlights how there are two peculiar caveats in panel data or cross-country analyses, therefore more seriously affecting researches on the pan-European experience: the arbitrariness in the classification of ICT-related (ICT-using and ICT-producing) industries and non-ICT sectors, which might lead to sensibly different results, and the problem of price deflation typical of highly innovative industries. Indeed, the rapidly improving quality of IT

goods and services poses difficulties in following the price of a homogeneous good over time. Daveri (2004) presents estimates of TFP using a hedonic global (national) prices deflator, but the values obtained by using this technique are significantly different from those resulting from official statistics: their use should therefore be careful.

The most recent estimates are provided in Timmer *et al.* (2003), which taking into account all EU-15 member States but Luxemburg, completes a series of more limited analyses (Schreyer (2000), Colecchia and Schreyer (2002), Daveri (2002)), and in van Ark and Piatkowski (2004). It deserves noting that the studies on evidence in Europe are not based on time series, therefore they are open to problems of underestimating the indirect effects of ICT on productivity, for example in case of systemic effects or time lags. At present some authors solve this problem with estimates at firm level or with analyses of impact within single countries. Also, new studies are being developed in order to cope with some of the problems explained in this section (for example, O'Mahony and Vecchi, *in press*): the academic debate is still open and the question of the empirical relevance of ICT on growth has not yet received an unambiguous and unanimous answer.

See Annex A and B for a detailed comparison of results.

2.5. What are the key lessons and policy implications?

In brief, many authors agree that ICT investments and adoption are not sufficient to fully explain the productivity gap between Europe and the USA, that their impact on productivity depends on institutional and cultural factors, and that economic growth is strongly dependent on the specific productive structure of the country: for example, it is sometimes found to be rather small, but relatively high when compared to the size of ICT capital or of ICT-producing or ICT-using industries as a share of national product. Empirical evidence is largely diverse, ranging from no effect of ICT on growth to pervasive structural technological revolution.

In general, however, it seems that ICT might affect positively economic performance. ICT adoption and diffusion should therefore be encouraged not only in the context of pursuing the Lisbon objective of increasing the international competitiveness of Europe through knowledge and technology, but also from a domestic growth perspective. In this sense policymakers are called to improve the conditions that allow the predicted effects to take place, to incentivate the technology revolution to happen and speed it up. The next sections provide a theoretical framework to assess a founding pillar of these policies, namely the adoption of ICT within Public Administration.

3. Economic Model

The aim of the economic model is assessing the impact of ICT within the Public Administration ito provide the theoretical underpinning of most of the elements presented in the Measurement Framework analytical model.

In this version of the model individual components of the various equations are presented as first approximation in need of further analysis and testing. This is particularly true for the more qualitative aspects of the Measurement Framework analytical model such as those related to the ***effectiveness*** and ***openness*** valued drivers. Moreover, other effects that are already formalised at a high level of abstraction in the model will have to be further broken done as in the case of time savings and opportunity cost quantification. In the following paragraphs the economic model is presented in a discursive and graphic fashion, leaving most analytical algebraic notations in the footnotes. ***Such formulas are, however, very important for the full comprehension of the model, since they formalise the "weight" of individual model components***.

In the following paragraphs the model will be broken down into its five components:

1. Effectiveness/Efficiency Effect – or "Smith Effect" (3.1);

2. Substitution / Integration between technology and personnel Effect – or "Ricardo Effect" (3.2);
3. Back-Office Reorganisation Effect (3.3);
4. Investments in Innovation Effects (3.4);
5. Other Take-up Driven Macroeconomic Effects (3.5);

Therefore paragraph 3.1 through 3.5 will cover the first two eGovernment impacts above (impact on public sector through productivity, impact on GDP through productivity), while in paragraph 3.6 the third impact (directly on GDP) will be considered.

However, before proceeding in the analysis, it is important to define three indicators:

- ASCU: the Average Social Cost of Use of services;
- ASVU: Average Social Value of Use of services;
- PVU: Perceived Value of Use.

Such indicators, to be identified through subjective judgements of users groups (citizens, businesses and public administrations) are necessary to come up with a monetary estimate of several impacts considered by our model.

Average Social Cost of Use (ASCU). ASCU measures the importance of ICT-driven services for users and will be computed through an approximation: i.e. by multiplying the average waiting time for each channel, "weighted" for the use of each of them, by the average opportunity cost for users, that is:

$$ASCU = \sum(Averagewaitingtimeforchannel * \%channeluse) * \sum(averagecompensationperusers'rangeperhour * \%users'range)$$

In other words, it is the calculation of a weighted mean for every service, after the identification, in collaboration with administrations, of the average waiting time for each delivery channel[5], the use of each channel, and the monetary computation of such value through the opportunity cost. The resulting value will be tied to the users' segmentation and the average compensation per hour on the one hand, and to the analysis of users' segments percentages using the different channels on the other. Once obtained, these monetary values have to be normalised, that is, reduced to an "absolute" scale, to make possible a comparison between the Average Social Value of Use, which, *per se*, can be expressed only in a qualitative way.

Average Social Value of Use (ASVU). ASVU represents the relevance of services for users, as well as one of the main challenges for the construction of the model. In fact, it is quite difficult to obtain a monetary "objective", quantification of this value. This is why the solution should be that of involving the public administrations in the definition of a grid of "value perceived" by users for each service delivered. Even if still subjective, this approach is the only one capable to exploit the field experience of civil servants, and the feedback they obtain directly from users; furthermore, it is less expensive than a sample survey among the population. ASVU, indeed, represents a value, estimated on data provided by the public administration, which has to be normalised on an absolute scale, to be compared with the Average Social Cost of Use.

Perceived Value of Use (PVU). PVU represents the perception of the improvement of services when delivered by eGovernment applications. Also the definition of PVU has to pass through a focus-group of users and administrations, which clearly identifies the "spread" of improvement with respect to the ASVU. For instance, if a service is considered as relevant (i.e., it has an high ASVU), and its spread in terms of perceived value – when delivered

[5] The average waiting time for channel is defined as a real *queuing time*, that is, the time citizens have to spend for starting an administrative procedure. It differs from the delivering time, which is the time needed by the public administration to deliver a service.

through eGovernment applications – is high, there will be a strong incentive for investing in the adoption of eGovernment applications for this service. This will have to be compared with the measures of labour cost (L), and with the cost of obtaining that service (ASCU), and then measured only for the organisational units interested.

3.1. Effectiveness/Efficiency Effect – or "Smith's Effect"

The adaptation of this effect to the Public Sector is based on the assumption that the introduction of eGovernment increases the supply capacity of the Public Sector, which is considered equal to the market enlargement effect, and that all services produced are also demanded by users. So the services delivered by public administration: a) increase in number; b) gain efficiency; c) gain effectiveness.

3.1.1. The direct effect (efficiency value driver)

The direct effect takes into account **only** the strictly internal benefits for public administrations, most of which can result in very tangible financial gains. In particular the direct effect can be attributed to the following concrete intermediate outcomes potentially yielded by eGovernment:

- Costs savings: cost reduction of the service (aggregated) or of the single transaction;
- Financial resources reallocation on services with greater Average Social Value of Use (ASVU, see later) / less Perceived Value of Use (PVU see later)
- Human resources reallocation according to areas delivering services with more Social Value of Use / less Perceived Value of Use;
- Faster Taxes collection;
- Increased revenue coverage (i.e. emerging of underground economy);
- New revenues from new premium services;
- Better budget management (proxy for "financial management and business planning improved"), considered as correspondence between planned earnings and expenditures (i.e., on the basis of agencies' address plans) …

The underlying reasoning is that eGovernment applications enable the Public Sector to make "expenditure" productive and to manage taxes in the most efficient way[6]. If this expenditure is helped by eGovernment to become more "productive", it will then act as a multiplier of the GDP generated by the public sector (GDP_{PS}).

This direct effect can be attributed to the concrete impacts listed above (and possibly to others) and the sum of weights and indicators associated to each one of them (***which are yet to be estimated***) will give the estimation in monetary terms of the direct effect, which can be rendered graphically as[7]:

Direct Effect on PS Output in period t	= **b** *	Variation of output directly produced by PS in period t, accordingly to the model

[6] It must be remarked, however, that the capacity to produce of the public expenditure must be considered in a wide sense: it does not refer only to investments in infrastructures, but also to that part of public expenditure which tends to increase the efficiency and the effectiveness of welfare (health, education, etc.); i.e. not only investment expenditure, but also part of the current expenditure.

[7] As a formula: $b'\hat{Y}_{PSd}$, where b' = ratio between "direct output" and the overall output produced by public sector and $\hat{Y}_{PSd}$ = variation of the output directly produced by public sector, in period t, accordingly to the model.

3.1.2. The Indirect Effect (efficiency and effectiveness value drivers)

The ***Indirect Effect*** consists of three components, the first two still related to the efficiency value driver, and the third instead strictly related to the effectiveness value driver. The estimation of this effect aims at giving a monetary quantification of all three components, in relation to the "ease and convenience" accruing from more effective/efficient services to citizens and businesses, as well as to public sector employees in their role as users of G2G e-services. As it will become clear, however, such quantification will be easier for the first two components than for the third.

The first two components will have to be estimated through the consideration of the opportunity cost deriving for every category of users from the possibility to have access to:

A. **More time efficient 'old' public services** (henceforth **A component**), where the opportunity cost is measured by the time "saved" multiplied for the average hourly wage for each range of users;
B. **New efficient public services as a result of back-office integration and "interoperability"**(henceforth **B component**): created by the fusion of one of more stand-alone services, through ICT-driven organisational innovation. Such measures could be connected to:
   - ✓ Additional effects of opportunity cost, which can be calculated as for **A Component**;
   - ✓ Reorganisation of Organisational Units (OU) involved in service delivery (which represents an ex-post measure of reorganisation activity);
   - ✓ Investments in improving public administration's interoperability.

Finally the third component derives from access to:

C. **More effective public services**, that is to say services that, by their quality should increase users satisfaction and provide them with better life chances and opportunities.

At ***least for the first two cases (A and B components)***, a monetary measure of the output effect can be given.

(A) Component: Time Efficiency. Assuming that each user group (citizens, businesses, government employees), and, more properly, each sub-set of these groups (i.e., retired, housewives, etc.), expresses an hour- opportunity-cost (i.e., related to the average wage or income), it is relatively easy to give a "monetary measure" to the generated time-saving. In particular, it can be estimate as follows[8]:

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[8] $b''_{PS,ef}\ \hat{Y}''_{PS,efy} = \sum\left[\left(\mathrm{Pr}_{b,t} - \mathrm{Pr}_{b,t-1}\right) * \overline{w}_{b,t} + \left(\mathrm{Pr}_{c,t} - \mathrm{Pr}_{c,t-1}\right) * \overline{w}_{c,t} + \left(\mathrm{Pr}_{g,t} - \mathrm{Pr}_{g,t-1}\right) * \overline{w}_{b+c,t}\right]$ where:

$b''_{PS,ef}$ = ratio between "efficiency effect" and the overall output produced by public sector;

$\hat{Y}''_{PS,efy}$ = Variation in the efficiency of the public sector, in period t;

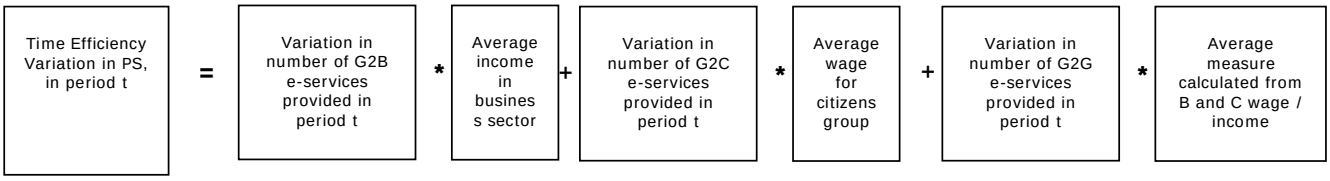
$\left(\mathrm{Pr}_{b,t} - \mathrm{Pr}_{b,t-1}\right)$ = increase / decrease in the protocol number of G2B e-services provided in period t;

$\left(\mathrm{Pr}_{c,t} - \mathrm{Pr}_{c,t-1}\right)$ = increase / decrease in the protocol number of G2C e-services provided in period t;

$\left(\mathrm{Pr}_{g,t} - \mathrm{Pr}_{g,t-1}\right)$ = increase / decrease in the protocol number of G2G e-services provided in period t;

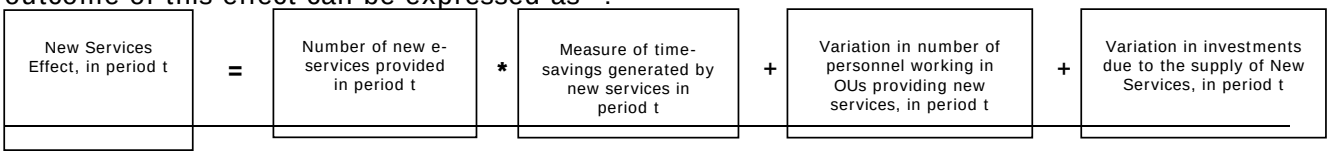
$\overline{w}_{b,t}$ =average "wage" / yearly incomes for the business sector, in period t;

$\overline{w}_{c,t}$ = average wage for citizens, in period t;



While this is still a first approximation estimate in need of further refinement, especially with regard to the monetary parameters used for the quantification of the government sector[9], nonetheless such approach ***gives a monetary measure of the gained / lost efficiency using an "opportunity-cost" paradigm***. More precisely it estimates the increased "time efficiency" of the services multiplying the difference between the number of services provided in the period t (when we assume the impacts of eGovernment is already felt), with respect to the period t-1 (before the introduction of eGovernment), for the average wage / retribution of the three groups. The assumption is that if the number of e-services provided increase, this means that public administration worked more efficiently and users had to wait/use fewer hours to receive a service they needed or simply to comply with an administrative requirement. The increase in the number of services provided in a given period t could actually mean, not only that public administrations speedily processed files opened in that given period, but also that they were able to process files cumulated in the previous period. This could become a virtuous cycle leading to time compression in file processing with tangible benefits for users. ***This time efficiency effect can also be considered a proxy measure of Administrative Burden Reduction*.**

(B) Component: New services. A measure could also be given to time saved through the use of new services, generated by the mix of two or more old ones. In this sense, while a simple increase in the speed of a service is taken into account by the **A Component**, this second component considers just new services delivery and takes into account interoperability and back-office integration among different units of public administrations (for instance, transactional services which involve more than one office of the same municipality). The contribution of these new services can be quantified and given a monetary value in the same way as for the previous one, as an additional "time-saving" effect for the users' group. Although further investigation is needed to avoid duplications, for the moment, the final outcome of this effect can be expressed as[10]:



$\overline{w}_{b+c,t}$ = average measure of yearly incomes both for citizens and business, in period t.

[9] The parameter for the public sector is here estimated as an average of compensations in the citizens and business sector to reflect the idea that public employees mainly work for other citizens or business units, so that an increase in the time efficiency of services finally translates into time-savings for these categories. Naturally, further investigation is needed to refined this assumption, but also to better specify the average wage for citizens and income for businesses.

[10] $b'''_{PS,ns}\ \hat{Y}'''_{PS,ns} = \Pr_{ns} * ts + \Delta UO_{ns}^{*} + \Delta I_{ns}$, where

$\hat{Y}'''_{PS,ns}$ = New Services effect, in period t;

$b'''_{PS,ns}$ = ratio between New Services effect and the overall output generated by public sector;

$\Pr_{ns}$ = Protocol numbers of provided New Services, in period t;

ts = measure of time-savings generated by New Services, in period t;

ΔUO_{ns}^{*} = variation in the number of personnel involved in the Organisational Units which supply New ICT-driven Services, in period t;

ΔI_{ns} = variation of the investment, due to the supply of New Services in period t.

It must be noted that the *measure of time savings generated by new services is currently still under discussion and investigation by the research team.* The monetary translation mechanism remains the same as the one used for measuring the previous A) Component. On the other hand, the variation in the number of employees working in OUs involved in the provision of new services provides a measure of reorganisation in those areas which deliver new services, or in other words a proxy calculation of changes in human resources allocated to new interoperable services. Finally at the right end side of the "graphic equation" it is added the variation in investments necessary for the effective delivery of these "new services". ***Also this new services effect can be considered a proxy measure of Administrative Burden Reduction*.**

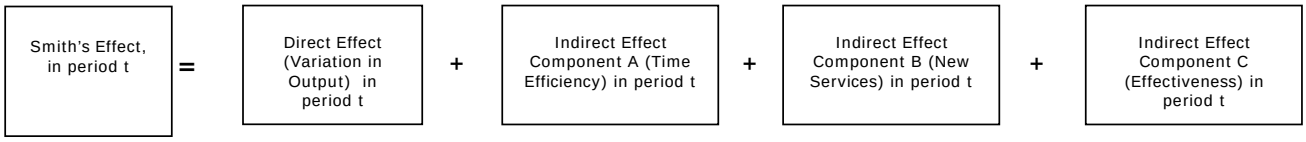
(C) Component: Effectiveness Effect. Finally the services' effectiveness measurement – a mostly qualitative item – represents, at the same time, the biggest technical challenge for eGEP and an element to which an eGovernment impact assessment cannot renounce. It is probably pleonastic to observe that more timely efficient and new services do not by themselves ensure that user needs are met and that user and general social value are increased. This latter two results depend also on more intangible sides of quality and on whether services are really needed and relevant by a given user group in a given territory.

Moreover, the services generating the impacts estimated so far by the **Direct Effect** (6.2.1) and by the first two components of the **Indirect Effect**, refer mostly to the so called general collective public administration services. These services reflect government administration of, and reactions to, market and social processes, or to put it differently how the government facilitate or hinder the basic life events of a citizen or of a business within society: changing residence, registering a business, complying with taxes, transferring properties, requesting certificates, registering for obtaining basic welfare coverage, and so on. Naturally contributing to a more efficient provision of these services would be already an outstanding result for eGovernment. Reducing the time wasted by citizens and businesses to get these services and/or comply with public administration mandatory requirements is a public value. Yet, if the public sector must proactively contribute to the well being of society, there are other more suitable services that it should provide especially to citizens. These services reflect the quality of the interaction between fiscal policies and the market process and the influence on individual opportunities this has. They are "process" or "opportunity" indicators. To put it in simple words, the question is how government uses resources gathered through taxation to increase the life chances and opportunities of individuals through, health, education, vocational training and other services aimed at increasing the capability of individuals to find a job[11]. ***How eGovernment contributes to the provision of opportunities is much harder to evaluate and measure.*** In light of these considerations, below we limit ourselves to a very preliminary reasoning on a number of steps that would be needed to extract from qualitative analysis and subjective judgement, as well as from available socio-economic statistics, some parameters to be further manipulated and quantified and finally inserted into an equation. In our view, to proceed further one would have to carry out: a) focus-group identifying eGovernment services considered effective and desired; b) monetary estimate of the contribution of the above identified services on local environment in terms of impact on local GDP, but also on health, education, employment, and social inclusion indicators. Once the above is taken care of, then the **(C) Component** in the model will take into account also: a)

[11] Naturally this consideration must be specified differently for businesses. First, the provision of efficient public services (implying the reduction of administrative burden) in the case of businesses comes close to be already an opportunity, and at the level of the economic system can stimulate foreign investments. Second, especially for SMEs the efficient and transparent functioning of specific sectors of general public administration do provide opportunities: a) public e-procurement lower the barriers for participation of the SMEs; b) Efficient Customs and one-stop-shop foreign trade portal increase export opportunities for SMEs. Third, in line of principles government can no longer devise specific individualised services for businesses without altering the market mechanisms.

the existence of these services on the local level: if presents, the contribution in terms of grater GDP attainable should be estimated; b) the use of socio-economic indicators derived from officially compiled statistics as an external measure or "weight" of services to identify their degree of effectiveness. Further effort is therefore needed to translate qualitative expressions into monetary ones. For the moment, we simply state that the **C Component** or **Effectiveness Effect** is one of the element the overall "Smith's effect"[12].

In conclusion, the total 'Smith's Effect' can be presented as follows:



The full equation reports all previously analysed components in a simplified version[13].

3.2. The Substitution / Integration Effect – or "Ricardo's Effect"

In presence of an increase of public sector role and function, measured by the various components of the **Smith's Effect** discussed earlier, an extra incentive to the increase of its total productivity can derive also from the Substitution/Integration between technology and personnel, also known as "Ricardo's Effect". ***When the cost of innovation compared with that of personnel decreases, it can be efficient for public administration to partially substitute and partially integrate the latter with a wide implementation of eGovernment services***.

The wages. For the model purposes, it is relevant to find a measure for wages variation of those organisational unit / subset of public employees "sensitive" to eGovernment projects. The term "sensitive" refers not only to those sectors which have already experienced eGovernment procedures, but also to those which would do so in the future. As eGovernment tends to involve the whole public body, the whole set of compensations could perhaps be "weighted" for the relevance of each category in the eGovernment project's development. This issue needs of course further analysis.

For the moment, however, it is possible to illustrate wage variation as follows[14]:

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[12] It might be of some use in assessing the **C Component** the Perceived Social Value, that is the perceived value of use of a set of e-services, with respect to non ICT-driven services (of the same nature), in period t (yet to be defined, within a specific focus-group, and with reference to the whole constituency).

[13] $\hat{bY}_{PS} = b'\hat{Y}_{PSd} + b''_{PS,ef}\,\hat{Y}''_{PS,efy} + b'''_{PS,ns}\,\hat{Y}'''_{PS,ns} + b''''_{PS,eft}\,\hat{Y}''''_{PS,eft}$, where

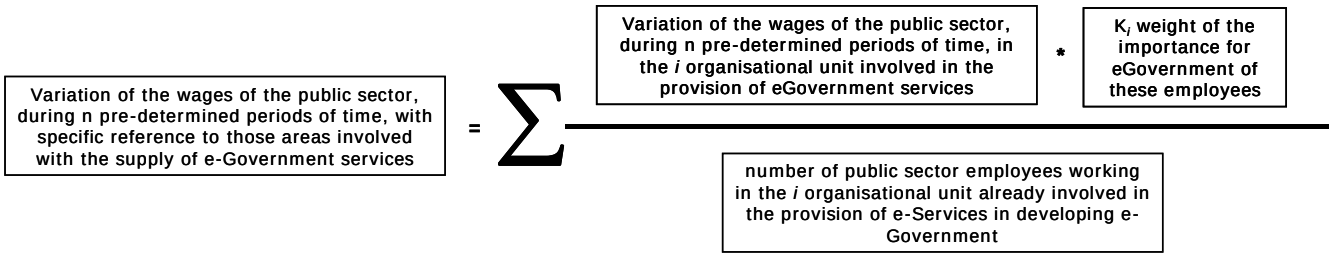
$\hat{Y}_{PS}$ = variation of the output produced by the public sector, in period t;

$\hat{Y}_{PSd}$ = variation of the output directly produced by public sector, in period t;

$\hat{Y}''_{PS,efy}$ = Variation in the efficiency of the public sector, in period t;

$\hat{Y}'''_{PS,ns}$ = New Services effect, in period t;

$\hat{Y}''''_{PS,eft}$ = "effectiveness effect", in period t.



Where the left end side of the "graphic equation" derives from a weighted average of the growth of the wages, experienced in the t–n period, for the subset of public employees involved or to be involved in the eGovernment process. This is reflected both in the weighting factors K_i, which estimates the importance of these employees in developing eGovernment, and in the use of a subset of employees as denominator.

The price of the innovation. This component tries to evaluate the role of an increase/decrease in the average costs public administrations face when they want to acquire a new technology. However, technology is not the only aspect to be considered in the eGovernment adoption process. Actually, at least four components have to be taken into account:

- The increase in the average cost of hardware[15];
- The increase in the average cost of software[16];
- The increase in the average cost of consulting interventions supporting the introduction of eGovernment[17];
- The increase in the average cost of training programs supporting the introduction of eGovernment[18].

For the moment, it is possible to define the increase in the "Price of eGovernment implementation", with the variables expressed in terms of variation in the average cost, as follows[19]:

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[14] $\hat{W}_{PS,t-jn} = \sum \frac{\hat{W}_{PS,i,t-jn} * k_i}{N^*_{PS,t-jn}}$

$\hat{W}_{PS,t-jn}$ = variation of the wages of the public sector, during j bargaining periods (j≥2), with specific reference to those areas involved with the supply of eGovernment services;

(k_i)=weighting factor, which estimates the importance of the employees of OUs already involved in the provision of e-Services in developing eGovernment;

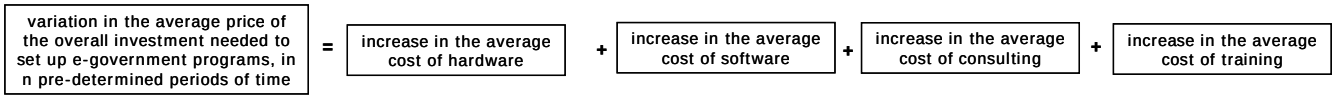
($N^*_{PS,t-jn}$)= number of public sector employees working in OUs already involved in the provision of e-Services in developing eGovernment.

[15] $\hat{\overline{P}}_{hw,t-n}$ = increase in the average cost of hardware;

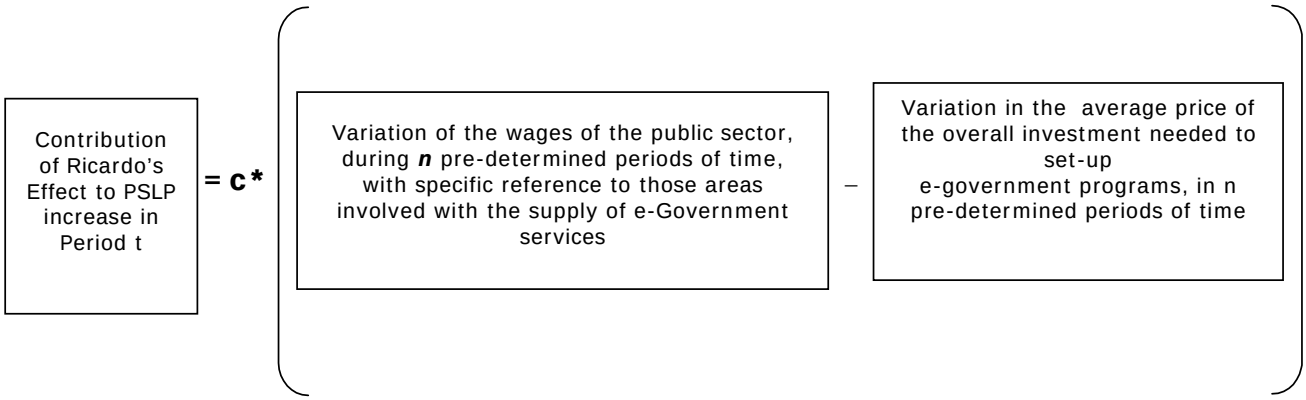
[16] $\hat{\overline{P}}_{sw,t-n}$ = increase in the average cost of software;

[17] $\hat{\overline{P}}_{cp,t-n}$ = increase in the average cost of consulting interventions supporting the introduction of eGovernment

[18] $\hat{\overline{P}}_{tp,t-n}$ = increase in the average cost of training programs supporting the introduction of eGovernment



At first instance, it is possible to affirm that an increasing wages/innovation prices ratio tends to lead to a productivity growth. As a consequence, the Substitution / Integration Effect between Technologies and Personnel (***"Ricardo's effect" for the public sector***) can be represented as follows[20]:



3.3. Back-office Reorganisation Effect

The reorganisation effect of eGovernment is due for the main part to the need of Organisational Units and areas involved in service delivery to cope with users' demands in the short run. This is particularly true for eGovernment, where the first wave of project focused on speedily bringing online services (without back-office reorganisation) were not delivering any real impact. Even this effect can be attributed to the "efficiency" value driver and its measurement is ex-ante: the variation of productivity is not tied to the change in human resources involved in service delivery through eGovernment applications, but to the drivers of back-office reorganisation. As in the private sector, the back-office reorganisation effect is connected to the difference between the cost of delivering a given service and its perceived value. If this cost grows disproportionately with respect to the perceived value, it will be the case to modify the delivery organisation influencing by this way the general productivity.

For what concerns the measurement of variation in labour costs, it is possible to adopt the same approach of the private sector. In particular, in the short run, if labour costs per unit of product (defined as $L = \frac{W}{\pi}$, namely wages on labour productivity) increases more than prices, enterprises will receive an immediate stimulus to change the organisation scheme of production. This is a short-run effect, which works when enterprises do not have time to make investments to increase their competitiveness. By reorganising the production line, or other

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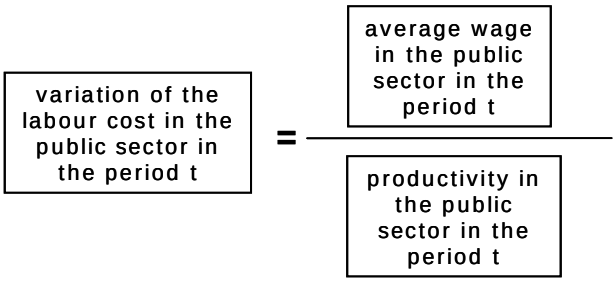
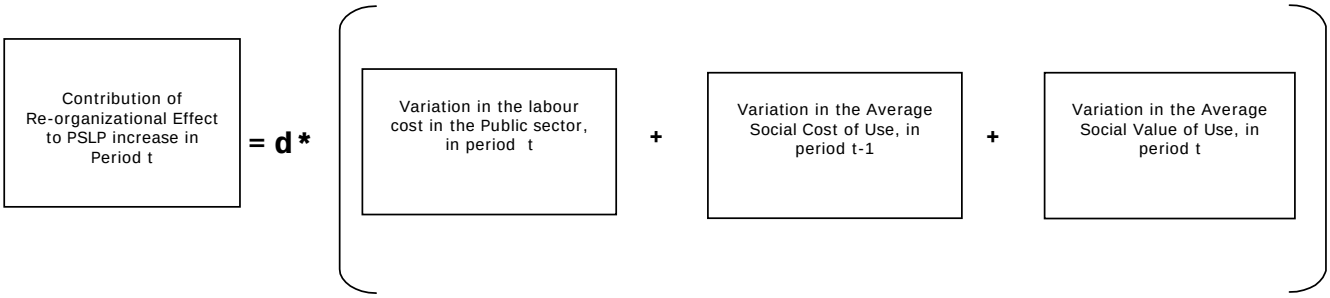
[19] $\hat{\overline{P}}_{egov,t-n} = \sum\left(\hat{\overline{P}}_{hw,t-n} + \hat{\overline{P}}_{sw,t-n} + \hat{\overline{P}}_{cp,t-n} + \hat{\overline{P}}_{tp,t-n}\right)$, where $\hat{\overline{P}}_{egov,t-jn}$ = variation in the average price of the overall ICT-driven investment, to be realised to set up eGovernment programs, in n pre-determined periods

[20] $c\left(\hat{W}_{PS,t-n} - \hat{\overline{P}}_{egov,t-n}\right)$, where c = ratio between "Ricardo's effect" and GDP increase, in period t;

specific factors, in fact, they tend to reach a competitive growth in the short term. With specific reference to public sector, we define[21]:



Hence, while the measurement of variations in labour costs does not present any particular problem, the difficulty is that there is not any "price" of product for public sector to consider. Users in general do not pay for a specific public service and, if it happens, it is usually only a part of the production cost. It is the overall contribution (the indirect taxation), indeed, that covers the expenditures public agencies make when providing all their services. Moreover, a growth or a decrease in taxation does not represent an incentive for public administration to increase / decrease its productivity, as it does not follow a profit-oriented approach. Consequently, the "Back-Office Reengineering effect" can be described as follows[22]:



Concluding, it is possible to affirm that the reorganisation effort in the administrative Operative Units manifests itself in case of increases in the unit cost of labour, or in the Average Social Cost of Use, or even in the Average Social Value of Use with respect to the spread of Perceived Value. This happens because users perceive a value augmentation of services delivered, especially if supported by ICT-driven policies, or because the users' social costs of obtaining them grow.

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[21] $L_{PS,t} = \frac{W_{PS,t}}{\pi_{PS,t}}$, where

$L_{PS,t}$ = unit labour cost in the public sector, with reference to those Organisational Units involved with the supply of eGovernment services in period t.

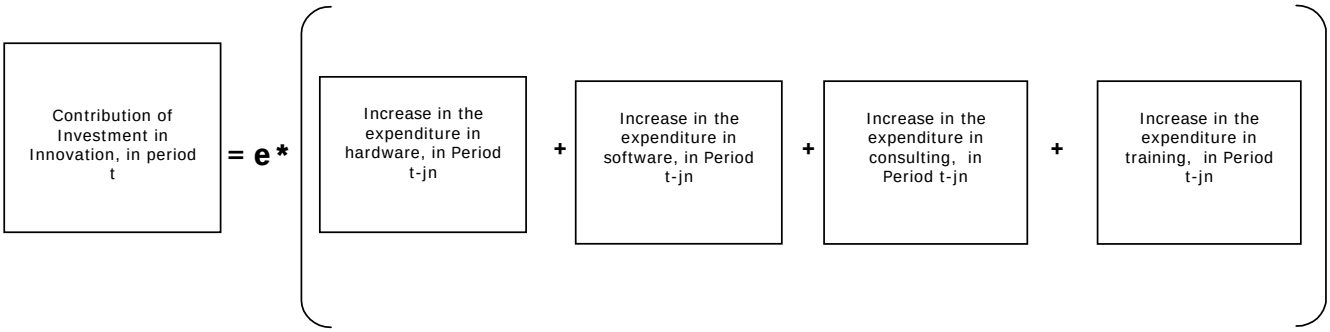
[22] $d\left[\left(\hat{L}_{PS,t} + \hat{ASCU}_{t-1} + ASVU_t\right)\right]$ where:

$\hat{ASCU}_{t-1}$ = variation in average social cost of use for services, in period t – 1 (to be defined, within a specific focus-group, and with reference to the whole constituency);

$ASVU_t$ = variation in average social value of use for services, in period t (to be defined, within a specific focus-group, and with reference to the whole constituency);

3.4. Investments in Innovation or Schumpeter's Effect[23]

With reference to the Measurement Framework analytical model, investments in innovation can be ascribed to the "efficiency" value driver. In particular, the purpose of this measurement is to analyse the role of investment in the increasing and in the general trend of productivity. The characteristic element of this component is the consideration of ICT investments, but also of their related aspects: organisation consulting, training, hardware, software, etc. This effect regards investments, realised by both private and public research centres, to produce small or large innovations. The impact of such innovations (as new innovations replace the older ones) generate an increases in productivity, after a lag time. This effect can be easily measured. It is possible to use the four categories of expenditure previously used to measure the "Ricardo's effect", even if in this case the absolute value of expenditures has to be considered, and not just the average cost per category. Consequently, by introducing the following items: a) the increase in the expenditure in hardware[24]; b)the increase in the expenditure in software[25];c) the increase in the expenditure in consulting programs supporting the introduction of eGovernment[26];d)the increase in the expenditure in training programs supporting the introduction of eGovernment[27]. The ***Schumpeter's effect*** can be thus described as follows[28]:



Its impact on public sector productivity can be observed in the long-run.

3.5. Other Macro-economic Effects Linked to Take up

As discussed in the Measurement Framework analytical model, take up can be considered as an amplifier and enabling condition for eGovernment. In particular, some aspects have to be considered:

- *The technological scenario*. In case of increasing trends in delivering ICT-based products and services, users should demand more ICT-based public services. This does not reflect only on the delivery channel, but also on the time of delivery.

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[23] (eI_{t-jn})

[24] $\hat{E}_{hw,t-jn}$.

[25] $\hat{E}_{sw,t-jn}$.

[26] $\hat{E}_{cp,t-jn}$

[27] $\hat{E}_{tp,t-jn}$

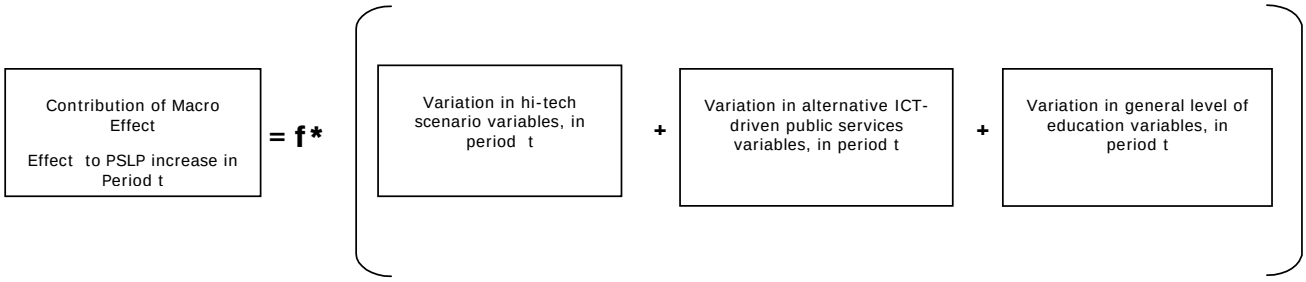
[28] $e\left(\hat{E}_{hw,t-jn}+\hat{E}_{sw,t-jn}+\hat{E}_{cp,t-jn}+\hat{E}_{tp,t-jn}\right)$

- *The existence of private competitor services.* An increase in the delivery of some kind of public service through e-GSP (eGovernment Service Providers) could induce an increase in the direct or indirect efforts of public sector for providing services in a better and speeder way*;*
- *The general education level*. With reference both to the personnel of public sector and to the entire population, some links should appear between the general level of education and the push to provide more knowledge-based services, via eGovernment programs.

In this way, the more the social environment is "receptive" (because of a wide ICT diffusion, for instance, or because of a broad, deep-rooted use of e-services the more the increase in public sector productivity can be observed). In particular, this happens for two reasons:

- The push to innovation exerted by community on public sector (the more innovative processes are used on every-day life, the more they will be demanded)
- The high level of ICT literacy of civil servants, as well as of users, which incentives the use of advanced services.

For the moment, we define the overall equation for other macroeconomic effects linked to take up as follows[29]:



Hence, ***the final equation for the productivity in the public sector will be the following****:*

$$\hat{\pi}_{PS,t} = b\hat{Y}_{PS} + c\left(\hat{W}_{PS,t-n} - \hat{\overline{P}}_{egov,t-n}\right) + d\left[\left(\hat{L}_{PS,t} + \hat{ASCU}_{t-1} + ASVU_t\right)\right] +$$

$$+ e\left(\hat{E}_{hw,t-jn} + \hat{E}_{sw,t-jn} + \hat{E}_{cp,t-jn} + \hat{E}_{tp,t-jn}\right) + f(\hat{ht} + \hat{rs} + \hat{li})_t$$

Summing up all the effects on the public sector productivity and, indirectly, on the overall GDP growth, as explained in the opening paragraph.

3.6. eGovernment Investments Direct Impact on total GDP

It can be estimated that eGovernment determines a further impact on total GDP through two elements: a direct one and a return one.

The Direct effect of Innovation Investments. Besides the indirect effect (measured by the second last component of equation for productivity of public sector, see 6.2.5) ICT-driven investments have a direct impact on GDP, which can be estimated using available statistics. Referring to the Measurement Framework model, this estimation means to evaluate the direct

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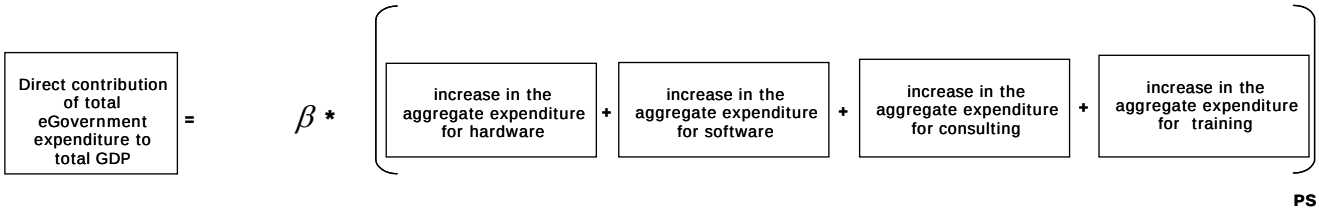
[29] $f(\hat{ht} + \hat{rs} + \hat{li})_t$

effects of "Connectivity" value driver on GDP. The elements to be considered, this time in an aggregated form, are the same as those considered for the indirect investment effect:

- The increase in the expenditure in hardware[30];
- The increase in the expenditure in software[31];
- The increase in the expenditure in consulting programs supporting the introduction of eGovernment[32];
- The increase in the expenditure in training programs supporting the introduction of eGovernment[33];.

The use of statistical series will reveal the impact of such investments in terms of total GDP growth differential, that is[34]:



Where PS stands for the contribution of investments made within the public sector, and

β for the coefficient to be estimated.

The Return Effect on Private Sector Productivity. Furthermore, it is possible to define an impact of public sector productivity changes on private sector productivity function. In other words, there could be an additional impact (possibly to be quantified later), besides the direct one.

4. Testing the model: case studies

The objective of our questionnaire (see ANNEX C) is to take into account individual PAs' actual experience. It must be observed that the gathering of all relevant information is a demanding and often difficult activity for the PAs themselves. Nonetheless, we decided to keep the questionnaire as complete (in terms of the variables involved) as possible, in order to achieve the first aim of our analysis: testing the feasibility of our theoretical model by collecting experiences at micro level.

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30 $\hat{E}_{hw,-t}$.

31 $\hat{E}_{sw,-t}$.

32 $\hat{E}_{cp,-t}$

33 $\hat{E}_{tp,-t}$

34 $GDP_t = \beta\left(\hat{E}_{hw,-t} + \hat{E}_{sw,-t} + \hat{E}_{cp,-t} + \hat{E}_{tp,-t}\right)_{PS}$ taking into account the direct contribution of the overall expenditure in eGovernment programs to the global GDP..

In particular, the selected case histories might prove useful in order to collect first hints about the political implications of studying the impact of e-Government on PS labour productivity; at the same time they might help to adapt the questionnaire and the model to specific Public Sector characteristics (such as labour bargaining etc.), making it ready to be used by next national or European survey projects.

It should be noted that, since we did not intend to carry out a proper statistical analysis, but simply to test our model by collecting exploratory experiences at micro level, we did not follow a proper sampling strategy (no minimum number of countries or regions, no relevant response rate, etc.). Instead, it proved essential to establish a direct contact with the single interviewed PAs in order to assure collaboration, mutual effort and suggestions in data-gathering, full reciprocal understanding of questions and answers, given the accuracy of some questions and the vagueness of some economic indicators.

Thus, the individual PAs have been selected on the basis of their ability to provide relevant information (e.g., they had to provide "market" services, quantifiable by number of transactions) and of the possibility of establishing a beneficial relation with our research group.

Table 1. Link between questions and variables

Effect	**Question**	**Variable** (asked or proxied through the questionnaire)
Smith's effect	3.1.1 , 3.1.2 4.2.4 4.2.1 4.2.2	Financial resources Time efficiency Saving on operational costs Additional Investment
Ricardo's effect	1.1 - 1.3 2.1. 2.2 2.3 4.2.1	Staff composition Cost of staff Cost of hardware Cost of software Saving on staff costs
Back- office effect	4.2.3 4.2.4 4.2.1	Reallocation of human resources Time efficiency Saving on Delivering time Average waiting time
Schumpeter's effect	2.2 2.3 2.4 2.5	Cost of hardware Cost of software ost of consultancy Cost of training

In what follows we give a brief description of the information gathered by the questionnaire in the light of our model. We focus on four case studies: the Italian Fiscal Agency (Agenzia delle Entrate), the Criminal Justice project in the United Kingdom, the Austrian Ministry of Justice (Bundesministerium für Justiz) and the Revenue On line programme in Ireland.

4.1. Case study n.1: "Agenzia delle Entrate"

The case study under exam regards the Italian Fiscal Agency and the project "Fisco Telematico" that changed very deeply the relation between the agency and its "customers".

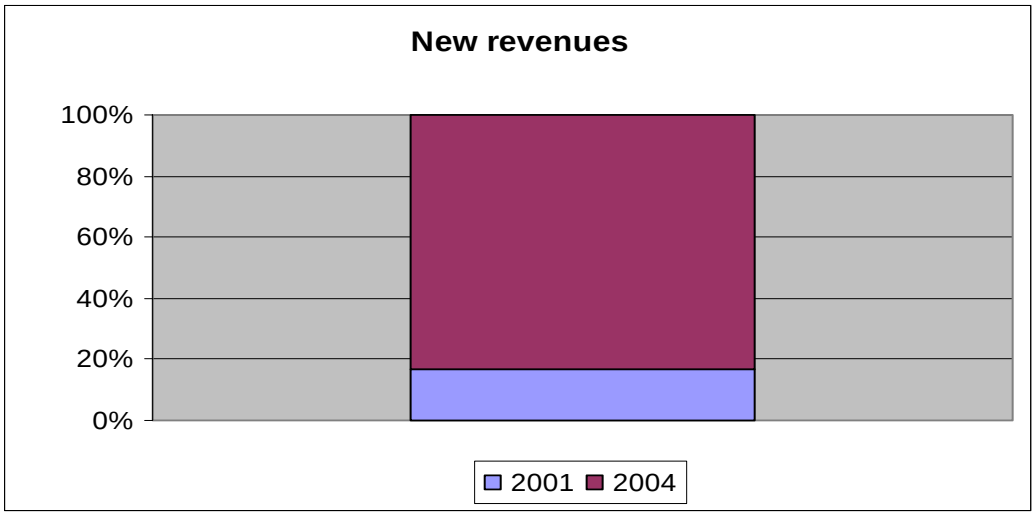
This project was launched in 1997 with the aim to eliminate the paper version of the fiscal management and to allow a quick monitoring of the contribuents' situation, within the Italian Tax System Reform that took place between 1997 and 2001. Through this project it has been possible to organize a network of more than 100,000 subjects among contribuents, professionals and public organizations.

Agenzia delle Entrate aims to achieve the maximum level of tax compliance both by providing assistance to taxpayers and by carrying out tax checks focused on fighting tax avoidance and evasion. It pursues this mission through the simplification of relations with taxpayers, assuring them access to assistance and information, reinforcing action against tax evasion and improving administrative performance through innovative organisational models. When it was established in 2001 the Agency provided services to nearly 44 millions taxpayers with 40,000 employees; today it manages 47 millions of taxpayers with a lower bulk of employees.

The questionnaire was filled in by direct answers given from the Agency and/or with data supplied by interviews. In what follows we check how our macro – effects impacted upon this administration at the light of the answers contained in the questionnaire (see ANNEX 1 for details about the data gathering).

Market enlargement or Smith's effect

According to this effect ICT-enabled innovations contribute to enlarge the demand of the services provided by the public administration involved. This quantity is influenced by 4 variables, so we must analyse separately each of them.



Financial resources

This variable is related with the increase in the Agency's capacity to acquire resources. Indeed, "Fisco telematico" has introduced new opportunities for obtaining revenues from services which did not exist in the past: revenues in 2001 result less than 20% of those registered in 2004, so the service had a positive impact of more than 80% in three years.

Time efficiency

Administration positively answered about the time efficiency impact of e-Government on service delivering, but it is not possible to compare new services with the one implemented in traditional form.

Saving on operational costs

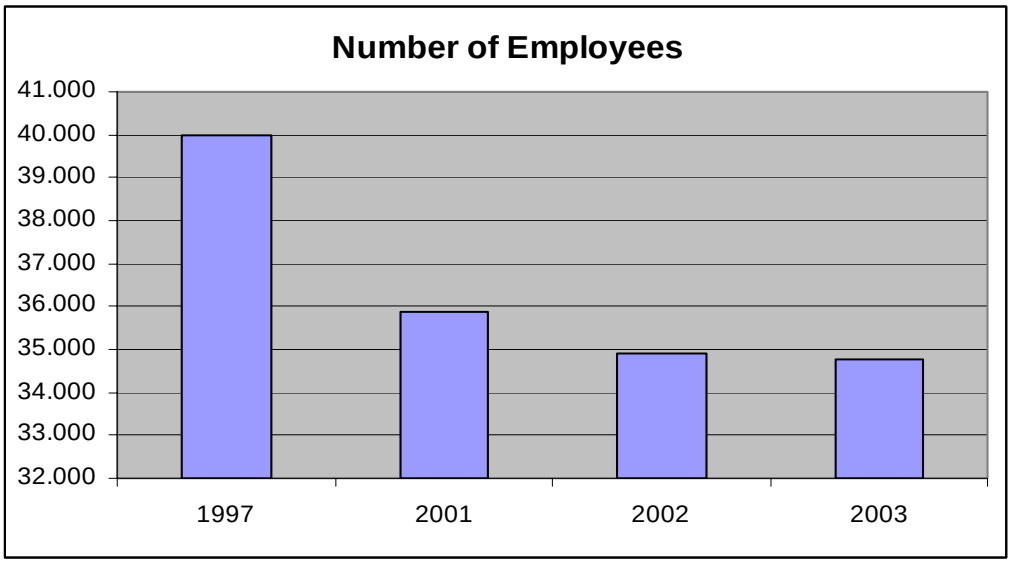
Cost savings for €90 millions have been gradually achieved through:

- the closure and disposal of ten tax return handling Centres since 2001 (400.000 sq. mt. of accommodation space savings), accounted for €20 millions.
- the elimination of data acquisition costs since 2000, accounted for €30 millions.
- the on-going reduction of 6,000 human resources, accounted for €40 millions.

Unfortunately it is not possible to quantify in a monetary way the reduction of average waiting time and of time needed to deal with dossiers.

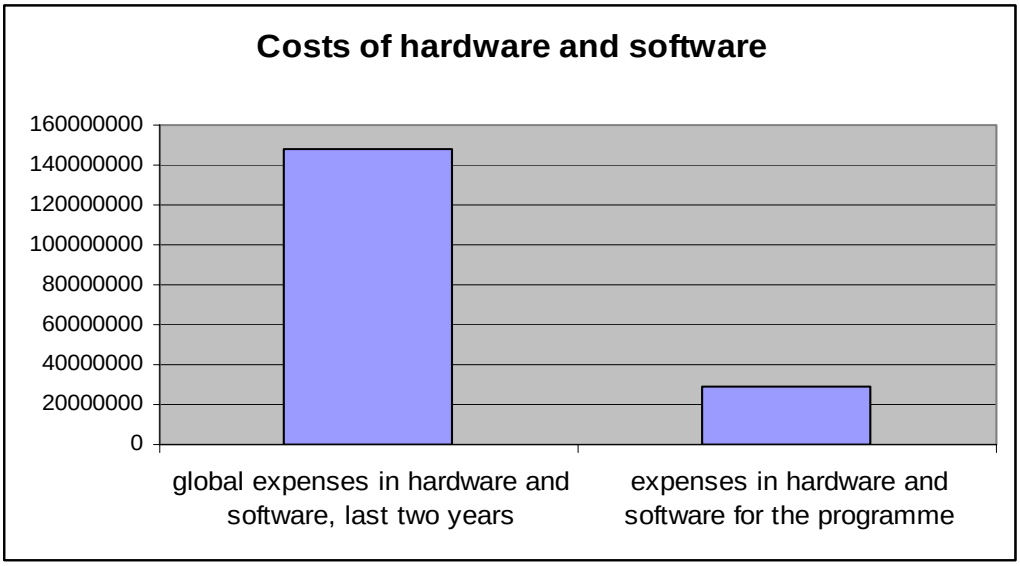
Substitution or Ricardo's effect

This effect is related to the possibility that ICT favours more efficient substitution between factors of production.



Firstly we examine the **staff composition**, both in the quantitative way and in the qualitative one. In general the reduction was very sustained and affected in similar proportion each level of personnel, so that actually the threshold of 34,000 employees is very close (the reduction is about 15% of the workforce of the Agency).

We have not specific data about **cost of staff** unless those of national contract agreements, but the **saving on staff costs** - caused by the staff reduction -amounts to 40 millions euros.



Now we have to compare this reduction with some non labour costs such as **hardware** and **software**. The expenses afforded for the project have been about 29 millions of euros that is a consistent budget (about 40% of total annual expenses for these investments).

Finally the project required a **global investment** of 100 millions euros, that we will examine in greater detail later.

Back-office effect

In this section we focus on how ICT-enabled innovations influenced the **reorganisation** of the Agency. This is strongly related with the reduction of personnel, but there has been also a re-qualification process of a group of employees (10,000 persons). This caused a cost of 14 millions euros broken down as follows: pay incentives for staff involved in paper backlog elimination activities from 1999 to November 2000 € 9,500,000 (68%) and compensation for staff who transferred to other offices because of the closure of tax return handling centres € 4,500,000 (32%).

As noticed above, changes in terms of **time efficiency** and **saving on delivering time and average waiting time** occurred, strongly affecting also the reorganisation, in addition to enlarge the market. Finally we know that the project caused an **integration of services**, but no specific description about this has been provided.

Schumpeter's effect

The last macro effect to analyse relates to investment in hardware and software, already analysed in terms of substitution with non-labour costs, in the context of the Ricardo's effect.

The other element to stress here are the **cost of consultancy** and the **cost of training**. The first one has an initial expenses of 17 millions of euros (including staff remuneration and consulting services), while during last two years there was a reduction in this cost respectively of 25% and 56%. The human resources training costs estimation (€11,000,000) can be broken down as follows: 45% (€ 5,000,000) for training employees and 55%(€ 6,000,000) for staff mentoring.

4.2. Case study n.2: "Criminal Justice"

This case study regards one of the several ICT projects introduced by the UK Criminal Justice Information Technology (CJIT), namely the *Secure eMail System* (SeMS)*28*. SeMs is a project

launched to improve the performance of the Criminal Court System by joining most of the internal and external stakeholders of the Criminal Justice System (CJS) in England and Wales through a system for the secure and certified exchange of trial sensitive data documents via e-mail.

The interaction system, defined in an extended form, includes the Police, the Crown Prosecution Service, Magistrates' Courts, Crown Courts, the National Offender Management Service and Criminal Justice Practitioners (CJPs).

The CJPs group consists of players who are not connected to Government secure network system but who are anyway involved in the criminal justice process as receivers and transmitters of relevant amount of sensitive data. Firstly is important to remember that 65 per cent of data flowing across the criminal justice process is initiated by the police. Until recently most of this information flow has been manually processed. This was due especially to the fact that CJPs, when receiving and transmitting sensitive data, were outside the secure electronic data exchange system used within the Criminal Justice Organisations.

In this sense the goal of SeMS is to include also external stakeholders into the secure exchange network thus improving the performance of information flows across the whole system.

In order to measure its benefits, the Secure eMail programme has used a balance scorecard approach and ended up identifying three different categories: *Performance benefits*, *People benefits*, and *Financial benefits*.

With regard to Performance benefits Secure eMail has improved the effectiveness of the CJS through a faster delivery of documents between the organisations working within it. People benefits refer to the advantage staff get in terms of an improved working environment and they have been measured through a questionnaire that was filled in before and 10 days after the project's implementation. The final result was that Secure eMail has definitely made a positive difference to the working lives of its users.

Talking about financial benefits, they can be divided into *Efficiency benefits* and *Effectiveness benefits*. The first ones are the savings in staff time, equipment costs, and all the other savings arising from IT enabled business change. Efficiency benefits have been obtained by simplifying the processes for making requests, transferring information, raising queries and distributing documents (especially when recipients are more than one) among CJOs and between CJOs and CJPs.

From this administration we received a smaller number of answers, either because questions were not applicable (and data absent), or for the fact that activities are divided between Home Office, CPS and Department for Constitutional Affairs.

Market enlargement or Smith's effect

Financial resources

This variable is related with the increase in the institution's capacity to acquire resources. For this PA, like for the first one, there are not financial resources by the increase of collected taxes or tariffs in services, but it is possible to obtain revenues from services which did not exist in the past. In this case it is not yet possible to quantify this increase in a monetary form.

Time efficiency

Administration positively answered about the time efficiency impact of e-Government on service delivering. Unfortunately, efficiency varies between department and agencies and it is not possible to quantify the number of files as each organisation deals with different parts. For the same reason it is not possible to compare these services with those implemented in a traditional form.

Saving on operational costs

Given by the fact that the programme is not fully rolled out this information is not yet available.

Substitution or Ricardo's effect

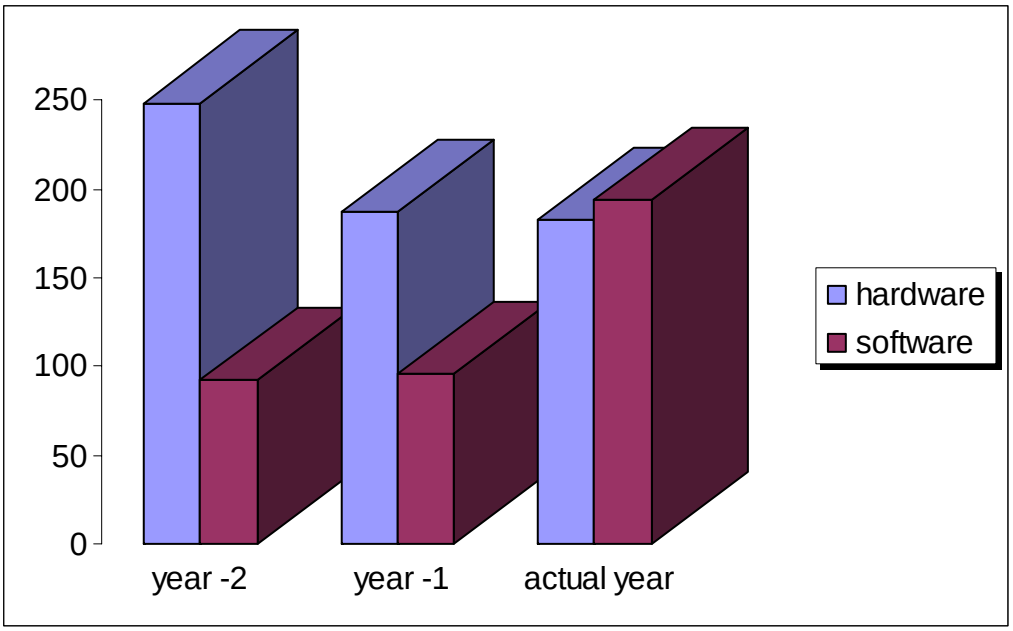
This effect is related to the possibility that ICT favours more efficient substitution between factors of production.

The data about the **staff composition** point out as this administration is much bigger than the first one: there are more than 106,000 employees between people working in Home Office, CPS and Department for Constitutional Affairs.

As before we have not specific data about people working in ICT programmes because the number of staff working in eGovernment is not collected.

Costs for **hardware** and **software** are showed by the graph below. It has to been stressed as the investments in hardware are by nature, gross investments, in fact for the first year there was a percentage of replacement close to 100%.

The **global investment** needed to deliver services introducing new technologies requires a sum of £2bn, that is the total cost of the CJS IT programme.



It is not easy to determine the change in the **cost of staff** given that there are different yearly increases according to the performance and the department. At the same time it is not possible to quantify the **savings on the staff costs**.

Back-office effect

The main critical lack of this interview is in the fact that we have not proxies indicating the **reorganisation** of the Criminal Justice, given by the fact the programme is not completely

implemented. About the reallocation of human resources administrations declare themself not aware of changes outside the Home Office, but even within it this information is not collected.

We already showed absence of variables in terms of **time efficiency** and **saving on delivering time and average waiting time**, so as we know that the project caused an **integration of services**, but there is not a specific description about this.

Schumpeter's effect

The last macro effect to analyze is this effect, that is usually composed by hardware and software, already analysed in terms of substitution with non labor elements, so we remind to the data analyzed for the Ricardo's effect.

The other element to stress here are the **cost of consultancy** and the **cost of training**. The first one amounted, for the year preceding the current one, to more than 15 millions of GBP (including staff remuneration and consulting services), while it is possible to estimate a reduction close to 40% for the current year. The second one is less important in absolute terms and much smaller than the former in absolute value so that the percentage is lower than 0.5% for the current year.

4.3. Case study n.3: "Bundesministerium für Justiz"

We have collected information about five ICT-enabled new services: Automation of Court Procedures, Electronic Legal Communication, Land Register, Companies Register and Edict File.

The Automation of Court Procedures (ACP) has been in operation since 1986. It started with summary judgements and since then has grown to support 46 type of judicial procedures. With the project REDESIGN it has undergone a process of complete renewal, utilising the latest Internet technology. This system has been extended with additional functions, mainly required by its users, facilitating an even faster and simpler management of procedures in the courts.

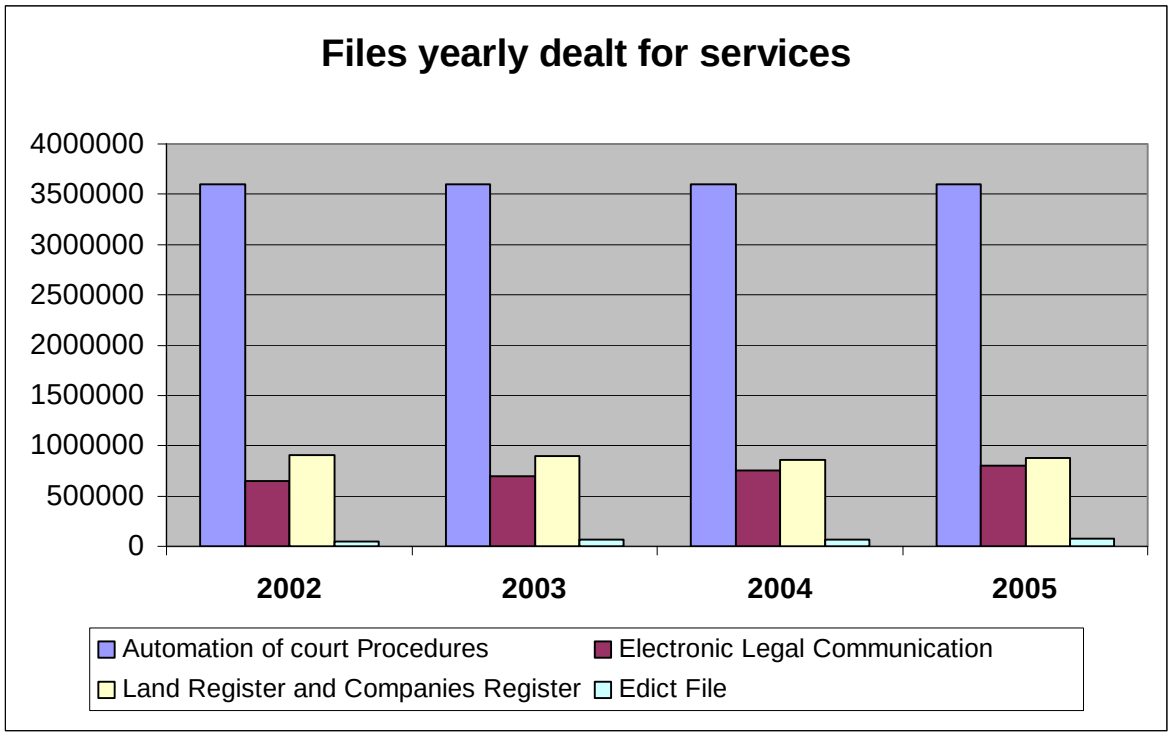
Electronic legal communication (ELC) with the courts as an instrument of communication with the parties of proceedings, on the same level as paper, was introduced into the rules of procedure in 1990. ELC allows electronic transmission of applications or submissions and the automatic transfer of procedural data to the Automation of Court Procedures: the resulting personnel savings in the administration of justice, which could be achieved in the final development, is estimated at 133 manpower unit.

Both Land register and Companies register were changed over to automatic support at the beginning of the nineties. The Commercial Register is now the Companies Register and includes not only businesses but also co-operative societies and private foundations. In 2001 the electronic transmission of annual financial statements was introduced: publication of entries in accordance with the requirements of commercial law is carried out fully automatically in the edict database.

Market enlargement or Smith's effect

We have to distinguish between two types of effects: firstly there is a direct saving effect deriving by IT services valued with 23.3 millions euros.

Secondly, there is an additional effect given either by the increase of tax/tariffs on services (like external enquiries) estimated in 1.7 millions euros per annum, or from new services, like for example Companies Register Publications, estimated in 13.3 millions euros per annum.



Four new services are supplied with ICT services and they are Automation of Court Procedures, Electronic Legal Communication, Land Register and Companies Register and Edict File.

Every one of this services caused cost savings and variation of time efficiency, even if it is not always possible to quantify them. For example the Electronic Legal Communication favoured a saving of €2.5 millions in the year 2004, while the saving due to Edict File is of €4.5 millions.

Only the Electronic Legal Communication is supplied also in the traditional form so that a comparison is reliable and it is interesting to note as in the period 2002 – 2005 the percentage of the ICT supplied service passes from 18.8% to 20.5%.

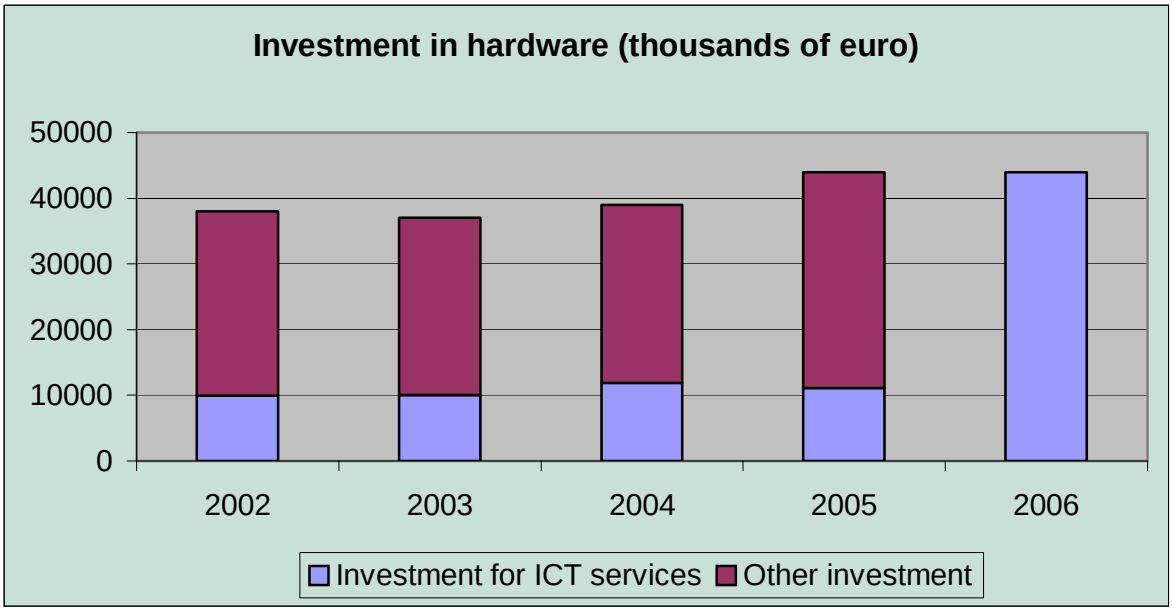
Substitution or Ricardo's effect

This effect is related to the possibility that ICT favours more efficient substitution between factors of production.

In this case there was not a sensible reduction of the personnel (more than 11,000 employees and less than 1% involved in delivering ICT services), while wage costs increased of about 2.5% per annum.

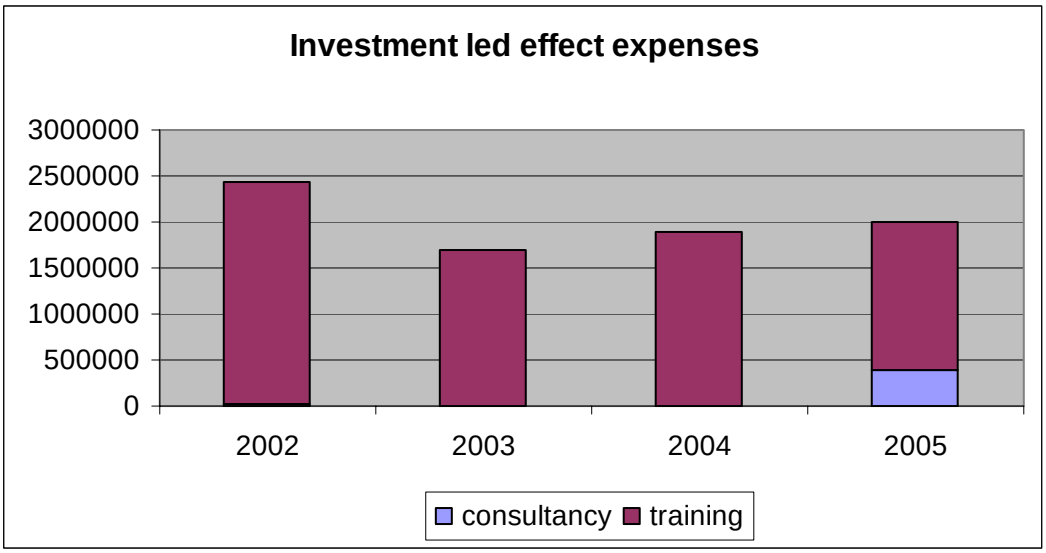
As before we have not specific data about people working in ICT programmes because the number of staff working in eGovernment is not collected.

Hardware expenses are slightly growing and an important percentage of them is in investment to deliver ICT services (there is not a specific forecast for 2006). About one fifth of these investment are used for replacement.



This administration develops internally the software, so the wage cost contains the expenses for software.

As before we refer to these investments also for the Schumpeter's effect, while is interesting to analyse separately the type of ICT services supplied from this administration.



The global additional investment for the services is about 30 millions of euros, with the 60% only for the Automation of Court Procedures, that is the service with the major number of files dealt with.

4.4. Case study n.4: "Revenue On Line Services"

The sector of this administration is the same of the case study n. 1 so that we have respectively four countries (Austria, Ireland, Italy and UK) with respectively two administrations involved in judiciary branches (nn.2 and 3) and the other two (nn.1 and 4) in the fiscal sector.

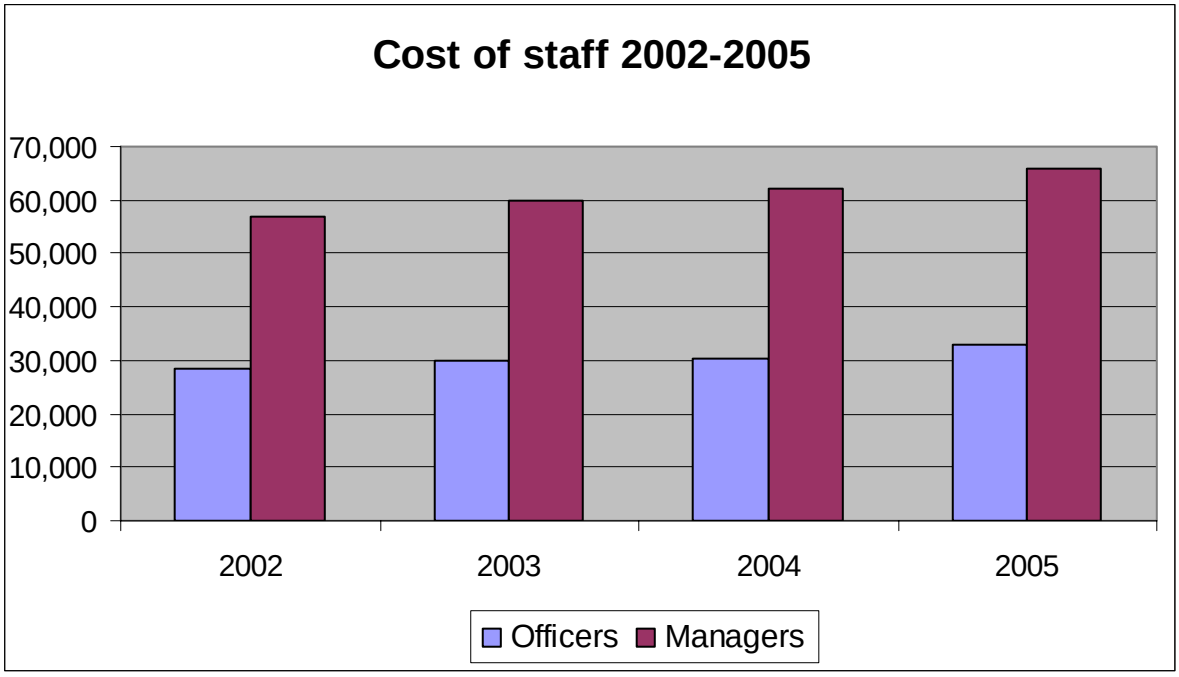
Launched in September 2000, the programme ROS (Revenue On Line Services) is an internet based facility which provides Irish businesses with a free, secure, confidential, and easy to use facility to conduct their Revenue related transactions 24 hours a day 365 days of the year. At the touch of a button ROS customers can access the latest information on their tax accounts, file returns, and make payments for more than 20 different taxes and duties. In 2005 ROS was awarded a eEurope award in recognition of the fact that it ranks amongst the very best practices of eGovernment in Europe.

Actually this administration has a well developped ICT structure so that it delivers a lot of e-services such as Online Payment facilities, Self employed Income Tax filing, Corporate Tax Filing, Customer Information Services and Vehicle Registration Tax filing.

Market enlargement or Smith's effect

About the financial resources there had not been a growth, because the service has simply provided a different channel for payment of taxes and it has enabled services that were there already.

For saving on operational costs there have been considerable savings on postage, phone calls and human processing time as a result of our online filing and payment service. Conservative estimates show that over €6.5 million was saved in this way in 2004 and that over €10.6 million was saved in 2005.

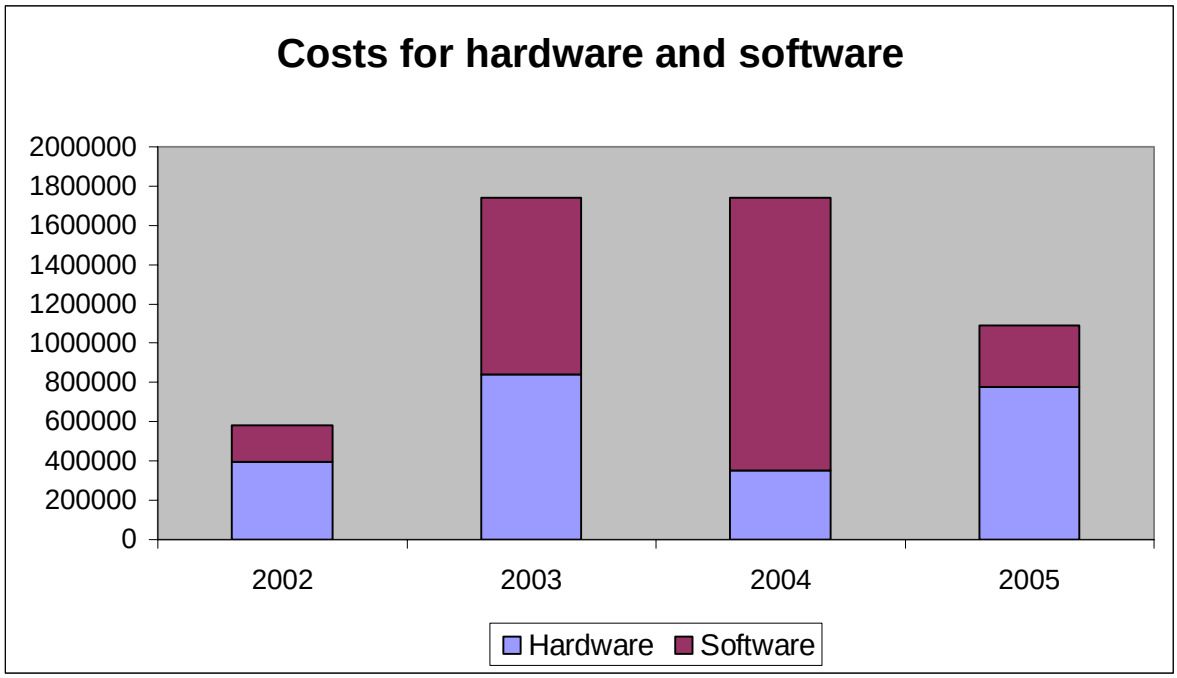


Substitution or Ricardo's effect

In this case the general personnel of the administration is of 6404 workers and the 8% of them (509) is involved in ICT (Revenue's ICTeB Division), but there have not been substantial changes from 2002. 100 persons are working in the ROS programme.

About the cost of staff, data show an average growth similar for officers and managers (about 5% each year).

It is possible to break down ICT expenditure between hardware and software. In general, we may observe that the growth path is not monotone, so we have two years of important growth and a final year of substantial reduction (due to software).



The cost of consulting reduces itself of 44% between 2002 and 2005, while it is not possible to provide a breakdown of training supplied to deliver e-services as it is not broken down. As a general rule the Revenue Agency uses 3% of payroll on training.

Back-office effect

The difficulty in interpreting this point is given by the fact that ICT programme was a part of a deep reorganization of 2002 that included the integration of Taxes and Customs regimes.

Some data highlight the success of the programme: online payment of tax increased with over €1.4 billion paid this year compared to €923 million at the same time last year and 65% of timely filers used the electronic route this year. This compares very favourably with 53% last year and 40% and 9% in the preceding years (source http://www.revenue.ie/press/pr_241105ros.htm).

While no human resources were lost as a result of these changes it has been possible to move resources from customer service to compliance functions. For example as a result of Online Vehicle Registration Tax Service it was possible to close some offices and reduce the opening hours of others.

A recent survey showed that 23% of returns filed on paper required subsequent amendment whereas only 7% of ROS returns require amendment. The ROS customer information service allows customers and their representatives to view details of their revenue account, details of returns filed and outstanding, payments made etc. This facility saves time and money for both Revenue Agency and customers on phone calls to the tax office.

Traditionally, particularly for more complex annual tax returns, there have been considerable delays for the customers in the processing of these returns when filed on paper. Because ROS is a fully integrated system from front end to back end these delays have been eliminated entirely for online filers and returns filed online are now fully processed within days. This process also ensures that customers who are entitled to refunds receive them in timely fashion if the return is filed online.

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ANNEX A: Estimates of ICT impact on the EU economy in a comparative perspective

Table A.1 : ICT contribution to TFP

	1980-1990	1990-1995	1995-2000
USA	0.35* / -0.15**		0.71* / 0.68**
EU-4	0.3* / 0.17**		0.53* / 0.19**
EU		0.15	0.31
USA		0.28	0.76
AT		0.12	0.26
B			
DE		0.18	0.29
DK		0.07	0.13
FI		0.21	0.55
FR		0.23	0.44
IE		1.55	5.12
IT		0.17	0.32
N			
NE		0.08	0.14
SE		0.19	0.41
UK		0.26	0.46

* = ICT-producing industries, **= ICT-using industries

Note: see Annex B

Legend: Inklaar, O'Mahony and Timmer (2003)

Van Ark *et al*. (2002)

Table A.2: ICT contribution to Labour Productivity (%)

	ICT capital deepening				Productivity in ICT sectors								
					Total			ICT-producing			ICT using		
	1980-1985	1985-1990	1990-1995	1995-2000	1980-1989	1990-1995	1995-2000	1980-1989	1990-1995	1995-2000	1980-1989	1990-1995	1995-2000
USA	**0.46**			**0.86**				**0.51**		**0.89**	**0.36**		**1.43**
EU-4	**0.33**			**0.53**				**0.44**		**0.65**	**0.62**		**0.59**
EU	0.25	0.29	0.25	0.37						0.6			0.42
USA	0.49	0.34	0.3	0.61					0.41	0.99		0.27	1.22
AT									0.12			0.59	
B									0.04			0.7	
DE	0.17		0.25	0.41	0.23	0.29	0.57		0.21			0.01	
DK									0.09			0.37	
FI									0.23			0.19	
FR	0.17		0.17	0.3	0.23	0.22	0.43		0.27			0.23	
IE									0.43			0.08	
IT	0.23		0.24	0.38	0.28	0.31	0.62		0.19			0.1	
N									0.03			0.37	
NE									0.22			0.05	
SE									0.27			0.45	
UK	0.2		0.25	0.64	0.2	0.22	0.62		0.18			0.37	
USA	0.41		0.43	0.87	0.22	0.25	0.44						
CA	0.27		0.34	0.46	0.14	0.14	0.21		0.1			0.61	
JP	0.42		0.33	0.81	0.23	0.29	0.61		0.36			0.67	

Note: see Annex B

Ref.: Jorgenson (2003)

Inklaar, O'Mahony and Timmer (2003)

Van Ark *et al.* (2000)

Van Ark *et al.* (2002)

van Ark, Inklaar, McGuckin (2003)

Table A.3: ICT contribution to GDP growth (%)

	ICT capital deepening						ICT total contribution				
	1980-1985	1985-1990	1990-1995		1995-2000		1990-1996	1980-1985	1985-1990	1990-1995	1995-2000	1991-1997
EU	0.25	0.29	0.25		0.37							
USA	0.49	0.34	0.3		0.61							
AT												
B							0.34					
DE	0.17		**0.26**	0.23	**0.36**	0.41	0.41	0.1	0.16	0.22	0.22	0.39
DK							0.4					
FI							0.41	0.18	0.25	0.01	..	
FR	0.23		**0.13**	0.22	**0.31**	0.42	0.34	0.14	0.21	0.13	0.27	0.31
IE							0.32					
IT	0.23		**0.13**	0.22	**0.43**	0.42	0.23	0.13	0.2	0.1		0.22
N							0.41					
NE							0.59					
SE							0.46					
UK	0.22		**0.38**	0.23	**0.72**	0.69	0.59	0.12	0.23	0.15	0.27	0.52
USA	0.46		**0.51**	0.47	**0.84**	0.97	0.64	0.44	0.43	0.43	0.87	0.58
CA	0.31		**0.33**	0.35	**0.6**	0.54	0.64	0.32	0.36	0.28	0.51	0.59
JP	0.43		**0.31**	0.31	**0.52**	0.78	0.45	0.09	0.18	0.14		0.4

Note: see Annex B

Ref.: **Pilat (2004)**
Colecchia & Schreyer (2002)
Van Ark *et al.*(2002)
Daveri (2002)
Jorgenson (2003)

Table A.4: Contribution to GDP growth from ICT industries

	ICT-producing		ICT using		Total ICT	
	1990-1995	1995-2000	1990-1995	1995-2000	1990-1995	1995-2000
CA					0.14	0.21
DE	0.11	0.24	0.49	0.76	0.57	0.29
DK	0.24	0.23	0.56	0.95		
FR	0.27	0.45	0.47	0.76	0.22	0.43
IT	0.18	0.2	0.66	0.77	0.62	0.31
JP					0.29	0.61
NE	0.27	0.53	1.04	1.75		
UK					0.22	0.62
USA	0.54	0.82	1.53	2.38	0.25	0.44

Note: see Annex B

Ref.: Van Ark *et al.* (2000)

Jorgenson (2004)

ANNEX B: Methodological notes on cited sources

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Sectoral Data: Shift-Share Analysis.

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Sectoral Data. By EU-4 the authors mean France, Germany, Netherlands and United Kingdom, which they believe to be representative of EU in light of their accounting for 70% of EU GDP. Growth accounting methodology with accumulation of human capital (quality of labour)

7- Jorgenson, D. (2004), "Information Technology and the G7 Economies", Department of Economics, Harvard University, mimeo

Aggregate Data, Growth Accounting methodology with harmonised price index.

8- Pilat, D. (2004), Capital Deepening, R&D and Productivity – Evidence from Comparative Studies of Productivity Growth, paper prepared for conference "Productivity: performance, prospects and policies", Wellington, 28-29 July 2004

Aggregate Data, Growth Accounting methodology with accumulation of human capital.

ANNEX C: Economic model questionnaire

This is the questionnaire that the eGEP Study Group is submitting in order to gather the data necessary for testing the Economic Model, which is one of the three main line of activity of the project.

Your contribution in filling this questionnaire is fundamental in supporting eGEP work.

Both we as the contractor and the Commission financing this project are fully aware of the methodological/conceptual and practical problems entailed in gathering the information required. In light of these difficulties it is clear that our objective is not to produce figures that can be considered ias official statistics.

We do ask you to signal the difficulties and limitation of the data you provide to us, but also to make an effort to give us any type of data that we could use to test our model.

The information gathered through the questionnaire will be processed by the eGEP Study Group and will subsequently be discussed and integrated by the EU partners on the occasion of the 3rd workshop which will be held in November.

The outcome of the final analysis will then be published on a web site specifically created for the project's participants to share information.

For additional information on completion of this questionnaire please contact:

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1. Back-office Reorganisation Effect

1.2 Please enter the number of employees in your institution (absolute value):

1.1. Please enter the number of employees directly involved in delivering e-Government services (absolute value):

1.3 Staff composition. Please divide your staff by category. Enter data for the last 4 years.

	Year – 3	Year – 2	Year - 1	Current year
Managers				
Officers				

2. Ricardo's Effect

2.1 Cost of staff

2.1.1 Please specify how the average salary has changed in the last four years in the organization units which deliver e-Government services. Enter yearly data (absolute value) for the last four years by staff category.

	Year – 3	Year – 2	Year - 1	Current year
Managers				
Officers				

2.1.2 Please specify how the average salary has changed in the last four years within your institution as a whole. Enter yearly data (absolute value) for the last four years by staff category.

	Year – 3	Year – 2	Year - 1	Current year
Managers				
Officers				

2.2 Cost of hardware[35]

2.2.1 Please specify the amount of investments in hardware made by your institution to deliver e-Government services in the last four years.

Year – 3	Year – 2	Year - 1	Current year

2.2.2 Please specify the amount of investments for replacement (percentage).

Year – 3	Year – 2	Year - 1	Current year

2.3 Cost of software[36]

[35] This segment includes the following types of hardware for IT/IS purposes:

- ☐ PCs (desktops) and Portable PCs (laptops, notebooks);
- ☐ Servers;
- ☐ Mainframes;
- ☐ Other (peripherals, printers, scanners, fax machines, etc).

[36] System Software (Operating systems (OS), such as Windows, Linux, Unix, etc); Application Software (Off-the-shelf and/or customised Applications).

2.3.1 Please specify the amount of investments in software made by your institution to deliver e-Government services in the last four years.

Year – 3	Year – 2	Year - 1	Current year

2.3.2 Please, specify the amount of investments for software replacement (percentage)

Year – 3	Year – 2	Year - 1	Current year

2.4 Cost of consulting

2.4.1 Please, specify the amount of investments in consulting made by your institution to deliver e-Government services in the last four years.

Year – 3	Year – 2	Year - 1	Current year

2.5 Cost of training

2.5.1 Please, specify the amount of investments in training made by your institution to deliver e-Government services in the last four years.

Year – 3	Year – 2	Year - 1	Current year

3. Smith's effect

3.1 Impact on financial revenues of the institution

3.1.1 New financial resources

Please, specify if e-Government services have brought to an increase in the institution's capacity to acquire resources in the form of

Increase of collected taxes (in absolute value)

yes/no of euros

Increase of taxes/tariffs on services

yes/no of euros

Revenues from services which did not exist in the past

yes/no of euros

3.1.2 Managing and coordinating financial resources

Please, specify if the introduction of e-Government services has improved the management of the Public Administration budget:

Improvement in the control of the expenditure flows

yes/no

Improvement in the coordination between spending, commitments and payments

yes/no

4. Service specific questionnaire

4.1 Please enter up to five e-Government services which your institution offers and considers the most strategic ones.

Service 1

Service 2

Service 3

Service 4

Service 5

Please, answer to the following questions referring to each of the e-Government service you provide.

Service 1

4.2 Savings, investments and reallocations of resources which are linked to the above services

4.2.1 Cost savings. Please, specify if the service has generated a saving on:

operational costs due to the service delivery

yes/no of euros

staff costs

yes/no of euros

time needed to deal with dossiers

yes/no of euros

average waiting time (by different type of constituency)

yes/no of euros

4.2.2 Additional investment. Please specify the financial investment which was needed to deliver this service introducing new technologies.

Euros

4.2.3 Reallocation of human resources (HR). Please specify how the composition of the organization unit in charge of the service delivery has changed in the last four years:

Enter the number of external HR which have been acquired for that purpose

Year – 3	Year – 2	Year - 1	Current year

Enter the number of HR who have been transferred to the organization unit within your institution

Year – 3	Year – 2	Year - 1	Current year

Enter the number of HR who have been transferred from the organization unit to another organization unit in the same institution because they were in excess.

Year – 3	Year – 2	Year - 1	Current year

Enter the number of HR which have been dismissed.

Year – 3	Year – 2	Year - 1	Current year

4.2.4. Variation in time efficiency. Please, specify if adopting an e-Government approach in delivering this service has increased the efficiency of its delivery.

Yes/no

4.2.4.1 If yes, please quantify the amount of files yearly dealt with (by register numbers).

Year – 3	Year – 2	Year - 1	Current year

4.2.4.2 If possible, provide comparable data about a service delivered traditionally

Year – 3	Year – 2	Year - 1	Current year

Service 2

4.2 Savings, investments and reallocations of resources which are linked to the above services

4.2.1 Cost savings. Please, specify if the service has generated a saving on:

operational costs due to the service delivery

yes/no of euros

staff costs

yes/no of euros

time needed to deal with dossiers

yes/no of euros

average waiting time (by different type of constituency)

yes/no of euros

4.2.2 Additional investment. Please specify the financial investment which was needed to deliver this service introducing new technologies.

Euros

4.2.3 Reallocation of human resources (HR). Please specify how the composition of the organization unit in charge of the service delivery has changed in the last four years:

Enter the number of external HR which have been acquired for that purpose

Year – 3	Year – 2	Year - 1	Current year

Enter the number of HR who have been transferred to the organization unit within your institution

Year – 3	Year – 2	Year - 1	Current year

Enter the number of HR who have been transferred from the organization unit to another organization unit in the same institution because they were in excess.

Year – 3	Year – 2	Year - 1	Current year

Enter the number of HR which have been dismissed.

Year – 3	Year – 2	Year - 1	Current year

4.2.4. Variation in time efficiency. Please, specify if adopting an e-Government approach in delivering this service has increased the efficiency of its delivery.

Yes/no

4.2.4.2 If yes, please quantify the amount of files yearly dealt with (by register numbers).

Year – 3	Year – 2	Year - 1	Current year

4.2.4.2 If possible, provide comparable data about a service delivered traditionally

Year – 3	Year – 2	Year - 1	Current year

Service 3

……..

Service 4

……..

Service 5

……

ANNEX D: Results from the questionnaires

Tables 1a, 1b, 1c, 1d summarise the results of our survey. For some questions we receive only general data without specific references or only qualitative answers (Yes/No) without quantification. About the time perspective, our survey refers mainly to the three years precedent to the actual, but alternatively is possible to indicate initial and final year of the program. Tables 2a, 2b, 2c, 2d highlight the number of years covered for each question. Note that there are questions which require only one data.

Table 1a. Results for "Agenzia delle Entrate"

Effect	Questions	Variables	Availability of data
Market enlargement or **Smith's effect**	3.1	Financial resources	Supplied from the Agency
	4.2.4	Time efficiency	Supplied from the Agency
	4.2.1	Saving on operational costs	Supplied from Agency and partially computed with available data
	4.2.2	Additional Investment	Computed with available data
Substitution or **Ricardo's effect**	1.1 - 3.3	Staff composition	Supplied from the Agency*
	2.1	Cost of staff	Computed with available data*
	2.2	Cost of hardware	Supplied from the Agency** and computed
	2.3	Cost of software	Supplied from the Agency**
	4.2.1	Saving on staff costs	Computed with available data
Back-office effect	4.2.3	Reorganisation	Supplied from the Agency without quantification and computed**
	4.2.4	Time efficiency	Supplied from the Agency
	4.2.1	Saving on	Supplied from the Agency
		- Delivering time	Supplied from the Agency
		- Average waiting time	
Schumpeter's effect	4.2	Cost of hardware	Supplied from the Agency** and computed
	4.3	Cost of software	Supplied from the Agency**
	4.4	Cost of consultancy	Supplied from the Agency** and computed
	4.5	Cost of training	Supplied from the Agency**

Table 1b. Results for "UK Criminal Justice"

Effect	**Questions**	**Variables**	**Availability of data**
Market enlargement or **Smith's effect**	3.1 4.2.4 4.2.1 4.2.2	Financial resources Time efficiency Saving on operational costs Additional Investment	Qualitative answer Not available Not available Supplied from the agency
Substitution or **Ricardo's effect**	1.1 - 3.3 2.1 2.2 2.3 4.2.1	Staff composition Cost of staff Cost of hardware Cost of software Saving on staff costs	Supplied from the Agency* Not available Supplied from the Agency Supplied from the Agency Not available
Back-office effect	4.2.3 4.2.4 4.2.1	Reorganization Time efficiency Saving on - Delivering time - Average waiting time	Not available Not available Not available
Schumpeter's effect	4.2 4.3 4.4 4.5	Cost of hardware Cost of software Cost of consultancy Cost of training	Supplied from the agency Supplied from the agency Supplied from the agency Supplied from the agency

Table 1c. Results for "Bundesministerium für Justiz"

Effect	Questions	Variables	Availability of data
Market enlargement or **Smith's effect**	3.1	Financial resources	Supplied from the agency
	4.2.4	Time efficiency	qualitative answer
	4.2.1	Saving on operational costs	Supplied from the agency, partially qualitative answer
	4.2.2	Additional Investment	Supplied from the agency Not available
Substitution or **Ricardo's effect**	1.1 - 1.3	Staff composition	Supplied from the Agency
	2.1	Cost of staff	Supplied from the Agency
	2.2	Cost of hardware	Supplied from the Agency
	2.3	Cost of software	Not available
	4.2.1	Saving on staff costs	Not available or not applicable
Back-office effect	4.2.3	Reorganization	Not available
	4.2.4	Time efficiency	Qualitative answer
	4.2.1	Saving on - Delivering time - Average waiting time	Supplied from the agency, partially qualitative answer
Schumpeter's effect	4.2	Cost of hardware	Supplied from the agency
	4.3	Cost of software	Not available
	4.4	Cost of consultancy	Supplied from the agency
	4.5	Cost of training	Supplied from the agency

Table 1d. Results for "Revenue On Line Services"

Effect	**Coefficients in (1)**	**Questions we refer in the questionnaire**	**Variables asked through the questions**	**Availability of data for the case study**
Market enlargement or **Smith's effect**	**B**	3.1	Financial resources	Not available
		4.2.4	Time efficiency	Qualitative answer
		4.2.1	Saving on operational costs	Supplied from the agency, partially qualitative answer
		4.2.2	Additional Investment	Not available
Substitution or **Ricardo's effect**	**C**	1.1 - 1.3	Staff composition	Supplied from the Agency
		2.1	Cost of staff	Supplied from the Agency
		2.2	Cost of hardware	Supplied from the Agency
		2.3	Cost of software	Supplied from the Agency
		4.2.1	Saving on staff costs	Not available or not applicable
Re – organisation effect	**D**	4.2.3	Reorganization	Supplied from the agency, partially qualitative answer
		4.2.4	Time efficiency	Qualitative answer
		4.2.1	Saving on - Delivering time - Average waiting time	Supplied from the agency, partially qualitative answer
Investment Led effect	**E**	4.2	Cost of hardware	Supplied from the agency
		4.3	Cost of software	Supplied from the agency
		4.4	Cost of consultancy	Supplied from the agency
		4.5	Cost of training	Supplied from the agency

*There are not specific data for UCL. ** There is not answer to more specific questions linked to this, like for example the percentage of eGovernment expenditure.

Table 2a. Time availability of data for "Agenzia delle Entrate"

Variables asked or proxied through the questions	**Years covered**	**Maximum years required**	**Remarks**
Financial resources	1	1	Difference between 2004 and 2001
Time efficiency	3	4	Partially for the year 2004
Saving on operational costs	1	1	Partially qualitative answer: time set to zero
Additional Investment	1	1	There is also an available data for the employment at the beginning of the program
Staff composition	3	4	
Cost of staff	1 – 3	3 – 4	Global data for hardware and basic software, for all services (not only e – gov services)
Cost of hardware	2	4	
Cost of software	2	4	
Saving on staff costs	1	1	
Reorganization	0 – 1	4	Qualitative (Y/N) answer
Integration of services	1	1	Qualitative answer
Saving on			
Delivering time	1		
Average waiting time	1	1	
Cost of consultancy	2	4	
Cost of training	2	4	

Table 2b. Time availability of data for "Criminal Justice"

Variables asked or proxied through the questions	**Years covered**	**Maximum years required**	**Remarks**
Financial resources	0	1	
Time efficiency	0	4	
Saving on operational costs	0	1	
Additional Investment	1	1	
Staff composition	1	4	
Cost of staff	0	3 – 4	
Cost of hardware	3	4	
Cost of software	3	4	There is also the percentage of replacement
Saving on staff costs	0	1	
Reorganization	0	4	
Integration of services	0	1	
Saving on			
Delivering time	0		
Average waiting time	0	1	
Cost of consultancy	2	4	
Cost of training	1	4	

Table 2c. Time availability of data for "Bundesministerium für Justiz"

Variables asked or proxied through the questions	**Years covered**	**Maximum years required**	**Remarks**
Financial resources	1	1	
Time efficiency	1	4	Qualitative answer
Saving on operational costs	1	1	
Additional Investment	1	1	Global data for 4 different services
Staff composition	4	4	
Cost of staff	4	3 – 4	Average annual wage increase
Cost of hardware	4	4	There is also the distinction for ICT
Cost of software	0	4	It is not possible to quantify this cost due to the nature of voice (see the case study description)
Saving on staff costs	1	1	
Reorganization	0	4	
Integration of services	0	1	
Saving on			
Delivering time	1	1	
Average waiting time	1	1	
Cost of consultancy	4	4	There are not expenses in consultancy for 2 years
Cost of training	4	4	

Table 2d: Time availability of data for "Revenue On line Services"

Variables asked or proxied through the questions	Years covered	Maximum years required	Remarks
Financial resources	0	1	
Time efficiency	1	4	Qualitative answer
Saving on operational costs	1	1	Complex answers; supplied as an example from the Agency (see case study description)
Additional Investment	0	1	
Staff composition	4	4	
Cost of staff	4	4	
Cost of hardware	4	4	There is not the distinction for ICT
Cost of software	4	4	There is not the distinction for ICT
Saving on staff costs	1	1	
Reorganization	1	4	Complex answers; supplied as an example from the Agency (see case study description)
Integration of services	0	1	
Saving on			Complex answers; supplied as an example from the Agency (see case study description)
Delivering time	0	1	
Average waiting time	0	1	
Cost of consultancy	4	4	
Cost of training	4	4	

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