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Organizational Innovation and Change

Managing Information and Technology

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Introducing and Discussing Information and Technology Management for Organizational Innovation and Change

Cecilia Rossignoli, Mauro Gatti and Rocco Agrifoglio

Abstract This chapter focuses on the interplay between information technology and organizational systems. It introduces the volume, providing a brief overview of some of the most relevant frameworks, approaches, and tools in the IS field which will be discussed later. The volume is divided into II parts, each one focused on a specific theme, such as 'ICT, organizational innovation and change' and 'ICT and knowledge management'.

This book explores a range of critical issues and emerging topics relevant to the linkages between information technology and organizational systems. It encourages debate and opens up new avenues of inquiry in the field of Information Systems, organization and management studies, by investigating themes of growing research interest from multiple disciplinary perspectives such as organizational innovation and impact, information technology, innovation transfer, and knowledge management.

The title of this book, 'Managing Information and Technology for Organizational Innovation and Change', already implies the understanding that information and technology are two crucial factors for developing innovation and for managing change within organizational contexts. Information and technology were widely recognised by the managerial literature as a major source of competitive advantage and increased business performance [1, 2]. In the last decades, organizations have increasingly invested in Information and Communication Technology (ICT) for improving their efficiency and effectiveness and thus for providing an opportunity for their businesses. Indeed, ICTs were often recognized as a way to develop organizational innovation and to lead organizational change [3–6]. However, empirical experience has immediately shown that ICT adoption is

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a necessary but not sufficient condition for improving individual, group and organizational performance, so opening the academic debate on the relevance of managing information and technology within an organizational setting.

In respect of other disciplines, the IS literature was often reluctant to generalize the relationships between information technology and organizational change. Building upon the research of Pfeffer [7], Markus and Robey [5] and Orlikowski [8], it is well-known that organizational change could be caused by information technology—the so-called technological imperative, by the motives and actions of information technology designers aimed at satisfying manager's information processing needs—the organizational imperative, and by the interaction between information technology and its human and organizational users—the emergent perspective. Thus, technology is both an external force influencing organizational structure and the outcome of managers' strategic choices and social actions. On the other hand, as Orlikowski [8] stated, the link between technology and organizations is affected by the human actions and by the socio-historical context where technology is developed and used.

Recognizing the existence of such different paradigms, this volume stresses the relationships between ICT, organizational innovation and change and looks to enhance their ties. On the other side, it also explores the role of information and knowledge within organizational settings by emphasizing the contribution of ICT in knowledge management activities.

The volume is divided into II sections, each one focused on a specific theme such as 'ICT, organizational innovation and change' and 'ICT and knowledge management'. The content of each section is based on a selection of the best papers (original double blind peer reviewed contributions) presented at the annual conference of the Italian chapter of AIS, held in Genoa, Italy, in November 2014.

1 Part I: ICT, Organizational Innovation and Change

This section explores the relationships between ICT, organizational innovation, and change. The aim of this section is to investigate the factors leading individuals and organizations towards ICT's adoption and usage, as well as the effects of such technologies on working practices, interaction and communication between people, and the organizational structure.

ICTs are part of corporate transformations in today competitive environments, often enabling new organizational forms and business models both in the Public and Private Sectors. Organizations expect to use the new ICT to run new processes, innovate products and services, reduce operating costs, and improve business management aimed at transforming their internal structures into better achieving organizations. The adoption and usage of ICT is usually accompanied by redesigning the business processes and changes in the organizational structure.

Empirical evidence and academic literature have widely shown that the effective implementation of new ICT is one of the most challenging tasks faced by managers,

since it requires people to understand, absorb and adapt to the new requirements [9, 10]. Managers often consider the implementation and adoption of ICTs as a way for promoting and realizing organizational and managerial changes [11–14]. However, organizational change does not only arise from ICT adoption and usage, but also depends upon a combination of technical and social influences which cannot always be controlled [15, 16]. Indeed, the success or failure of ICT implementation and adoption are mediated by a number of factors, many of which require an in-depth understanding of the organizational context and human behaviour [10, 17–21].

This part of the volume has 10 contributions aimed at exploring the interplays between ICT, organizational innovation and organizational change, by using different methodologies, theories and approaches. These researches stress the role of ICT, discussing the limiting and encouraging factors in technology adoption and usage and the effects of such technology on organizations arising from the interaction with human choices and institutional properties.

Spagnoli, Bellini, and Ghi's paper aims to develop a methodology for evaluating the economic, social, legal and environmental impacts of a cloud computing initiatives in the Italian PA and, in particular, in the Ministry of the Economic Development.

Castelnovo, Sorrentino, and De Marco explore a new e-government initiative in Italy, named municipal One-Stop Business Shops (SUAPs), developed and launched by Italian legislator in 1998 for simplifying government relations with business and industry.

Spinelli analyzes the literature on IT adoption in SMEs and combines perspectives from various research streams in order to identify its determinants—barriers and incentives. The paper explores well-established research areas and aims at highlighting links which are underdeveloped or ignored, and provides directions for future research.

Marchegiani and Rossi's paper also explores the interplay between technology and organizational change, but focusing on the effects of recent technological innovations on the valorization of cultural heritage. This research is aimed at identifying the sense-making that each actor confers to the technological innovations, and its impact on cultural heritage valorization.

Zardini, Rossignoli and Campedelli, instead, explore the interplay between ICT and organization within a peculiar sector of Italian PA, such as the healthcare sector. Using the Zaharia and colleagues framework, the study investigates the impacts of Electronic Medical Record's (EMR) implementation in an Italian university hospital.

Ennas, Marras and Di Guardo investigate the trends in microprocessor market in order to understand if competition between rival technologies can be reopened after a dominant paradigm occurs. The results show the existence of a non-conventional S-curve trend.

Depaoli, Resca, De Marco and Rossignoli aim to assess Claudio Ciborra's legacy of Information Systems Studies and Organizational Studies. Comparing Ciborra's seminal work, 'The Labyrinths of Information', with papers published in

four top IS journals, the research shows that Ciborra's thinking contributed to the swing toward a more praxis-oriented attitude in the IS discipline.

Based on the social innovation literature, and digital social innovation in particular, Passani, Spagnoli, Bellini, Prampolini and Firus's paper analyzes the social, economic, political and environmental impacts of the Collective Awareness Platform for Sustainability (CAPS) by using an ad hoc methodology, such as IA4SI, developed for assessing the projects related to digital social innovations.

Pozzi, Pigni, Vitari, Buonanno, and Raguseo conduct a literature review on the business model studies in the IS discipline. Using an electronic search, the paper provides an overview of business model studies in IS field, highlighting the main research streams and limitations.

Finally, using a case-study method, the paper of Makhlouf and Allal-Cherif explores the consequences of simultaneous implementation of different process approaches in Telkom. The research is aimed at analyzing the contributions of the implementation of these approaches and problems resulting concerning governance, agility and strategic flexibility.

2 Part II: ICT and Knowledge Management

This section explores the relationship between ICT and knowledge management. The aim is to investigate how individuals, groups and organizations manage information and knowledge and which technologies enable them to run this process more efficiently.

The literature has widely recognized knowledge as a strategic asset for organizational growth and sustained competitive advantage [9, 22–26]. Nowadays, organizations view knowledge as a crucial resource, a key for survival and success mainly due to high competition and increasingly dynamic environments. Unlike before, the business complexity and the growth in information volume, velocity, and variety have significantly increased the difficulties for individuals in managing knowledge activities within organizational settings [9, 27]. People need advanced effective methods and tools to take advantage of the ways that knowledge is acquired and exploited within organizations [28, 29]. In order to face knowledge management issues, software houses and vendors have designed various platforms enabling organizations to develop, share and access huge quantities of available resources from internal and external sources [30]. Recently, organizations are often looking for new ways and tools to acquire knowledge from outside [31, 32]. Communities of practice and cloud, social and mobile platforms are some examples [33–35].

This part of the volume has 10 contributions aimed at exploring the interplays between information, technology, and knowledge management. Using different methodologies, theories and approaches, these researches stress the different concepts and meanings of information and knowledge, discussing the role of various

platforms in creating, sharing and storing knowledge within an organization and between organizations.

Marzo and Braccini's paper aims at investigating the behavioural differences between digital natives and digital immigrants in terms of trust and control. This research designs an experiment based empirical study that might highlight potential differences in trust and control dynamics between digital natives and immigrants. It provides an insight into psychological aspects whose dynamics might influence individuals' behavior in teams.

Caporarello, Magni and Pennarola explore the interplay between ICT and learning within the education sector. The paper investigates the support factors influencing tablet-mediated learning effectiveness by stressing the role of 'Support Activities' in determining it.

Abbate and Cesaroni focus on the crucial role of information within academic spin-off companies. Using an explorative qualitative analysis, the paper explores how academic spin-off companies generate and disseminate useful market information within their organizational boundaries. Findings show the relevance of the activities of generation, dissemination and integration of market information for academic spin-off companies.

Ambrosino and Sciomachen's paper explores product flows within the multi-channel distribution network with the aim of minimizing logistic costs. It describes and compares different inventory management policies and presents a two-phase procedure aiming at integrating, in the same framework, inventory and distribution functions thanks to information sharing.

Dameri, Garelli and Resta's paper explores the relationships between information, technology and organizations. The paper focuses on the unsupervised neural networks (NN) for analysing data regarding business performance at infra-city level. A micro-territorial dash-board based the unsupervised neural networks for collecting business performance data and thus for supporting small territory development policies was developed and tested in the Municipality of Genoa.

Delibes Rodriguez and Hart's paper focuses on the Pre-emptive Customer Experience Management Systems, tools designed for collecting the customer experience data through network experience survey. This research explores how those systems are designed and implemented and how they should be, and what their benefits are for mobile broadband communication.

Ficco and Rak address their research on the topic of cloud computing, focusing on the threats arising from cyber attacks, and 'Economic Denial of Sustainability' (EDoS) in particular, against cloud applications. The paper proposes an approach to mitigate economic effects of EDoS attacks against cloud applications.

Like the Ficco and Rak research, Amato, Di Martino, Xhafa, and Venticinque's paper also investigates the cloud computing paradigm, but by focusing on the different techniques and tools that support users in decision making. Using the combination of the Grid and Cloud paradigms, it proposes a methodology that provides the flexibility of Cloud Computing avoiding the need for users to learn new resource access.

Raguseo, Vitari and Pozzi, instead, explore the relationship between ICT and knowledge management, focusing on a peculiar platform for generating and capturing data natively in digital form, integrating this data in the appropriate business processes, and effectively managing data once produced. In particular, this research investigates whether the development of the Digital Data Genesis dynamic capability in firms leads to valuable outputs in terms of data quality and data accessibility.

Finally, Rocchi, Spagnoletti and Datta investigate digital platforms with particular reference to their maintenance process from the perspective of the software vendor. The paper aims to explore the digital platform evolution processes in order to identify new methods for guiding the emergence of complex socio-technical systems.

References

1. Porter, M.E.: Technology and competitive advantage. J. Bus. Strategy **5**(3), 60–78 (1985)
2. Melville, N., Kraemer, K., Gurbaxani, V.: Information technology and organizational performance: an integrative model of IT business value. MIS Q. **28**(2), 283–322 (2004)
3. Orlikowski, W.J.: CASE tools as organizational change: investigating incremental and radical changes in systems development. MIS Q. **17**(3), 309–340 (1993)
4. Orlikowski, W.J.: Improvising organizational transformation over time: a situated change perspective. Inf. Syst. Res. **7**(1) (1996)
5. Markus, M.L., Robey, D.: Information technology and organizational change: causal structure in theory and research. Manag. Sci. **34**(5), 583–598 (1988)
6. Ricciardi, F., Rossignoli, C., Zardini, A.: Factors influencing the strategic value of IT: a literature review. In: Jun, Y. (ed.) Humanities, social sciences and global business management. Singapore Management and Sport Science Institute, Singapore (2012)
7. Pfeffer, J.: Organizations and organization theory. Pitman, Marshfield (1982)
8. Orlikowski, W.J.: The duality of technology: rethinking the concept of technology in organizations. Organ. Sci. **3**(3), 398–427 (1992)
9. Gatti, M.: Cultura d'impresa, innovazione e conoscenza. In: Brondoni, S.M. (ed.) Market-driven management, concorrenza e mercati globali. Giappichelli, Torino (2007)
10. Magni, M., Pennarola, F.: Intra-organizational relationships and technology acceptance. Int. J. Inf. Manag. **28**(6), 517–523 (2008)
11. Rossignoli, C.: Coordinamento e cambiamento. Tecnologie e processi interorganizzativi, FrancoAngeli (2004)
12. Agrifoglio, R., Metallo, C.: ERP acceptance: the role of affective commitment. In: D'Atri, A., De Marco, M., Braccini, A.M., Cabiddu, F. (Eds.) Management of the interconnected world. Springer, Berlin (2010)
13. Metallo, C.: L'evoluzione dei sistemi informativi: un'analisi nei contesti information-intensive. ARACNE editrice, Roma (2011)
14. Mola, L., Pennarola, F., Za, S.: From information to smart society: environment, politics and economics. Lecture Notes in Information Systems and Organisation (LNISO), vol. 5. Springer, Berlin (2015)
15. Robey, D., Sahay, S.: Transforming work through information technology: a comparative case study of geographic information systems in county government. Inf. Syst. Res. **7**(1), 93–110 (1996)

16. Giustiniano, L., Bolici, F.: Organizational trust in a networked world: analysis of the interplay between social factors and information and communication technology. J. Inf. Commun. Ethics Soc. **10**(3), 187–202 (2012)

17. Davis, F.D., Bagozzi, R.P., Warshaw, P.R.: User acceptance of computer technology: a comparison of two theoretical models. Manag. Sci. **35**(8) (1989)

18. Venkatesh, V., Morris, M.G., Davis, G.B., Davis, F.D.: User acceptance of information technology: toward a unified view. MIS Q. **27**(3), 425–478 (2003)

19. Braccini, A.M.: Does ICT influence organizational behaviour? An investigation of digital natives leadership potential. In: Spagnoletti, P. (Ed.) Organizational change and information systems. Lecture Notes in Information Systems and Organisation, vol. 2, pp 11–19 (2013)

20. Agrifoglio, R., Metallo, C., Black, S., Ferrara, M.: Extrinsic versus intrinsic motivation in continued Twitter usage. J. Comput. Inf. Syst. **53**(1), 33–41 (2012)

21. Agrifoglio, R., Metallo, C., Lepore, L.: Success factors for using case management system in Italian courts. Inf. Syst. Manag. (In Press)

22. Nonaka, I.: A dynamic theory of organizational knowledge creation. Organ. Sci. **5**(1), 14–37 (1994)

23. Miller, D., Shamsie, J.: The resource-based view of the firm in two environments: The Hollywood firm studios from 1936 to 1965. Acad. Manag. J. **39**(3), 519–543 (1996)

24. Teece, D.J.: Capturing value from knowledge assets: the new economy, markets for know-how, and intangible assets. Calif. Manag. Rev. **40**(3), 55–79 (1998)

25. Alavi, M., Leidner, D.E.: Knowledge management and knowledge management systems: conceptual foundations and research issues. MIS Q. **25**(1), 107–136 (2001)

26. Schultze, U., Leidner, D.E.: Studying knowledge management in information systems research: discourses and theoretical assumptions. MIS Q. **26**(3), 213–242 (2002)

27. Malhotra, Y.: Integrating knowledge management technologies in organizational business processes: getting real time enterprises to deliver real business performance. J. Knowl. Manag. **9**(1), 7–28 (2005)

28. Spagnoletti, P., Resca, A.: The duality of information security management: fighting against predictable and unpredictable threats. J. Inf. Syst. Secur. **4**(3) (2008)

29. Rossignoli, C., Mola, L., Cordella, A.: Reconfiguring interaction through the e-marketplace: a transaction cost theory based approach. In: Dwivedi, Y., Lal, B., Williams, M., Schneberger, S., Wade, M. (eds.) Handbook of research on contemporary theoretical models in information systems, pp. 311–324. Information Science Reference, NY (2009)

30. Zardini, A., Mola, L., Vom Brocke, J., Rossignoli, C.: The role of ECM and its contribution in decision-making processes. J. Decis. Syst. **19**(4) (2010)

31. Lindkvist, L.: Knowledge communities and knowledge collectivities: a typology of knowledge work in groups. J. Manag. Stud. **42**(6), 1189–1210 (2005)

32. Handley, K., Sturdy, A., Fincham, R., Clark, T.: Within and beyond communities of practice: making sense of learning through participation, identity and practice. J. Manag. Stud. **43**(3), 641–653 (2006)

33. Alvino, F., Agrifoglio, R., Metallo, C., Lepore, L.: Learning and knowledge sharing in virtual communities of practice: a case study. In: D'Atri, A., Ferrara, M., George, J.F., Spagnoletti, P. (Eds.) Information technology and innovation trends in organizations. Springer, Berlin (2011)

34. Francesconi, A., Bonazzi, R., Dossena, C.: Solar system: a new way to model online communities for open innovation. In: Spagnoletti, P. (Ed.), Organizational change and information systems. Lecture Notes in Information Systems and Organisation, vol. 2, pp. 205–214 (2013)

35. Schiavone, F., Metallo, C., Agrifoglio, R.: Extending the DART model for social media. Int. J. Technol. Manag. **66**(4), 271–287 (2014)

Part I
ICT, Organizational Innovation and Change

A Methodology for the Impact Assessment of a g-Cloud Strategy for the Italian Ministry of the Economic Development

Francesca Spagnoli, Francesco Bellini and Alessandra Ghi

Abstract The paper has the objective to provide a methodology for the socio-economic, technological and environmental impact assessment of a Cloud Computing strategy for the Italian Ministry of the Economic Development and more specific at the service of the Department for Communications. In order to develop a detailed and tailored model for implementing the g-Cloud strategy, we analyse the current services and functions performed by the Department for Communications of the Italian Ministry of the Economic Development, showing the current ways of managing information flows within and outside the administration. Starting from the available background analysis on the current state of the art of the adoption of g-Cloud services in Europe and USA, we provide assumptions and hypotheses for the definition of the g-Cloud Strategy. We then compare the requirements provided by the General Directorates of the Department for Communications of the Italian Ministry of the Economic Development in order to validate the hypotheses previously defined. By reviewing the approaches for the impact assessment available from literature review, we define the best effective methodology for assessing the potential impacts of g-Cloud strategies. The methodology considers four areas of impact: economic, social, legal and environmental impacts. For each area of impact we identify specific indicators for the assessment of efficiency and effectiveness of Cloud Computing initiatives in the Italian PA that have been validated by a set of Cloud Computing experts.

Keywords g-Cloud computing · Impact assessment · Methodology · Italian Ministry of the Economic Development

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1 Analysis of g-Cloud State of the Art in Europe, in Italy and in the U.S.A

1.1 European Cloud Strategies for the Public Administration

The European Economic and Social Committee, on January 20, 2011, decided to draw up an opinion on the subject: "Cloud Computing in Europe" [1], in accordance with art. 29, paragraph 2 of the Rules of Procedures. Based on Europe 2020 strategy [2], and in particular on the Digital Agenda, the European Economic and Social Committee (EESC) primarily aimed to gather and share experiences developed by stakeholders and the market in the Cloud Computing field. The opinion had also the objective of formulating a series of recommendations to encourage Europe to position itself at the head of this promising field, with the help of leading companies. The opinion highlighted potential economic benefits and weaknesses of the Cloud Computing technologies, which are mainly due to a lack of maturity. With reference to the economic model of Cloud infrastructures, the Economic and Social Committee supported the following elements as the most relevant for the full development of the economic model: a larger number of potential users, the sharing and optimization of resources, the users mobility, the easy, flexible and transparent integration of the technical components, the distribution of costs throughout the complete life cycle of the technology, the focus on the core business and the growth opportunities offered by the creation of new fields of activity. Instead, at European level, the weaknesses of Cloud technologies are mostly related to the lack of a core governance structure, the multiplicity of regulations, the lack of reference points to support the users to evaluate the potential risks, the fragility and the saturation of internet and servers, the risks related to outsourcing and relocation of data and processes in other countries with a different legal system, the complexity of the contracts available. However, the European Union understands the importance of Cloud Computing strategies in order to operate on a promising and strategic market. With specific reference to the adoption of Cloud Computing in the Public Administration, the Committee states that these technologies are fully legitimized in the general austerity context, as they do not require huge initial capital investments. Furthermore, public investments could generate a leverage effect by encouraging private national and European telecommunications operators to invest in Cloud Computing technologies.

1.2 U.S.A g-Cloud Strategy

Vivek Kundra, CIO of the US Government, is the creator of the Federal Cloud turning point [3], a first step for the technological modernization process that will generate greater efficiency and transparency on the US government. Kundra is the

head of strategic IT investments plans with a federal budget of over $70 million/year. Hence, the US government stands as the largest buyer of technology in the world. The US Government has developed a "Federal Cloud Computing Strategy" on 8 February 2011 with the aim to provide guidance to federal agencies on complying with the Cloud first strategy. The choice to turn to Cloud Computing technologies has been strongly supported by Obama, in order to reduce the government operation costs and make it safer, open and flexible. The expected number of IT services that will migrate to the Cloud are about $20 billion out of $80 billion broken down by individual agency, mainly based on private Cloud deployments. The decision framework for the migration of the US Government to Cloud technologies is based on three processes: selection, to analyse and identify the IT services to move and the time; provision to aggregate the demand, ensure interoperability and integration with IT portfolio, provide security contracts, repurpose legacy assets and redeploy freed resources; management, to shift IT mindset from assets to services, build new skill sets, monitor the compliance of the provider with SLAs and re-evaluate vendor and service models.

Within these processes, Kundra has first identified the IT operations that had not produced relevant results, to redirect $25 million to more profitable activities. The Cloud transformation has not only affected the technologies, but also the cultural and organizational processes of the US government. The processes started by the US government arise coherently in the broader dematerialization strategy and encourages the creation of new service delivery models. Within this context, it will be developed the Data.gov site that will gather and make available the information of the US government. Actually, the US government budget for the migration to Cloud Computing technologies is of $19 billion dollars. The US Government Cloud Computing strategy is aimed at changing how the institution thinks.

1.3   Italian Cloud Initiatives for the Public Sector

According to the Global Cloud Computing Scorecard [4] developed by the Business Software Alliance, which drafted a global ranking of countries prepared to deploy and use Cloud technologies, Italy is third in Europe and sixth in the World. In the first positions of the Global Cloud Computing Scorecard are Japan, USA, France, Germany and Australia. The research was based on several indicators, mainly related to the quality of infrastructures and effectiveness of the Italian legislations in terms of Cloud Computing cybercrime and privacy security. A negative element of the Italian government for the full adoption of Cloud Computing technologies is constituted by the slow bureaucracy, for instance legislation on the digital signature while is in line with the international standards, often encountering problems in its application. Unfortunately, in terms of adoption of Cloud Computing technologies for the Public Administration, we have no positive data. Indeed, Italy is in delay in adopting infrastructures, platforms and applications residing on the network, rather than on corporate servers. In addition to the physiological delay related to the decision, there

is also the lack of a central governance. Compared with the growing attention that the US federal government is devoting to the optimization of technological resources, and the adoption of Cloud Computing technologies in Northern Europe, in Italy we are far behind. The Italian Cloud and ICT as a Service Observatory of the Polytechnic Institute of Milan [5] analysed since 3 years ago the evolution of Cloud Computing in Italy through an empirical ad hoc research involving 35 Public Administration, in-house companies validated the results of the surveys. According to the Observatory, the Cloud infrastructure could be very useful for the Italian Government in order to reduce costs and the inefficiencies of the current systems to move to a new IT paradigm, to lower the critical mass of investments and skills required, also allowing the smaller Governments to access and benefit from a widespread digitisation. However, the analysis of the current technological situation of the Italian Government shows a fragmented infrastructure that is inefficiently handled. Looking at the current Data Center scenario, an important source of cost and complexity is involved in managing the IT infrastructure, as the central Government has 1033 Data Centers, plus 3000 Data Centers of local Governments. The hardware of these Data Centers is managed unevenly and is used only for a fraction, with an use of the virtualisation techniques only for a 25 % of its potential. Consequently, the IT spending, although not high in absolute terms, is inefficient and is hiding management costs approximately per 1 billion euro a year in human resources management and the energy expenditure is estimated at 270–300 million euro. According to the Italian Observatory, by following a rationalisation scenario and considering these three main aspects, in five years, the Italian Government could achieve a saving of 3.7 billion euro. Moreover, if the local Governments will start to use the virtualisation techniques more widely, they will overcome the 1 server—1 application paradigm and benefits could grow to 5.6 billion euro. The process of rationalisation of resources through the Cloud infrastructure will require a set of actions, including the most important that is the rationalisation of the infrastructure (Data Centers) to guarantee medium-term returns easy to quantify, removing the scepticism and pushing the Governmental actors to action. However in Italy, during the 2012, several positive initiatives were initiated for the adoption of g-Cloud infrastructures. For instance, one best practice is related to the Health sector, where the debate is more active. Indeed, several Local Health Authorities (ASL) tested online payments solutions and are adopted Cloud technologies (ULSS of Asolo).

2 Services and Functionalities of the Department for Communications of the Italian Ministry of the Economic Development

In order to correctly analyse the services and functionalities of the Department for Communications it is required to identify the different organization charts of the Department, which is constituted by 3 General Directorates, the Institute of

Communications and Information Technology (ISCOM), 16 Territorial Inspectorates of the Ministry of the Economic Development (Abruzzo e Molise, Calabria, Campania, Emilia Romagna, Friuli-Venezia Giulia, Lazio, Liguria, Lombardia, Marche e Umbria, Piemonte e Valle D'Aosta, Puglia e Basilicata, Sardegna, Sicilia, Toscana, Trentino—Alto Adige, Veneto) and the Staff Offices of the Head Department. A detailed description of activities developed by the 3 General Directorates and the High Institute of Communications and Information Technology (ISCOM) is required in order to identify the services provided.

2.1 General Directorate for Electronic Communication Services and Broadcasting

The General Directorate for electronic communication services and broadcasting is mainly aimed at granting authorizations for the sound and television system, and more generally for all electronic communications services acquiring royalties relating to concessions, providing grants to support publishing, monitoring on progress obligations in the electronic communications sector and in particular of the RAI contract service, controlling premium rate services, participating in the work of national and international organisations, as well as the formulation of legislative and regulatory proposals in the field of communications.

2.2 General Directorate for Planning and Management of the Radio Spectrum

The General Directorate for planning and management of the radio spectrum is aimed at allocating frequency band to the different radio-electrical companies, managing the allocation of frequencies to station of different services, protecting duly authorized services through the monitoring and control of the radio spectrum. The Directorate manages the radio spectrum through a coordination and technical assistance process for the resolution of specific problems with the collaboration of the Regional Inspectorates and the National Center for the control of radio frequency emissions, that is a body set up within the International Telecommunicaton Union in the field of Communications.

2.3 General Directorate for the Regulation of the Postal Sector

The General Directorate for the regulation of the postal sector establishes the conditions, prices and tariffs of services, defines the quality level of the postal

service and verifies the compliance of Poste Italiane spa, responsible for the provision of the service, applying penalties for breaches. This Directorate also sets the "Program Contract" with Poste Italiane spa. in order to regulate the relationship between the parties, ensures the compliance with the obligations of the service provision and participates in the work of international and European organisations.

2.4 Institute of Communications and Information Technology (ISCOM)

The Institute of Communications and Information Technology (ISCOM) is taking care of the experimentation and research, technical support to companies, institutions and citizens through the testing of activities, data and network security, check for ICT services quality, training, specialisation and dissemination in the field of electronic communication, regulation and standardisation. The School of Specialisation in Telecommunications is also part of the Institute of Communications and Information Technology.

3 A Model for Assessing the Impact of Cloud in the Italian PA

According to the commonly agreed approach [6], the methodology for the impact measurement we are proposing, is focusing on the inputs, outputs, outcomes and impacts approach, where:

- *Inputs* are the investments made in, or the resources required to produce a product or develop/undertake an activity.
- *Outputs* are the products or services provided (e.g. number of services created, papers published, events held, etc.).
- *Outcomes* are the immediate changes resulting from an activity—these can be intentional or unintentional, positive or negative (e.g. employment, increased usability and personalisation).
- *Impacts* are the net difference made by an activity after the outputs interact with society and the economy (e.g. higher and easier access to cloud services in new member countries leading to the increment of local human resources) (Tables 1, 2 and 3).

The methodology presented in this chapter is based on a quali-quantitative approach to impact assessment and builds on the principles of the Cost-Benefit analysis [7, 8] and of the Multi-Criteria analysis [9]. These two methods are seen as complementary to one another, as they help framing both impacts that can be represented in a monetary form, as well as impacts that are better described in

Table 1 Economic impact indicators

Economic indicators
Improve service/product/system quality
Reach more users
Improve the access to large amounts of data. Improve the possibility to exploit large amounts of data (more efficient data analysis)
More efficient data exchange
Improve scalability
Improve reliability
Improve recoverability
Improve portability
Reduce the time needed to deliver a service
Ability to better target users/beneficiaries' needs
Reduce hardware costs
Reduce connectivity costs
Reduce maintenance cost
Lower software development costs
Cost reduction due to increment in software reusability
Cost reduction due to improvement of test-deploy-rework cycle management
Cost reduction due to less process break/system failure
Cost reduction due to energy saving
Indicators of cloud ROI cost ratios
Availability performance compared to current service levels
CAPEX cost on premise ownership versus cloud
OPEX cost for on-premise ownership versus cloud
Cost effective cloud workload utilization
Percentage of IT asset workloads using cloud
Indicators of cloud ROI profitability
Rate of new product market acquisition
Indicators of cloud ROI saving models
Rate of time change of TCO reduction by cloud adoption
Rate of cost change of TCO reduction by cloud adoption
Increase in provisioning speed
License cost reduction from cloud adoption
Indicators of "perceived efficiency"
Content retrieving time-saving
Time savings accessing or using the service

non-monetary terms (such as social or technological impacts). The combination of the two methods enables us to not only consider a wide spectrum of impacts, but also to combine variables that need to be expressed in different ways. The methodology considers four areas of impact: Economic, Social, Legal and

Table 2 Legal impact indicators

Indicators of "legal offered efficiency"
Improve transparency level of the conditions for the provision of the cloud services
Improve fairness of the conditions for the provision of the cloud services
Ensure security of personal data
Ensure fair collection of personal data
Ensure fair processing of personal data
Ensure fair transfer of personal data
Ensure confidentiality of PA data
Assume liability for loss of data
Assume liability for failure to provide the cloud services
Assume liability for defective provision of the cloud services
Minimize violations of IPRs
Frequency of defective responses (SLA response error rate)
Indicators of l legal "perceived efficiency"
Transparency of conditions of use of the cloud services
Fairness of conditions of use of the cloud services
Easy procedures for accessing personal data by data subjects
User friendly procedures for exercising rights by data subjects
Notice-and-take down procedures to notify violations of IPRs

Environmental. For each area of impact we identify specific indicators to be validated by the experts in the next chapters for the assessment of Cloud Computing initiatives in the Italian PA. The process for the development of the methodology for assessing of the socio-economic, environmental and legal Impact of the Cloud Computing model for the Italian Public Administration is based on 4 steps:

1. Background analysis and literature review.
2. Definition of impact indicators.
3. Validation by a set of experts of the impact indicators.
4. Testing of the methodology on current available initiatives in the Italian PA.

With reference to the efficiency, we identified some indicators to be measured quantitatively and to be further expressed in monetary terms. The assessment of the efficiency will be made in two different ways and using two different viewpoints: the first, will be called "offered efficiency" and will be calculated by analysing the technological advances brought by the Cloud Computing infrastructures. The second, will be called "perceived efficiency" and will be calculated by asking the stakeholders and end-users to describe which are the benefits they experience by using the service/product offered by the PA through Cloud Computing infrastructures. Starting from the literature review and the previous considerations, we identified the following list of indicators for assessing the social, economic, legal and environmental impacts of Cloud Computing initiatives/projects in the

Table 3 Technical SOA impact indicators

Technical Indicators
Robustness: any system must be capable of withstanding errors which should not affect system stability
Security and confidentiality
Extensibility: the system must allow support for a variable number of users
Integration: the system must have the ability to communicate with other systems that they supported SOA
Management and provisioning: the system must ensure its management and monitoring of implemented services.
Based on open standards
Interoperability: the ability of a system or product has to work with other systems or products without special effort
Portability: it is possible that the application may be available on all machines regardless of the system architecture
Availability: to be freely available or that it is ready for use or used
Persistent: ensure the ability to store information of the system to return to the previous or retrieve information
On time: the response of the system should be given within an appropriate timeframe
Reliable or deterministic: the system should give the same result while making a deal with the same operators
Transactional: the system should be able to return to its state before the transaction started
Modifiability: is about the ease with which a change can be made to application architecture.
Support for extended web services protocols like decentralization, security, flexibility, ubiquity or extensibility

Italian PA. Below in the following tables we provide a list of indicators that could be used in assessing outputs efficiency (Tables 4 and 5).

Once the indicators are defined for measuring the impacts of the identified assessment categories, the third assessment step consists in measuring the related costs and benefits. In consistence with the principles of cost-benefit analysis, the evaluation of the benefits generated by a project/strategy may be evaluated by identifying the willingness that the society has to pay for obtaining that positive impact. The final assessment of a project/strategy efficiency, will be made by using the following indicators:

- Economic net present value (ENPV*) perceived: the difference between the discounted total economic benefits and costs. The benefits will be evaluated as (1) the total willingness to pay of the users (i.e. the average willingness to pay of the users multiplied for the total number of users), (2) the average time savings (in hours) per user multiplied for the average hourly salary of

Table 4 Environmental impact indicators

Environmental impact indicators
User count: number of provisioned users for a given application
Server count: number of production servers to operate a given application
Device utilization: computational load that a device (server, network device or storage array) is handling relative to the specified peak load
Power consumption per server: average power consumed by a server
Power consumption for networking and storage: average power consumed for networking and storage equipment in addition to server power consumption
Data center power usage effectiveness (PUE): defined as the ratio of the total data center power consumption divided by the power consumption of the IT equipment.
Data center carbon intensity: amount of carbon emitted to generate the energy consumed by a data center, depending on the mix of primary energy sources (coal, hydro, nuclear, wind, etc.) and transmission losses.

researchers/workers/users multiplied for the total number of users. The costs corresponds to the total budget of the project.

- B/C* ratio perceived, i.e. the ratio between discounted economic benefits and costs (as above).
- WTP/C* the Willingness to Pay is evaluated by the stakeholders and end-users and it is compared to the costs of the project. The Willingness to Pay of the user indicates how much a user is willing to pay for that service. If the total Willingness to Pay (WTP) calculated by multiplying the average declared by the users to the number of total users indicated in the project scenario) is greater than the cost of the project, i.e. the ratio WTP/C* > 1, it means that the services can be commercially sold on the market or however he can assess the marketability of this service. Otherwise, WTP/C* < 1 means that most likely the project can sell such a service and so it would be necessary to investigate any alternative business models or at least think about mixed business models (finance and marketing).

3.1 Results from the Interviews with the Experts of Cloud Computing for the Italian Public Administration

During a first round of interviews with a set of experts, the indicators previously mentioned were validated and consistently reduced, in order to provide to a second group of experts, only the indicators that can be effectively relevant for the analysis

Table 5 Social impact indicators

Social impact indicators
Changes in the volume of digitally available cloud resources
No. of services offering customisable access to content
Composite index of usability
Composite index of personalization
Composite index of expected impacts on improvements in way citizens experience PA online services
Support knowledge transfer
Make available high-quality knowledge/information to citizens
Support democratic processes/democratization
Enable diversity and individual expression
Make highly innovative services available to citizens
Develop services that will positively impact on citizens' everyday life
Reduce the digital divide
Flexibility for personalisation on a large scale/high interface adaptability
Reduce the work of the users (more operations will be automated)
Improve the way in which users communicate and collaborate with each other (the quality of the collaboration)/facilitate social interaction
Improve trust among PA target users
Improve citizens' trust in public administration
Support network creation/collaboration of enterprises working for the PA
Support network creation/collaboration among citizens

of a g-Cloud strategy for the Italian PA. Interviews were conducted with fourteen major experts in the Cloud Computing field for the Italian PA to explore the Cloud possible adoption process and outcomes for the Italian Public Administration. The open-ended interviews are one of the approaches used among researchers, and an increasing number of researchers are using multi-methodology approaches to achieve broader and often better results. Interviewing is currently undergoing not only a methodological change but a much deeper one, related to self and other [10]. We have structured each interview on six open-ended questions. The experts have been selected according to their experience and knowledge of national and international experiences of Cloud Computing services adoption both in private and public sectors, so they can effectively provide for a real and correct analysis. The interviews were conducted in different ways: on skype, face-to-face, by phone and by e-mail. In this paragraph we will focus on the analysis of the results of the six open-ended questions, presented in a single section. The experts were invited to express an opinion in terms of assessment of the benefits and legal issues, managerial and operational impacts of Cloud strategies for the Italian PA. With regard to

the first question, about the possibility of Cloud Computing to be a winning resource from an economic, operational and social point of view in the future of the Italian PA, all the experts answered affirmatively, pointing out a reduction in operating costs, especially in the short term on the condition of setting real effective implementation of Cloud strategies aimed at the control of process and data security. With reference to the second question, about the real and effective benefits of Cloud Computing for the Italian PA, experts have pointed out the relevance of cost reduction, as incurred for the effective use, the accessibility to all, the platform standardization, the increased data security and the continuous monitoring and improvement of the overall processes of service delivery to users. The third question was related to the possibility of a Cloud infrastructure to increase the legal and personal data management issues of citizens using the Public Administration services and focus on the measures that may be adopted to reduce such risks. All the experts have highlighted that the localization of the Cloud issues and the protective measures to be taken could improve the adoption of a specific legislation relating to data protection and the use of structuring agreements between the cloud services provider and the Public Administration, to protect the privacy. With reference to the fourth question, about the possibility of Cloud Computing to increase the operational risks (e.g., disaster recovery) of the Italian PA and what measures could be adopted, most of the experts answered negatively. However, experts have said that any hypothetical operational risks arising from the high levels of integration are waged through distributed cloud architecture, using a modeling approach to the Cloud for the provision of common services, also highlighting the importance of service delivery contracts and the contractors professional skills. With regard to the fifth question, about the possibility for the Italian PA to adopt a Cloud strategy in a short time, there is an uncertainty among experts. They have answered that although the intention of adopting Cloud Computing in Italian PA exists, however the current regulatory, contractual barriers and economic barriers (such as the shift of costs from capital costs to operating costs), and the transition costs on the expiry of the contractual delivery of IT services, every 3–5 years are slowing its adoption in the PA. With reference to the sixth question, on which typology of Cloud infrastructure to implement, if centralized or not, the experts have suggested the possibility for the government to manage a unified and centralized cloud, based on a distributed private infrastructure. Other assumptions made by the experts concerned the future convergence of different private Clouds into a single public Cloud, or the creation of a network of regional data centers on which to consolidate the municipalities data centers, also implementing cooperation policies with private Cloud service providers. The "Community" Cloud model based on the sharing of resources and services could be a model for the future.