

éditorial

Cloud computing and organisational design: towards a comprehensive research agenda

Due to the generative nature of digital technology (Yoo, Kulathinal, Wattal, 2015), new business models and therefore new ways of organising are continuously emerging, inducing a continuous change in the competitive. But despite their importance, digital business models and their organisational practices have rarely been addressed systematically. What should the future modes of organisation be?

In the knowledge economy, business models are closely related to value creation and its modalities. This has several implications, notably identifying the optimal modes of organisation for value creation in multiple spaces. Here, we consider one the most important dimensions of organisational design: cloud computing (CC). CC appears to be the newest trend in the virtualisation and “service-isation” of information systems (IS). It helps to make organisations more agile, by making it possible to run “anything as a service” (XaaS) (Oredo and Njihia, 2014). With CC, information technology (IT) becomes even more flexible;

for example, an organisation can manage and operate its IT (infrastructure and services) as a utility (like power or water) (Brynjolfsson *et al.*, 2010). More specifically, some vendors argue that CC solutions allow an organisation to upscale its operations quasi-transparently (including in the short term if necessary). It only pays for usage, thereby transforming fixed costs into variable costs (Motahari-Nezhad *et al.*, 2009; Marston *et al.*, 2011), and can (out) source its IT in the way it finds most convenient (e.g. selecting and changing external providers). At the same time, organisations must confront a variety of new issues (technical, legal, security, economic, organisational or societal) that must be addressed holistically. In this context, we need to better evaluate the organisational stakes related to CC. The issues relate to the readiness of IT departments, and more generally corporate management, to deal with these new approaches to resources. In particular, organisations can find it difficult to

evaluate and compare the different options available to them.

This suggests that, as a managerial practice, CC challenges every dimension of a firm's business strategy: its speed, scope, scale and source of value creation (Bharadwaj *et al.*, 2013). Consequently, there is a need for an overall and syncretic view of how it affects, or might affect, both firms and their performance measured in terms of cost, value, risk, competences, data and intellectual property rights (IPR) management. However, the CC literature is dominated by technical and to a lesser extent, security questions, while business issues have received very little attention (Bhattacharjee and Park, 2013). There has been some research into dimensions such as the classification of cloud business models (Weinhardt *et al.*, 2009), the cost effectiveness of computing clouds (Brumec & Vr ek, 2013, Kantere *et al.*, 2011), value creation in stock markets (Huntbeburth *et al.*, 2013), the ranking of cloud computing services (Garg, Versteeg and Buyya, 2013) and outsourcing business (Motahari-Nezhad, Stephenson & Singhal, 2009).

Needless to say, IT managers and companies as a whole are not necessarily well equipped to deal with the new context. Although the role of the Information Officers has evolved considerably in recent years, organisations can still find it difficult to assess available options, and ultimately to determine the CC configuration(s) that both meets users' needs and guarantees the comprehensive nature of the deployed approach. While service vendors are willing to help companies find the solution that is best for them, the situa-

tion is relatively new and comprehensive solutions need to be found.

CLOUD COMPUTING AS AN ORGANISATIONAL ISSUE

Although CC as a managerial practice presents a challenge to many facets of the organisation and therefore to organizing, some of the issues are not completely new. In particular, the question of IT outsourcing practices was addressed in the literature of the late 1980s and the 1990s (Bahli & Rivard, 2004). Most of the discussion can be summarised in terms of economic performance and, to lesser extent, the strategic implications of outsourcing (loss of competences, quality of service, etc.). Transaction cost economics, complemented by a strategic management perspective (the Resource-Based View among others) provided a framework for the understanding and analysis of many of the facets of IT outsourcing.

The advent of CC has raised similar issues. Their relevance is amplified by the nature of digital resources and relate to their location (especially data), contracting and pricing mechanisms, risk management (security, privacy) and IPRs. Transaction cost economics and the RBV are equally appropriate techniques that can be applied in the CC context, but with a major difference: the ubiquity of data and the inability to clearly define their frontier and localisation. Ongoing research at ANR CBOD (www.cbod.u-psud.fr) has highlighted several issues related to CC as a management practice. They can

be succinctly expressed as the organisational fit between IT and IS (String and Wolkoff, 2010). This provides a starting point for the delineation of several interesting dimensions: the functions of IT services (service level agreements, processes and interoperability), data management (access, operations, control and risk), the usability of IT services (notably with regard to data access and localisation), roles and competences (clarity of roles, alignment of competences, task bottlenecks and control, service delivery, etc.), organisational culture and governance structures. This helps to demonstrate how CC as an organisational “system” poses important managerial questions, while at the same time, opens up opportunities for innovation in the dissemination and bundling of digital resources.

In management science, CC is seen as belonging to the domain of decision making rather than in terms of organisational issues. In this context, the focus is on criteria such as cost, on-time delivery, capacity, dependability, risk, functionality and architecture¹. But the way companies and institutions organise their CC is less well documented. We therefore need an agenda that addresses organisational design based on CC, in order to understand how practices are implemented on the ground and their contingencies. A recent survey highlighted some of the dimensions that concern companies, notably related to data management,

service delivery, control and competences.

CLOUD COMPUTING: THE COMPUTER SCIENCE PERSPECTIVE²

From a technical perspective, CC is often associated with several dimensions of ageing technical information. In general, virtualisation refers to “the creation of a virtual version of a device or a resource”. In the case of CC, it refers to the creation of a virtual machine(s), managed by a software supervisor. CC is also associated with grid computing, which is based on the use of resources that “are loosely-coupled and accessible through a network”. Service oriented architectures (SOA) and software-based storage (SBS) are other key ingredients in the implementation and viability of CC approaches. These technical innovations offer various CC configurations including, for example, XaaS, SaaS, PaaS, IaaS, TaaS, NaaS, Maas, CaaS, etc.

This raises two issues: 1) the ownership of data centres and the geographical distribution of resources, especially with regard to resilience to hardware failure or natural disasters; and 2) resource provisioning. With respect to the latter, CC is fundamentally an on-demand system, which has reduced the need for, and availability of resources. Several other technical and

¹ For a review of the literature on decision making for CC, see the paper by Xiaolin Cheng in this special issue; for an early review of the literature on CC see Yang & Tate (2012).

² This section is based on Alessandro Solimano's paper: Deliverable 1, Task 1, CBOD project: www.cbod.u-psud.fr

non-technical questions arise: legacy software, pricing, vendor lock-in and governance.

TOWARDS A CC RESEARCH AGENDA

The above shows that CC challenges many organisational aspects. Several specific issues can be identified both for the research agenda and actions.

The issue of adoption

This topic is traditional in the IS literature, at the level of the individual, team and organisation. Sociological perspectives in particular (e.g. Giddens) have been used to understand the impact of IT artefacts on organisations. To be adopted, CC services must be supported by an “organizing vision” (Swanson and Ramiller, 1997) that is developed by their promoters. Ad hoc frameworks have also been used to explain “migration to the cloud” for specific applications (Bhattacharjee and Park, 2013). Large companies as end-users also addressed this issue from an operational point of view (CI-GREF, 2013).

However, the advent of CC as a fuzzy system requires a new approach in order to understand why and how organisations adopt it: What are the determining factors? Who are the key stakeholders? What are the governance structures? What is the role of IT vendors? What games are being played around and within organisations? All of these issues need to be better documented in terms of both practice and analytical approaches.

The issue of economics in decision making

The economics of CC remains to be addressed by researchers (Etro, 2011). A few recent papers have examined some relevant dimensions, for example by comparing in-house resources with external alternatives (Naldi and Mastroeni, 2016). However, there is a need to better document these dimensions, especially those related to pricing and cost mechanisms, economies of scale and scope (including vendors), market stability and finally the resource bundle (e.g. internal/external, per application) that is best-suited to the needs of end users.

Data, IPRs and legal issues

Moving digital resources outside the traditional boundaries of firms and organisations raises important issues related to data management (identification, localisation, control and re-insourcing), IPR (control and ownership) and privacy (the risk of infringing local rules, especially in the international context). These business and policy issues are often raised by executives, especially in the European context. There is a need to better document them, for example through a comparative analysis of different regional contexts (Europe, Asia, and North America among others).

The issue of risk

Risk is a particular concern for executives who must take CC decisions. Beyond a general discussion of risk intensity, there is a need to document

how the issue might, or should, be addressed in decision making, including with regard to uncertainties in contractual arrangements (Kalyvas *et al.*, 2013). This could take the form of a risk typology, together with a typology of the data and strategic options. It invites us to examine the dynamics of cloud solution proposals, the role of institutions and their evolution (Kshetri, 2013).

The issue of organisational frontiers and business modelling

CC is fundamentally an organisational issue, in the sense that organisational frontiers become fuzzy and instable. This is self-evident from a data localisation perspective and more generally, in business modelling. Although a few frameworks have already been developed that are more-or-less adaptable to digitisation (Osterwalder and Pigneur, 2010; El Sawy and Pereira, 2013), we need to go further and consider, on the one hand CC as a building block of business modelling and, on the other hand, its dynamics (Batteson *et al.*, 2015) on a much larger scale.

Cloud computing and the future of organizing

Finally, CC is not only about what firms and organisations do, it is also about what they might look like in the near future. We therefore need then to develop future scenarios and options for organisational design. This work is particularly necessary in a context that is dominated by volatility, uncertainty and liquidity (Bounfour, 2015). We

need to initiate and reinforce a research agenda that includes future organisational design. CC offers an excellent opportunity.

PAPERS IN THIS SPECIAL ISSUE ON CC AND ORGANISATION DESIGN

The papers in this special issue offer some insights into the impact of CC on how companies and public institutions organise themselves. Several, complementary, perspectives are developed. They include potential future scenarios of how CC could impact the way IT resources are supplied, and how CC decision-making processes are developed. Collectively, the four papers that address these questions make up a “bundle” of contributions to the CC research agenda.

Erick Leroux and **Pierre-Charles Pupion’s** article “*Modelling cloud computing adoption in major French local public authorities*” analyses the patterns of, and barriers to, the adoption of cloud systems in a highly institutionalised context. Their research aims to create a general model that is based on four explanatory dimensions: technological, human, organisational and institutional. The proposed model helps to explain not only the adoption of cloud systems, but also the format and type of clouds that are selected (IaaS, SaaS, SaaS, etc.). The results of their quantitative study (based on a sample of more than 60 local authority IT directors) show that in a highly institutionalised environment, legal compliance heavily influences behaviour. This is compounded by pressure to re-

spect legal and confidentiality obligations. While some dimensions (such as risk reduction) are seen as an asset in the adoption of any cloud system, other perceived advantages carry greater weight in the selection of a particular system. With respect to cloud format, the study finds that the desire for legal compliance justifies the creation of internal clouds.

In their article “*Changing organizational models of IT departments as a result of cloud computing: proposal for a typology*”, **Emmanuel Bertin** and **Sébastien Tran** propose an organisational perspective.

Their study presents a typology of the relationships between information systems and their organisational stakeholders through a focus on the relations between actors: the IT department, business departments, software publishers and online service providers. Four models are constructed from two representative case studies. These are proposed and discussed in terms of power relationships. They find that any model can be the ‘best’ model, depending on its capacity to meet the organisation’s strategic needs—a finding that is consistent with IS alignment theory. They conclude with a stimulating proposal: IS, as a platform or a “two-sided market”, marks the boundaries of the organisation. Consequently, it benefits from cross-network externalities that maximise value for each of the actors.

The third paper by **Xiaolin Cheng** on “*Cloud Computing decision-making using a fuzzy AHP approach*”, addresses a critical issue in management science: how to design an integrated

approach that allows managers to rationally select a vendor based on a set of predefined criteria. Although most organisations are known to be “rationally bounded”, the approach helps to make decision criteria more explicit and can integrate the idiosyncrasies of individual firms and organisations. The model, which has been implemented using real (cloud screen) data, clearly shows the differences among vendors, as a function of performance parameters such as service cost, RAM, broadband, risk, response time, availability, etc.

Finally, the paper by **Adel Benyoussef**, **Walid Hadhri** and **Téja Maherzi** on “*Adoption of cloud computing in emerging countries: the role of absorptive capacity*”, provides an overview of how CC is used by firms in an emerging country context. The paper determines the conditions for its adoption and indicates the importance of factors such as competitor behaviour and international ICT (human capital) capabilities. Company age and sector are other variables taken into consideration. Finally, the paper determines the role of absorptive capacity as a key determinant in the development of innovative CC approaches.

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