

WEB SERVICES, IT INTEGRATION AND VALUE GENERATION IN EGOVERNMENT: AN EXPLORATORY CASE STUDY*

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The IT value generation process in the public sector is still far from being well-understood and managed, both at the scientific level and in established practices. This paper investigates the enabling role of Web services technology in IT integration processes and its effects on IT value generation in the public sector. We advance the hypothesis that a higher degree of IT integration, enabled by the adoption of Web services technology, could lead to increased effectiveness in IT conversion, ultimately enhancing the value of IT investments. We offer a preliminary investigation into this issue based on an exploratory case study, drawing on an IT integration project implemented by the Italian City of Genoa. Our hypothesis would be rejected by the theory of IT conversion effectiveness, but confirmed if we extend the IT conversion process theory to the public sector, where it produces significant advantages in terms of IT value generation. The integration project investigated would not generate significant growth in the legacy IT asset portfolio, but would contribute to value generation. Our conclusions highlight pending issues and proposals for future research.

1. Introduction and research question

Over the past few years, efforts to integrate services and IT projects in the eGovernment sphere have been stepped up. Today, many eGovernment experiences and projects around the world no longer earmark IT expenditures for the creation of an IT infrastructure from scratch, which was typically the case at the outset. More often, IT expenditures are allocated to bridging, incorporating or integrating several parts of different, mainly unconnected, information systems (“islands of automation”). Even at the European Union level, a pan-European interoperability framework is currently being developed (European Commission 2004) [2]. Still, understanding and evaluating IT integration is difficult. Apart from the numerous theoretical and empirical works on IS project evaluation, there is no explicit IS theory to answer a quite obvious question: does IT integration actually produce benefits in eGovernment? In particular: how and why can IT integration projects and technologies contribute to value generation in eGovernment? Section 2 of this paper proposes to answer these questions by illustrating and commenting on the theoretical framework of “IT Conversion Effectiveness”. The main argument of this study is advanced by asking whether IT integration could contribute to IT value production in the public sector. Sections 3 and 4

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present an exploratory case study of an IT integration project implemented by the City of Genoa. Finally, Section 5 outlines our conclusions and proposals for further research.

2. A theoretical framework for IT value generation process in eGovernment

A good example of the empirical analysis of the IT value generation process is given in Markus and Soh (1993) [8], who evaluate IT investments in the US banking industry, based on the well-established “theory of IT conversion effectiveness” (Weill 1988 [16]; Weill and Olson 1989 [17]). The theoretical framework used by Markus and Soh is based on the concept that each organization enjoys a different level of “IT conversion effectiveness”, i.e. “the ability to convert expenditures into assets that provide value to the investing firm”. Indeed, “*IT expenditures are a necessary, but not sufficient, condition for producing IT assets*” (Markus and Soh 1993 [8] p. 39). According to the underlying theoretical framework, two classes of factors are believed to influence the capability of organizations to transform IT expenditures into valuable assets: structural factors (such as industry and company size, see below) and IT management factors. Therefore, the theory of IT conversion effectiveness is based on three key aspects:

1. Value is not generated by IT expenditures until they are converted into IT assets; accumulated IT assets include IT applications and IT infrastructure.
2. Structural factors can influence IT conversion effectiveness.
3. Internal IT management factors can also influence IT conversion effectiveness.

In particular, relative to the Public Sector, IT conversion effectiveness could be defined as the ratio between the value of IT assets and the IT expenditures that originated the IT assets:

$$IT\ Conversion\ effectiveness = Value\ of\ IT\ Assets / IT\ expenditures.$$

What is the “value” of an IT asset? First of all, it may be helpful to recall what an IT asset actually is for a firm: an IT asset is a tangible/intangible good originated by an IT expenditure; it may have an annual or a long-term useful life, i.e. the capability to produce revenues for one year (current asset) or for several years (fixed asset). We now need to transpose this notion of an asset to the Public Sector: in this context, an IT asset would be a tangible/intangible good originated by the IT expenditure; it may have an annual/long-term useful life, depending on its capability to produce public policy “effects” for one year (current asset) or for more than one year (fixed asset).

What is meant by the “effects” of a public policy? According to the literature on Public Policy (Regonini 1997 [10] and references therein), three types of effects can be identified in the Public Sector: policy outputs, policy outcome and policy impact. “Think about the problem of criminality repression: the figures about the number of blockades done, of judgments emitted, of barracks built, of bank verifications executed, give us a general view of what the public authority did in this sector, i.e. of the *outputs* of public policy against criminality; but *per se* such figures do not say anything about their actual capability to reduce the virulence of mafia organizations, that is their actual *policy impact*” (Regonini 1997, [10] p. 164). Here follows a more detailed classification:

Policy outputs: “Products of the PA activity, such as goods, services, payments, norms, put into the field in consequence of a public policy approval” (Regonini 1997, [10] p. 163).

Policy outcome: The *direct* result of the *action* taken by the policymakers (through policy outputs) on the policy recipients (Regonini 1997, [10] p. 163). Policy outcome does not include the influences of external factors that are outside the control of the policymaker (such

as, other administration policies, demographic effects, economic effects, social phenomena and trends, weather, natural events etc.).

Policy impact: the wider consequences, intended and unintended, of the policy on the community when combined with external factors that are outside of the policymakers’ control. “Talking about (policy) impact, we refer to the general aims of the public policy and to the (solution of) the problem that originated the policy itself (Regonini 1997, [10] p. 163).

Therefore, IT expenditures in the public sector might generate different kinds of IT “assets”, i.e. policy outputs. In the (Soh and Markus 1995) [12] schema, applied to the public sector in (Sorrentino and Virili 2005) [13], IT assets might be used to produce IT effects and then organizational performance. Figure 1 shows how IT assets (i.e. policy outputs) can be used to generate an IT-enabled policy outcome and then to produce an IT-enabled policy impact.

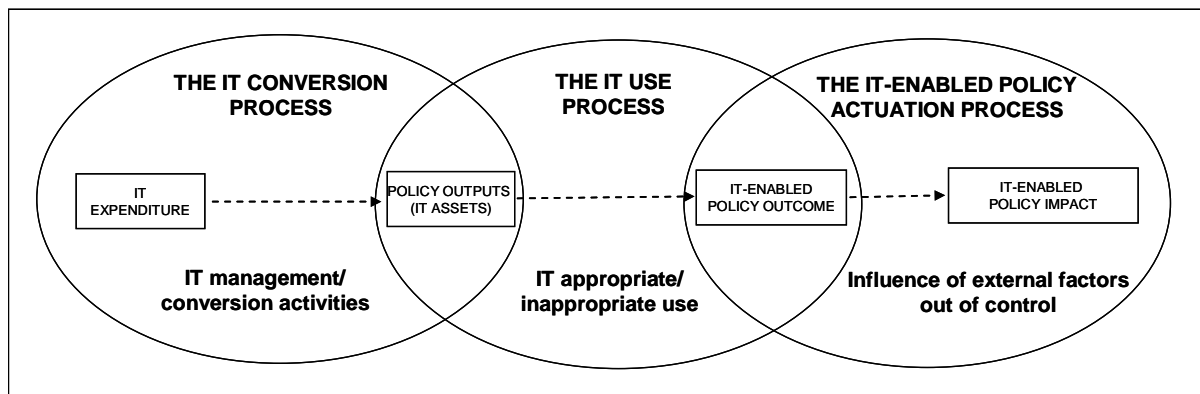


Figure 1: Adapting the theoretical framework proposed in (Soh and Markus 1995) [12] to the particular nature of public administration activity and outcome.

The process-oriented schema shown above should be regarded as a first attempt to adapt the theoretical framework proposed in (Soh and Markus 1995) [12] to the particular nature of the public administration activity and outcome. Given that the model in (Soh and Markus 1995) [12] is the result of a careful and profound effort of theoretical integration, much research work is still needed, both at the theoretical and at the empirical level, in order to complete, refine and validate the model. The schema presented in Figure 3 should be thought of more in terms of a promising direction for further elaboration than as a final theoretical framework.

Still, among the three sub-processes outlined in Figure 1, the IT conversion process in the left side of the schema appears to be less affected by the shift from private to the public sector compared with the subsequent stages. Furthermore, the underlying theoretical framework of IT conversion effectiveness appears to be solid and well-developed enough to proceed with our analysis in Section 4 below. IT integration is a widely discussed concept in eGovernment literature: see for example (Klischewski 2004) [5] and (Pardo et al. 2004) [10].

How does IT integration affect IT Conversion Effectiveness in the PA? We hypothesise:

$$IT\ Conversion\ Effectiveness\ in\ the\ PA = \frac{Value\ of\ IT\ Assets\ (policy\ outputs)}{IT\ expenditures}.$$

The IT integration process may affect existing IT assets, increasing *a posteriori* their value. Therefore, the working hypothesis of the following empirical analysis is that IT integration might positively affect the IT conversion effectiveness, by increasing *a posteriori* the value of the existing IT assets. To understand if, how and why this hypothesis can be supported by facts, the following section presents an exploratory case study. In particular, the case study analysed below underscores the enabling role of a specific IT integration technology, i.e. Web services.

3. Methodological set-up and project description

Why a case study? Case studies can achieve a holistic understanding of cultural systems of action (Feagin, Orum and Sjoberg, 1990 [3]; Tellis, 1997 [14]), and facilitate multi-perspective analysis aimed at the study of complex, dynamic social phenomena that are both context and time-dependent (Orlikowski and Baroudi, 1991 [9]). The sketches of empirical evidence offered here are not intended to represent an exhaustive, well-grounded and detailed analysis of the effects of IT integration on IT value generation in PA, but are exploratory in nature, aimed at drawing a preliminary picture of the phenomena under observation and at providing orientation for further data collection and analysis. The case study is based on open interviews and on project documents collected at the project site.

The aims of the IT integration project subject of our case study were to connect a software application that was originally built as a stand-alone solution with a one-stop eGovernment services portal, based on Web services technology. The original “Commerce Regulation” (CR) application was designed to enable the City of Genoa to issue commercial permits. CR implementation started in 2002. The CR project was carried out by an external software company, Engineering SpA. The application went fully operational in Summer 2003. The benefits of the CR system, compared with the old procedures and practices, met a general policy approach, demanding a more modern, more efficient, lighter and less bureaucratic administration. Nevertheless, our focus is not on the CR system itself.

A few months later, in 2004, the City of Genoa embarked on an important project (the ‘SEAP’ project) aimed at the integration of a one-stop services portal for firms. The SEAP project was co-financed as part of the first round of the Italian eGovernment Action Plan. In order to issue integrated services, the SEAP system was designed to interact with four legacy systems: Commerce Regulation, Sanitary Regulation, Building Regulation, Environment Regulation. The four legacy systems had been implemented independently, at different times and by different administrative units, on different hardware and software platforms and different architectures. Various IT vendors had contributed to building and implementing the four systems interacting with SEAP.

The whole SEAP integration drive was (and still is) significant, involving several administrative units in partnerships with different vendors. Our investigation in this area focused on the IT integration (sub)project that connected the Commerce Regulation system with the SEAP portal. The Commerce Regulation Integration (or “CRI”) subproject accounted for a relatively small part of the whole SEAP integration project, but was still significant. And the fact that it had just been completed and delivered (again by Engineering SpA) when we started this research, thus made it an ideal candidate for our exploratory analysis.

4. Discussion: IT integration and IT value generation in the City of Genoa

To return to our question of “How and why can IT integration projects and technologies contribute to value generation in eGovernment?” we recall the working hypothesis: The IT integration process –including the enabling technologies adopted – may have an impact on existing IT assets, enhancing their value a posteriori. In order to test this working hypothesis, a few key points of the CRI case study deserve special attention: the enabling role of the Web services technology; and the question of whether the CRI integration project is actually adding value to the original CR system.

The enabling role of Web services technology in IT integration

According to the development team of the software provider, the adoption of Web services (WS) technology was not actually the result of an autonomous decision process. It was a mandatory technical requirement of the CRI project, stated at the national level by the Italian eGovernment Action Plan. We asked both the software company's development team and the Chief Information Officer (CIO) if the peculiarities of WS technology had to be regarded as determining and unique for project success, and why. According to the CIO, alternatively, the CRI system could have been built on a "case-by-case" basis, i.e. creating and managing points of data interchange (based on direct database connections or batch file processing) in each of the different software environments to be integrated. In particular, the CR system would have required significant modifications using the Oracle Developer software development platform in PL/SQL language. According to the development team of the software company, another technically viable alternative would have been to use pure XML. To use the developer's words, the Web services integration approach "*simplifies life greatly when you have to make different worlds talk to each other; Web services software components are just black boxes, we don't have to worry about the content inside*".

While we only have room to outline a few sketches of empirical analysis in this exploratory study, the overall impression is that the key enabling role of WS technology stems from its XML-based and component-based nature. Being XML-based, it enables standard, low-cost and ubiquitous inter-application communication; being component-based, it enables reuse and emergent, incremental development. Both aspects were strongly leveraged in the CRI project.

Is the CRI integration project adding value to the original CR system?

If the value generation analysis is confined to the IT conversion process shown on the left side of Figure 1, we would deduce that, in our case study, *IT integration does not generate a significant portfolio of new assets, therefore, it has negligible effects on IT value generation*. However, a more detailed analysis of the value of IT assets in the public sector enables us to reformulate the question as follows: "What value is added to the CR system by the CRI integration project *in terms of the new capabilities of the CR system to produce effects under appropriate conditions*? In other words: is the post-integration CR system capable of achieving the underlying policy objectives (outcome and impact) better than before?"

Taking into account that the CRI project was delivered only recently, we were unable to collect direct tangible evidence on it. We could only record the positive response towards the CRI system by some of the stakeholders, for example, the system users, managers and policymakers. Tables 1 and 2, below, outline an illustrative evaluation of the possible policy effects of the CR+CRI system (CR before and after IT integration). Table 1 outlines the CR system pre-IT integration. Table 2 takes into account the CR system post-IT integration with SEAP, i.e. after the delivery of CRI. Column 1 indicates a negligible increase in the IT assets post-integration, as mentioned above. A few illustrative dimensions for IT-enabled policy outcome and policy impact are reported in the second and third columns of both tables, respectively. The overall opinion is that policy outcome (e.g. "less bureaucracy") is reinforced by the integration drive.

Commerce Regulation System before IT integration with the SEAP portal (CR)		
Outputs/IT assets	IT-enabled policy outcome (IT assets put into use)	IT-enabled policy impact (affected by external factors)
HW, SW and working procedures of the CR system replace the previous paper-based practices	Less bureaucracy: more efficient and lighter administrative procedures.	Stimulate economic vitality.

Table 1: IT assets and IT-enabled policy outcome/impact of the CR system before IT integration

Integrated Commerce Regulation System after IT integration with the SEAP portal (CR+CRI)		
Outputs/IT assets	IT-enabled policy outcome (IT assets put into use)	IT-enabled policy impact (affected by external factors)
CR system + CRI system. CR assets now include several new HW and SW systems dedicated to integration with the SEAP portal.	Less bureaucracy: more efficient and lighter administrative procedures; easier and wider access to services by citizens via Internet. Heightened transparency and accountability: on-line process tracking.	Stimulate economic vitality. Improve quality of life (e.g. less traffic congestion).

Table 2: IT assets and IT-enabled policy outcome/impact of the CR system after IT integration

That impression is confirmed by data resulting from similar experiences with one-stop portals in Italy, according to the Report of the European Commission to the Council and the Parliament (February 2004): two years after the introduction in Italy of the “*Sportello Unico per le Imprese*” (one-stop e-government services portal for firms), the average time needed to obtain the administrative permits to launch a new company was reduced from 22 to 6 weeks (time-saving of 73%); administrative procedures were reduced from 21 to 12 weeks (-43%); administrative costs were cut from €7,700 to €3,516 (cost-saving of 54%); while for an individual enterprise, the time spent on red tape was cut from 16 weeks to just 1 week (-93%), on procedures it was reduced from 11 weeks to 5 (-54%), while costs shrank from €1,150 to €340 (-70%).” (Bellé 2004, [1] p. 1).

5. Conclusions and proposals for future research

Neither definitive nor rigorous answers can be provided to our research questions: value generation in the public sector is a complex process, a terrain that remains unexplored in many aspects, especially in terms of the various levels and dimensions of IT-enabled policy effects. The current work is based on a theoretical framework still under development; the empirical evaluation has been carried out in an exploratory way. Nevertheless the process theory approach (Mohr 1982 [6]; Markus and Robey 1988 [7]) adopted here, based on (Soh and Markus 1995) [12], opens several promising horizons:

1. it sheds light on the three different levels at which IT integration efforts may affect the value generation process: the conversion of IT expenditures into IT assets; the proper use of IT assets aimed at policy outcome; the achievement of policy impact;
2. it shows how IT integration projects (such as the CRI project) may have negligible direct effects on IT assets, but a significant effect on policy outcome and policy impact;

3. it highlights how Web services technology could play a significant enabling role in IT integration and, ultimately, on policy outcome and policy impact, thanks to its intrinsic characteristics (XML ubiquitous access and extensibility; component-based reusability).

Several research paths may branch off from this starting point: from the theoretical viewpoint, an extensive analysis of public policy evaluation literature – in contrast with IS literature on IT value generation – would pave the way to a more definitive and rigorous theoretical integration effort. The empirical analysis of the contribution of IT integration to IT value generation processes would require the definition of appropriate metrics for IT-enabled policy evaluation. More generally, an empirical analysis of the impact of IT integration on value production might be based on the comparative evaluation of the contribution of IT assets to value production (before and after integration). With this aim, an apparently promising technique was recently advanced in (Tillquist and Rodgers 2005)[15]. To identify the contribution of IT within the value generation processes, the authors employ the so-called Dependency Network Diagram (DND) methodology. DND traces down the atomic activities contributing to value generation, identifying dependency relationships between the intervening actors and resources. The DND-based analysis of an information system (before and after an IT integration effort) may be a powerful way to analytically and more rigorously determine how the IT integration effort may leverage existing IT assets to accrete value, in apparent contradiction to the theory of IT conversion effectiveness, as discussed earlier in Section 4.

In conclusion, we have a great deal more work ahead of than behind us. After all, it is a good sign.

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