ABSTRACT

This paper seeks to identify the characteristics of firms that choose to transfer all or at least part of the fulfilment of their information technology needs to an outside party. We focus both on outsourcing and on offshoring. With a statistical approach, based on a large and nationally representative data set at the firm unit level, we look at the profiles of firms that have decided to outsource and/or offshore at least part of their ICT activities. We show that the firms with the most specific ICT needs choose to acquire these services from external suppliers or firms located abroad. The firms with the highest level of ICT investment are also the firms that choose to resort to outsourcing to a great extent.

Keywords: IT services, outsourcing, offshoring, survey data, empirical approach

INTRODUCTION

IT outsourcing has emerged as a key method for managing information systems, especially since the report about Eastman Kodak and IBM’s outsourcing partnership in 1989 (Loh & Venkatraman, 1992). IT outsourcing practices cover many different situations, from delivering all the information services to providing specific services (Elitzur, Gavious, & Wensley, 2012). With technological changes, the compatibility and tradability of many services across the world have become easier (Abramovsky, Griffith, & Sako, 2004; Goodman & Steadman, 2002). At the end of the 1990s, the offshoring phenomenon spread from the manufacturing to the service sector (Stringfellow, Teagarden, & Nie, 2008), in particular in IT, banking, and financial services. For most firms, IT does not belong to their core competencies and they obtain IT resources and capabilities from IT outsourcing.
(Dibbern, Goles, Hirschheim, & Jayatilaka, 2004). Therefore, the phenomena of outsourcing and/or offshoring have grown during the last decade: 44% of enterprises in the European Union (the EU with 27 countries) used external suppliers to perform IT functions fully or partly during 2006 (Eurostat, 2007). The Economist (2004) has published a survey on outsourcing, which points out the growing development of IT outsourcing, especially in Asia.

A broad literature focuses on the outsourcing and offshoring of activities (Gonzalez, Gasco, & Lopis, 2006; Grossman & Helpman, 2005; Marin & Verdier, 2003). Although some researchers find negative impacts of outsourcing on organizational competencies (Aubert, Patry, & Rivard, 1998), on the strategic direction of companies (Gupta & Gupta, 1992), or on security and control (Fink, 1994), it is recognized that outsourcing has a positive effect on companies: cost savings, technical efficiency, the development of alliances, and the expansion of the IT infrastructure (Tjader, May, Shang, Vargas, & Gao, 2014). Conversely, it is largely considered that offshoring has negative societal impacts (Doh, 2005). Particularly for developed countries, offshoring affects the bargaining power and the level of wages (Bronfenbrenner, 2000) and induces job destruction. In the US, 830,000 jobs in the service sector moved to foreign countries in 2005 (Geewax, 2004). Because outsourcing and offshoring have direct and different implications for public policies (Doh, 2005), this contribution proposes to identify companies that will resort to outsourcing and offshoring based on their features (size, sector, technological investments, belonging to a group, etc.).

To achieve this goal, as Olsen (2006) suggested, this study focuses on the outsourcing of IT services and distinguishes “offshoring” from “outsourcing”. We also investigate different IT services (the management of the information and communication technology (ICT) system, the development of software, the database, the website, and the administration of the internal and external communication networks) and use a statistical approach to look at the profiles of firms that have decided to outsource and/or offshore at least part of their IT activities.

The paper is organized in three sections: firstly, we present both the theoretical and the empirical literature concerning the outsourcing and offshoring of IT services in order to formulate our research hypotheses; secondly, we present the methodological aspects; and lastly, we present our statistical evidence and discuss the main findings.

RELATED LITERATURE AND RESEARCH HYPOTHESES

The concepts of outsourcing and offshoring suffer from the lack of a common definition, as underlined by Loh & Venkatraman (1992) for outsourcing and by the literature review of Jahns, Hartmann, & Bals, (2006) for offshoring. As underlined by Abramovsky & Griffith (2006), Curzon Price (2001), Diaz-Mora (2008), and Kimura & Ando (2005), the first phenomenon concerns the ownership dimension of the production of IT services and the second the geographical dimension of the choice. Thus, the outsourcing decision occurs when firms choose to “buy” rather than “make” in-house. It involves greater specialization as firms switch from sourcing inputs internally to sourcing them from external suppliers. When a firm provides services or goods for another, the word “subcontracting” could also be used. However, “Outsourcing refers to the special case where the contractor has no in-house production capability and is dependent on the subcontractor for the entire product volume” (Mieghem, 1999, p. 954). The offshoring decision occurs when firms move their production overseas, either to their own foreign affiliates or to outsourced suppliers. In comparison with outsourcing, this concept takes into account another dimension: where the activity takes place. The OECD (2010) also uses the terms “offshore outsourcing” and “subcontracting abroad”. In this paper, we retain the definition of Abramovsky & Griffith.
(2006) illustrated in figure 1: “Outsourcing is the decision to make or buy, regardless of where the activity takes place (denoted by the vertical arrows). Offshoring is about where the activity takes place, regardless of whether it is within the corporate boundary or outside it (denoted by the horizontal arrows).”

Figure 1. Outsourcing and offshoring (Abramovsky & Griffith, 2006, p. 595)

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<th>Location decision</th>
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According to the reviews by Blaskovisch & Mintchik (2011), Dibbern et al. (2004), and Lacity, Khan, & Willcocks (2009), the broad areas of research conducted on outsourcing and offshoring decisions mainly contain four topics:

2. The second topic focuses on the characteristics of the products delivered by outsourcers and the management of the relationship between the firm and the outsourcer or the firm located abroad (Bhatnagar & Madon, 1997; Currie & Seltsikas, 2001).
3. The third most important topic concerns the measurement of the outsourcing results, for example the effect on firm success in terms of productivity (Altinkemer, Cahturvedi, & Gulati, 1994; Heshmati, 2003; Holger, Hanley, & Strobl, 2008; Ohnemus, 2007).
4. Finally, the fourth main topic discussed in the literature consists of the macroeconomic consequences of the phenomena (Amiti & Wei, 2005; Chongvilaivan & Hur, 2011; Chongvilaivan, Hur, & Riyanto, 2009). Artis, Ramos, & Surnach (2007) analyse the determinants of firm relocation and outsourcing decisions and their effects on firms’ employment decisions.

The researchers have broadly addressed the first topic. They identify the determinants of firms’ decision to outsource and the characteristics of firms that decide to outsource (Blaskovisch & Mintchik, 2011). At the firm level, three categories of determinants are highlighted (Dibbern et al., 2004): financial, strategic, and demographic factors (such as size and economic sector). While offshoring is a growing and relatively new phenomenon (Dibbern et al., 2004), the existing literature does not try to identify the profile of the firms that offshore their IT outsourcing practices (Lacity et al., 2009). Our contribution fills this gap and takes into account both outsourcing and offshoring activities.
To identify the firms that will outsource and/or offshore, we will examine demographic factors: the size, the economic sector, and the fact that the firm belongs to a group. To analyse the effect of the demographic factors on the adoption of outsourcing or offshoring, we will adopt the two main explanations used in the literature. First, they pursue a strategic goal by focusing on their core competencies and outsourcing the rest, like the information system (IS) function. To explain this choice, the researchers use the transaction cost theory (Lacity & Willcocks, 1995, 1998). Second, they consider that the IS function generates costs, which it is possible to minimize if external providers take into account the IS function. In this case, the literature focuses on organizational choice practices theory (Lacity & Hirschheim, 1993).

Size is linked to the needs and the financial resources of the firm. It is recognized that larger companies have greater needs and IT competencies and more important financial resources. Conversely, small and medium firms cannot assume all the IT functions, so they depend on IT providers (Cragg, Caldeira, & Ward, 2011). However, they have limited IT skills as a consequence, and they do not have the capacity to assess all the provider’s tasks (Cragg et al., 2011). In this context, small and medium firms face a complex situation. To deal with this situation, we could take into account which IT functions can be outsourced, which is an important question for Grover, Cheon, & Teng (1994). IT functions can be classified into three categories according to Arnett & Jones (1994): hardware, software, and “comprehensive management activities”. In the hardware category, we regroup technology systems integration, installation, development and administration of firms’ networks, and technical support. Software activities include software development, programming, and user help and support. “Comprehensive management activities” concern the management and administration of e-business, databases, websites, and IT systems.

We could suppose that small and medium firms will keep the basic function in-house – hardware – and that they will outsource the rest, which could be easily transferred across firms, especially the programming and network needs. Large firms have the competencies to assume IT functions in-house, but, at the same time, they have the greatest needs. In this situation, the costs associated with IT outsourcing make the difference. The cost of purchasing goods or services on the market includes the market price and other costs of outsourcing that are firm-specific. These costs cover the cost of identifying the real needs of the firm, knowing that the success of an IT outsourcing project depends on the accurate delineation of the project’s scope and definition (Gotschalk & Solli-Saether, 2005). The best providers on the market are the providers that can help the firms and understand their needs (Behara, Gundersen, & Capozzoli, 1995). They cannot propose standard contracts (Lacity & Hirschheim, 1993). Consequently, we have to take into account the transaction costs on the market and the costs of writing contracts and monitoring their execution. These costs can be diminished by the bargaining power of the firms in the negotiation and the renegotiation of contracts. Transaction cost theory, developed by Coase (1937), assumes that the market is always the lowest-cost producer of a good or a service. Thus, we can formulate the following hypothesis:

**Hypothesis 1**: IT sourcing is linked to the size of the firm. Large firms have a higher probability of outsourcing the IT function.

The trade-off between in-house production of IT needs and outsourcing also depends on companies’ business activities. Firms have more or fewer needs for software sophistication, security of data management, etc. In addition, when firms belong to a fast-changing and complex economic sector, they face problems in remaining competitive in all the IT functions. IT staff have to improve the IT core competencies to respond to in-house IT demands and manage IT outsourcing contracts simultaneously. Moreover, the choice
between in-house and outsourcing can vary in accordance with firms’ investment in technologies. Following Abramovsky & Griffith (2006) and Magnani (2006), we can suppose that technologies affect the cost of outsourcing. Technological diffusion in specific economic sectors seems to facilitate outsourcing because it “induces convergence of firm-specific skill to general skill over time” (Magnani, 2006, p. 618). Thus, it increases the transferability of services across firms and reduces the specificity of the transaction. Moreover, the investment in and usage of technologies, such as those relating to the Internet, should influence the other costs of outsourcing, such as the search costs for the best outsourcer on the market and the costs of monitoring the execution of the contract. IT competencies and skills should also reduce the costs of adjusting the services purchased to the firm’s needs. Nevertheless, if firms have enough internal IT competencies, the costs of producing in-house can be lower than those induced by outsourcing. However, IT competencies can affect firms’ needs. When a firm accumulates IT competencies, it can develop new needs that are more specific and that induce it to resort to an external service provider. For example, in the financial sector, firms have more resources available to produce internally but at the same time their needs are greater than those of other sectors (e.g. security function). Furthermore, the larger the resources and competencies of the firm, the higher is its bargaining power. Consequently, the transaction costs are reduced for the negotiation and renegotiation of contracts, and the probability of outsourcing increases. Thus, we hypothesize:

**Hypothesis 2**: Firms will outsource when they belong to an economic sector with a high level of IT competencies.

In comparison with outsourcing, offshore outsourcing is a more complex situation. According to Chen, Tu, & Lin. (2002), offshoring involves firms having to take into account language barriers and time zone barriers. They could also encounter problems relative to individual privacy and data security (Vijayan, 2004). Laws and regulations may sometimes be very different between countries and firms could face corruption and incompetence or see inconsistency in foreign regulations. With the geographic distance between the firm and the IT provider, new challenges appear. Espinosa, Slaughter, Kraut, & Herbsleb (2007) consider that offshoring is associated with lower team familiarity, which negatively impacts on team members’ interactions. For Stratman (2008), the geographic distance introduces difficulty in monitoring the providers’ outcomes. Offshoring also contributes to increasing cultural distance in terms of values and norms (Cramton, 2001). Cultural distance introduces another difficulty into the relation between the firm and the IT providers. The differences in national cultures could concern individualism vs collectivism, masculinity vs femininity, or long-term vs short-term orientation (Handley & Benton, 2013). Small and medium-sized firms are not able to meet these challenges. On the other hand, firms that are located in different places, in particular in different countries, have become accustomed to managing this kind of situation. Consequently, we can formulate a third hypothesis: **Hypothesis 3**: Belonging to a group has a positive impact on the adoption of offshoring IT functions.
METHODOLOGY

Data description

The data set comes from the “ICT Usage in Enterprises” community survey collected in 2007 in Luxembourg by the CEPS/INSTEAD on behalf of STATEC, with financial support from the European Commission (Eurostat). It gives information about the characteristics of the firms surveyed and the demand for IT services produced by external suppliers and foreign suppliers. Among the 3144 firms surveyed, of firms employing 10 persons and more operating in all sectors of the economy, 1955 responded. Our sample consists of 1905 enterprises that are computerized.

The characteristics of the establishments surveyed are available in Appendix 1. We have information on the business in which the firm operates. The sectors surveyed are: industry, construction, trade, tourism, transport (of merchandise), finance, and services. The most-represented sectors in our sample are trade and construction, each accounting for 25% of the firms. We also know the size of the firms. We use the classification of the European Union concerning small (10–49 employees), medium-sized (50–249), and large firms (250 and more). The large majority (76%) of the firms surveyed are small ones. In order to capture the organizational structure, we introduce two dummy variables: the first equals one when the firm has more than one legal unit in its organization, and the second equals one when the firm is a subsidiary of a group. Of the firms in the sample, 13% are multi-establishment firms.

By focusing on companies from Luxembourg, it is possible to analyse the situation of a very dynamic country in the IT domain. Luxembourg was the first EU country to enact a law on electronic commerce (14 August 2000). Luxembourg has had an act on electronic media since 27 July 1991 and one relative to the protection of individuals with regard to the processing of personal data since 2 August 2002. Luxembourg actively supports outsourcing development. No particular restrictions apply to the outsourcing of services to a specific company, but the Government has established specific legislation applying to service providers that enter into outsourcing arrangements with financial institutions, which are an important contributor to the economy of Luxembourg (the law of 5 April 1993 on the financial sector).

Definition of the main variables

The technological investments of the firms are taken into account with the creation of three variables. The first is based on the number of usual technologies (ICTs) deployed in the firm: local computer network (wireless or not), Intranet, Extranet, electronic mail service, video conferencing, electronic forum, electronic working group calendar, and group project scheduler. We construct a score with five levels: 1) no or just one ICT, 2) two ICTs, 3) three ICTs, 4) four ICTs, and 5) five or more ICTs. Our second variable of ICT investment is based on the number of management ICTs adopted by the firm: internal systems for re-

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2 Data collected in 2007 are used for two main reasons: the regulations in force in Luxembourg, relative to IT sector, have not been amended since 2002. Accordingly, we have enough perspective to take into account their effects; firm behaviors, in particular in the financial sector which is a very important sector in Luxembourg, are not yet affected by the financial crisis of 2008.

3 The tourism sector includes hotels, restaurants, travel agencies, and companies operating in the market for passenger transport (by train, by car, by boat, and by plane).

4 This sector includes both financial and insurance activities.
ordering replacement supplies, systems for invoices and payment, systems for managing, logistics, or services operations, ICTs linked with suppliers’ business systems or with customers’ business systems, the use of software for customer relationship management (CRM), the use of enterprise resource planning (ERP), and finally the automatic processing of the reception or the sending of invoices in digital format. The variable can take six levels: 0) no management ICT, 1) one management ICT, 2) two management ICTs, 3) three management ICTs, 4) four management ICTs, and 5) five management ICTs or more. The third variable concerns the trust of the firm in the security of the data transfer on the Internet. The variable includes resorting to e-government, that is to say, the use of the Internet for interaction with public authorities, and the fact of selling and/or purchasing on the Internet or other computer networks. To capture information on the skills of the workforce, we use a variable that captures whether a firm employs IT specialists or not: 21% of the firms employ one or more IT specialists.

We also create a variable concerning the trust of the firm in the security of the data transfer on the Internet. The variable includes resorting to e-government, that is, the use of the Internet for interaction with public authorities, and whether the firm sells and/or purchases on the Internet or on external computer networks. The average in the sample is one, that is to say, a medium level of trust. In detail, we can see that 38% of the firms have a high or a very high level of trust in data transfer on the Internet or other networks.

Concerning outsourcing and offshoring by the firms, the IT activities outsourced or produced abroad that we want to analyse concern hardware, software, and “comprehensive management activities”, as defined by Arnett & Jones (1994). The proportion of firms that choose to outsource part or all of their IT activities is 45%, and for offshoring the figure is 21%.

**Empirical strategy**

In order to define the most important company profiles of those that choose and those that do not choose to outsource and/or to offshore at least part of their IT services, for each phenomenon we conduct a multiple correspondence analysis (MCA) followed by a hierarchical cluster analysis.

All the variables that characterize the firm and its technology investments outlined above are introduced into our MCA in order to interpret the proximity between individuals. The MCA allowed us to identify firms relative to their outsourcing or offshoring behaviours. As our data are qualitative, our cluster analysis is conducted in the continuity of the MCA. The cluster analysis provides different firms’ typologies.

**STATISTICAL EVIDENCE**

**Firms that choose to outsource IT activities**

Figure 2 shows the results of the MCA. We report only the modalities of the significant variables, that is, the variables with a contribution on at least one dimension higher than 1/m, with m being the number of modalities of the variables introduced into the model (m=33 and 1/m= 0.03030).

[Insert Figure 2]
In accordance with the partial contributions of the variables computed with the MCA, the modalities that contribute the most to dimension 1 are presented in Table 1.

[Insert Table 1]

Dimension 1 opposes firms that outsource the IT services they need against firms that produce them in-house. In the positive part of dimension 1, we find firms with large resources because they belong to a group and because of their size (large) and firms conducting financial or insurance activities. Moreover, these firms use a large amount of technologies, both common ones and management ones, and employ IT specialists. Conversely, in the negative part, we find firms that make little use of technologies and that have no IT specialists.

As there is a parabolic shape of the technologies’ variables in Figure 1, we can observe what is commonly known as a “Guttman effect”. Consequently, almost all the information from our MCA is given by dimension 1. The information given by the dimensions of subsequent rankings reflects the same phenomenon as the first dimension. Because of the presence of such a specific effect, it seems that previous investments in technologies have great importance in our analyses.

As stated previously, we conduct our cluster analysis on the coordinates of individuals computed by the MCA. In order to determine the number of classes, we use the “stopping rules” evaluated by Milligan & Cooper (1985) as being among the best existing rules. Figure 3 shows the distribution of these rules.

[Insert Figure 3]

Large values of the Calinski & Harabasz (1974) pseudo-F stopping-rule index indicate a distinct cluster structure. In addition, a large value of the Duda & Hart (1973) $\frac{Je(2)}{Je(1)}$ index value and a small associated pseudo-T-squared value indicate distinct clustering. At least two of the three criteria favour a four-class clustering (the vertical line in Figure 2), the number of classes that we retain.

The four classes identified are composed of two classes with a large number of firms that choose to insource the fulfilment of their IT needs and two other classes with a large proportion of firms that choose to outsource.

We present in Table 2 the identified classes with a ranking from the class with a small number of firms that use outsourcing to the class with a large proportion of firms that use this governance mode.

[Insert Table 2]

The first class identified encompasses 28% of the sample. This class includes a large proportion of firms that choose to insource the IT services they need (84% of the firms do not outsource). As described in Table 2, this class does not seem to use outsourcing, a

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5 The dimension 2 doesn’t retain our attention because it is not linked to outsourcing or offshoring behaviour and no particular firms’ feature emerges from this dimension.

6 The Guttman effect is introduced as a result of factor analyses. The expression ‘Guttman effect’ is used when the recourse to multidimensional methods in the data treatment allows for extracting structures of unidimensional data.
priori, simply because the need for IT of the firms in this class is low, so they do not require external service providers.

The second class includes 43% of the firms sampled. The majority of firms in this part of the clustering insource the IT that they need (56% of the firms). We can conclude that the firms belonging to this class have IT needs, but they are not very specific and therefore the firms do not require outsourcers.

The third class identified includes 18% of the firms sampled. The majority of firms in this part of the clustering choose to outsource their IT activities (75% of the firms). The firms belonging to this class use a large number of technologies and employ IT specialists, but choose to outsource, a priori, because of wide and very specific needs for IT services. This statistical evidence is consistent with the observations of Willcocks, Lacity, & Fitzgerald (1995). It seems, indeed, that those firms choose to retain part of their IT competencies in-house to facilitate the adjustment of purchase services on the market and to control the good execution of contracts with external service providers.

The fourth class of our clustering analysis includes 11% of the firms surveyed. In this part of the clustering, 76% of the firms choose outsourcing for their IT activities. This class is somewhat special because it concerns a specific part of the sample, that is to say, firms evolving in the financial and insurance markets. Consequently, their IT needs are very specific and as the data they handle are confidential they require a great deal of security, which is very costly to develop internally. Like the firms in the third class, they retain large IT competencies internally to manage their contracts with external service providers (Willcocks et al., 1995).

**Firms that choose to offshore IT activities**

Figure 3 shows the results of the MCA concerning offshoring decisions. Like our first analysis regarding outsourcing decisions, we report only the modalities of the significant variables \((m=33\text{ and } t/m=0.03030)\).

[Insert Figure 3]

The first observation that we can formulate from Figure 3 is that this MCA has great proximity to the one conducted on outsourcing decisions.

Regarding the first MCA, in accordance with the partial contributions of variables computed with the MCA, the modalities that contribute most to dimension 1 are presented in Table 3.

[Insert Table 3]

Again, the results of the MCA on offshoring are very close to those on outsourcing decisions. Dimension 1 opposes firms that offshore against firms that use IT services produced in-house in Luxembourg or buy services produced locally\(^7\). In the positive part of dimension 1, we find firms with a large amount of resources (belonging to a group and having a large size) and firms conducting financial or insurance activities. Moreover, these

\(^7\) The dimension 2 doesn’t retain our attention because she is not linked to outsourcing or offshoring behaviour and no particular firms’ feature emerges from this dimension
firms use many technologies, both common and management technologies, and employ IT specialists. Conversely, in the negative part, we find firms that make little use of technologies and have no IT specialists. We also find, as in our first analysis, a "Guttman effect". Thus, we can observe a parabolic shape concerning ICT variables. This particular effect underlines the importance of investment in technologies in our analyses.

Then, we conduct our cluster analysis on the coordinates of individuals (i.e. the establishments surveyed) computed by the MCA. In order to determine the number of clusters, we use the "stopping rules" developed by Calinski & Harabasz (1974) and Duda & Hart (1973). Figure 4 shows the distribution of these rules.

Taking into account these stopping rules, we select four classes. The four classes identified include three classes of firms that on the whole do not choose to offshore at least part of their IT activities and one class containing a large proportion of firms that do choose to offshore.

We rank the identified clusters from the cluster including the smallest number of firms that use offshoring to the cluster including a large proportion of firms that widely use foreign production of IT.

Our first class includes 42% of the firms sampled. In this part of the clustering, 96% of the establishments do not offshore their IT activities. Moreover, they have a low level of use of technologies that induces no need for outsourcing and thus for offshoring (cf. Table 4).

Our second class includes 36% of the firms sampled. In this part of the clustering, 78% of the establishments do not offshore. Our conclusion about this class is close to the one formulated for the nearest class in the outsourcing analysis. The firms in this class have IT needs but these needs are met by the use of management and common technologies. Thus, they do not really need to outsource or offshore their IT activities.

Our third class includes 10% of the firms sampled. This class is close to the fourth class in the analysis of outsourcing in terms of the firms’ characteristics and technology investments. Even though the characteristics of this class are close to those of the fourth class in outsourcing, there is an important difference between this class and its "neighbour" in outsourcing. In this class, 59% of the firms do not offshore. Thus, firms conducting financial and/or insurance activities choose the outsourcing of IT activities often but include offshored services in their production process only a little. Thus, it seems that the IT activities used by these firms are produced by external service providers located in Luxembourg.

The fourth class includes 12% of the sample. This cluster is close to the third cluster in the outsourcing analysis. Moreover, the majority of firms in this cluster and its "neighbour" in the outsourcing analysis use IT services produced by outsourcers and 62% of these firms resort to IT services produced abroad. Another observation that we can make here is the large number of firms employing IT specialists. It seems that more monitoring is needed when firms decide to offshore their IT operations. Moreover, problems of language (the wide use of English in the IT industry) can appear, requiring internal skills to make the external services compatible with the enterprises’ current system.
DISCUSSION

With a multiple correspondence analysis (MCA) followed by a hierarchical cluster analysis, we define the most important company profiles of those that choose and those that do not choose to outsource and/or to offshore at least part of their IT services.

It is possible to oppose firms that outsource the IT services they need against firms that produce them in-house. Firms that outsource the IT services have large resources, use a large amount of technologies. At the opposite, firms that produce them in-house don’t use technologies intensively and don’t have any IT specialists.

As we said before, we could also identify in most details four classes of firms: two classes with a large number of firms that choose to insource the fulfilment of their IT needs and two other classes with a large proportion of firms that choose to outsource. In our analysis, size does not appear to be a discriminating variable to distinguish between firms that insource and those that outsource. The first hypothesis is rejected.

However, it seems that firms with specific and/or wide needs choose the outsourcing of IT activities more than others. Moreover, the resources that can be provided by the group to which they belong seem to discriminate the two populations of firms.

In addition, our observations (especially regarding class 3) give support to the fact that investments in technology favour the phenomenon of outsourcing. The observations especially (relating to class 2) seem to give support to the fact that having a large amount of IT competencies can reduce the cost of managing IT services in-house and will curb the phenomenon of outsourcing. Our observations for this point are close to the conclusions of Willcocks et al. (1995), who underline the importance of in-house IT capabilities when firms choose to outsource at least part of their ICT activities. These results confirm the second hypothesis.

Concerning firms that choose to offshore IT activities, it is possible to oppose firms that offshore against firms that use IT services produced in-house in Luxembourg or buy services produced locally. We could identify four classes of firms: three classes of firms that do not choose to offshore and one class containing firms that do choose to offshore.

The statistical evidence that we can formulate here is quite close to that formulated for outsourcing. However, we can add one or two things to distinguish the two decisions. It appears that financial and insurance firms choose to use the IT services of firms located in Luxembourg due to the large local presence of a large number of IT suppliers specializing in finance. For firms that choose to resort to offshoring, the presence of internal IT specialists occurs more frequently than for firms that choose to resort to outsourcing, at least for firms in trade and services. This observation may emphasize the fact that the monitoring and compatibility of services require the presence of internal technology competencies. Our results shown that belonging to a group has not always a positive impact on the adoption of offshoring IT functions. The third hypothesis is rejected.

CONCLUSION

This paper seeks to identify the characteristics of firms that choose to transfer all or at least part of the fulfilment of their information technology (IT) needs to an outside party. Currently, many firms outsource their IT services and offshoring is an increasing phenomenon. To take into account these two dimensions, this paper analyses both outsourcing and offshoring. As underlined by Abramovsky & Griffith (2006), the outsourcing
phenomenon concerns the ownership dimension of the production of IT services and the offshoring phenomenon concerns the geographical dimension of the production of these services.

To take into account the great diversity of IT functions in firms, this paper classifies IT functions into three types in accordance with Arnett & Jones (1994). These IT activities are hardware, software, and “comprehensive management activities”. Hardware covers ICT systems integration, installation, development and administration of firms’ networks, and technical support. Software activities include software development, programming, and user help and support. “Comprehensive management activities” concern the management and administration of e-business, database, website, and ICT systems.

With a statistical analysis of survey data, based on two methods – a multiple correspondence analysis and a hierarchical cluster analysis – we show the great proximity of characteristics of firms that resort to outsourcing and to offshoring. It appears that large firms and firms belonging to a group and to the financial sector choose to acquire these services from external suppliers or firms located abroad. Our results also show that specific IT needs have an impact on outsourcing and offshoring.

- **Research contributions**

  This contribution makes two main research contributions. First, we focus both on outsourcing and on offshoring because, in comparison with outsourcing, offshoring introduces additional difficulties for firms. Firms encounter language barriers, time zone barriers, and problems with individual privacy and data security. Firms could have difficulties with foreign laws and regulations, corruption, incompetence, team familiarity, and cultural distance. Second, our contribution examines different outsourcing activities (hardware, software, and “comprehensive management activities”) to take into account the difference in the difficulty involved in transferring IT activities across firms.

  The originality of this contribution also comes from the statistical approach, based on a large and representative data set at the firm unit level.

- **Contributions to practice**

  From the managerial point of view, the results show the influence of firms’ demographic factors in the decision to outsource and/or offshore IT functions. The firms with the most specific IT needs choose to acquire these services from external suppliers or firms located abroad. The firms with the highest level of internal investments in technologies are also the firms that choose to resort a great deal to outsourcing. These results can potentially help managerial decisions on whether to outsource, to offshore, or not.

  The results of this research may also have implications for public sector organizations interested in the identification of enterprises that can decide to outsource and/or offshore IT services. From the characteristic of the enterprise, public authorities will be able to ascertain whether a company is likely to move its IT functions overseas and evaluate the consequences for job destruction. Our research identifies the firms and occupations that are vulnerable to being offshored. These results could help public policymakers to increase the level of competencies of workers in vulnerable economic sectors.

- **Limitation and future research**

  One limitation of our study lies in the measure of the outsourcing and offshoring phenomena. Indeed, we have global information on the use of these possibilities to obtain ICT services. Further research needs to address this limitation by finding precise information on the degree or the number of ICT functions outsourced or offshored by firms.
REFERENCES


OECD. (2010). *Information technology outlook*. OECD.


Table 1. Variables that contribute the most to dimension 1 of outsourcing decisions

<table>
<thead>
<tr>
<th>Negative part of dimension 1</th>
<th>Positive part of dimension 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td>Finance</td>
</tr>
<tr>
<td>No group</td>
<td>Group</td>
</tr>
<tr>
<td>0 management ICTs</td>
<td>Large</td>
</tr>
<tr>
<td>4 management ICTs</td>
<td>5 or + management ICTs</td>
</tr>
<tr>
<td>2 ICTs</td>
<td>5 or + ICTs</td>
</tr>
<tr>
<td>No ICT skills</td>
<td>ICT skills</td>
</tr>
<tr>
<td>No outsourcing</td>
<td>Outsourcing</td>
</tr>
</tbody>
</table>

Figure 3. Values of the criteria to choose the number of classes of outsourcing decisions

Note: The scale on the left side represents the values of the Calinski/Harabasz pseudo-F and the Duda/Hart pseudo-T-squared and the scale on the right side the values of the Duda/Hart Je(2)/Je(1).
Table 2. Description of classes about outsourcing decisions

<table>
<thead>
<tr>
<th>Class</th>
<th>Percentage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 1 – 28% of firms</td>
<td>84% of firms do not outsource</td>
<td>84% of firms do not outsource The business sector that is the most represented here is construction (52% of the firms in this class evolved in this sector) Practically all the firms are small ones and are independent of a group (88% of the class and 89%, respectively) 58% of firms do not use management technologies 80% use at most two usual technologies 98% have a low or a medium level of trust in data transfer on the Internet Nearly 100% have no IT specialist among their employees</td>
</tr>
<tr>
<td>Class 2 – 43% of firms</td>
<td>56% of firms do not outsource</td>
<td>56% of firms do not outsource The business sector that is the most represented here is trade (36% of the firms in this class evolved in trade) Practically all the firms are small ones and are independent of a group (83% of the class and 84%, respectively) 60% of firms use at most two management technologies 70% use at most three usual technologies 96% have no IT specialist among their employees Nevertheless, they have trust in data transfer on the Internet (40% use at least one of the Internet or network possibilities we study (e-government, online sales, or online purchases) and 44% use two of these network possibilities</td>
</tr>
<tr>
<td>Class 3 – 18% of firms</td>
<td>75% of firms outsource</td>
<td>75% of firms outsource Two business sectors are largely represented: trade and services (36% and 37% of the firms in this class, respectively) 57% of firms are small, 34% are medium-sized, and the large majority belong to a group (60% of the class) 71% of firms use at least four management technologies 60% use five or more usual technologies 62% have an IT specialist among their employees 56% have a high level of trust in data transfer on the Internet</td>
</tr>
<tr>
<td>Class 4 – 11% of firms</td>
<td>76% of firms outsource</td>
<td>76% of firms outsource One business sector is largely represented: 63% of the firms evolved in finance (and insurance) 52% of firms are small, 29% are medium-sized, and 19% are large firms. 91% belong to a group 58% of firms use at most two management technologies 69% use five or more usual technologies 70% have an IT specialist among their employees 93% have a medium level of trust in data transfer on the Internet</td>
</tr>
</tbody>
</table>
Figure 4. Projection of the contributed variables for the analysis of firms that choose offshoring

Table 3. Variables that contribute the most to dimension 1 of offshoring decisions

<table>
<thead>
<tr>
<th>Negative part of dimension 1</th>
<th>Positive part of dimension 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td>Finance</td>
</tr>
<tr>
<td>No group</td>
<td>Group</td>
</tr>
<tr>
<td>0 management ICTs</td>
<td>Large</td>
</tr>
<tr>
<td>2 ICTs</td>
<td>5 or + management ICTs</td>
</tr>
<tr>
<td>No IT skills</td>
<td>5 or + ITs</td>
</tr>
<tr>
<td>No offshore</td>
<td>ICT skills</td>
</tr>
<tr>
<td></td>
<td>Offshore</td>
</tr>
</tbody>
</table>
Figure 5. Values of the criteria to choose the number of classes of offshoring decisions

Note: The scale on the left side represents the values of the Calinski/Harabasz pseudo-F and the Duda/Hart pseudo-T-squared and the scale on the right side the values of the Duda/Hart Je(2)/Je(1).
Table 4. Description of classes of offshoring decisions

Class 1 – 42% of firms

96% of firms do not offshore
The business sector that is the most represented here is construction (44% of the firms in this class evolved in this sector)
Practically all the firms are small ones and are independent of a group (85% of the class and 88%, respectively)
49% of firms do not use management technologies
72% use at most two usual technologies
91% have a low or a medium level of trust in data transfer on the Internet
Nearly 100% have no IT specialist among their employees

Class 2 – 36% of firms

78% of firms do not offshore
The business sector that is the most represented here is trade (40% of the firms in this class evolved in trade)
Practically all the firms are small ones and are independent of a group (83% of the class and 79%, respectively)
24% of firms use five management technologies or more
30% use three usual technologies and 30% four usual technologies
89% have no IT specialist among their employees
Nevertheless, they have trust in data transfer on the Internet (58% use at least two of the network possibilities studied)

Class 3 – 10% of firms

59% of firms do not offshore
One business sector is largely represented: 70% of the firms evolved in finance (and insurance)
51% of firms are small, 29% are medium-sized, and 20% are large firms. 90% belong to a group
40% of firms use at most two management technologies
70% use five or more usual technologies
71% have an IT specialist among their employees
93% have a medium level of trust in data transfer on the Internet

Class 4 – 12% of firms

62% of firms offshore
Two business sectors are largely represented: trade and services (30% and 39% of the firms in this class, respectively)
46% of firms are small, 40% are medium-sized, 14% are large, and the large majority belong to a group (74% of the class)
71% of firms use at least four management technologies
75% use five or more usual technologies
76% have an IT specialist among their employees
44% have a high level of trust in data transfer on the Internet
## Appendix 1. Descriptive statistics of the whole sample (1905 observations)

<table>
<thead>
<tr>
<th>Modalities</th>
<th>Mean</th>
<th>Std Dev.</th>
<th>No. of modalities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry</td>
<td>10.08%</td>
<td>0.3011</td>
<td>1</td>
</tr>
<tr>
<td>Construction</td>
<td>24.93%</td>
<td>0.4327</td>
<td>1</td>
</tr>
<tr>
<td>Trade</td>
<td>24.57%</td>
<td>0.4306</td>
<td>1</td>
</tr>
<tr>
<td>Tourism</td>
<td>3.99%</td>
<td>0.1958</td>
<td>1</td>
</tr>
<tr>
<td>Finance</td>
<td>6.88%</td>
<td>0.2531</td>
<td>1</td>
</tr>
<tr>
<td>Transport</td>
<td>9.71%</td>
<td>0.2962</td>
<td>1</td>
</tr>
<tr>
<td>Services</td>
<td>19.84%</td>
<td>0.3989</td>
<td>1</td>
</tr>
<tr>
<td>Small (10–49 employees)</td>
<td>76.38%</td>
<td>0.4249</td>
<td>1</td>
</tr>
<tr>
<td>Medium (50–249)</td>
<td>19.69%</td>
<td>0.3977</td>
<td>1</td>
</tr>
<tr>
<td>Large (250 and more)</td>
<td>3.93%</td>
<td>0.1945</td>
<td>1</td>
</tr>
<tr>
<td>Multi-establishment</td>
<td>12.60%</td>
<td>0.3319</td>
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</tr>
<tr>
<td>Group</td>
<td>30.39%</td>
<td>0.4601</td>
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</tr>
<tr>
<td>Score usual technologies:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0–1 ICT</td>
<td>3.12</td>
<td>1.2728</td>
<td>5</td>
</tr>
<tr>
<td>2 ICTs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 ICTs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 ICTs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 ICTs and more</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Score management technologies:</td>
<td>2.07</td>
<td>1.8173</td>
<td>6</td>
</tr>
<tr>
<td>0 management ICT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 management ICT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 management ICTs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 management ICTs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 management ICTs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 management technologies and more</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ICT trust:</td>
<td>1.36</td>
<td>0.7660</td>
<td>4</td>
</tr>
<tr>
<td>- Low trust</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+ Medium trust</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>++ High trust</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+++ Very high trust</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IT specialists</td>
<td>20.58%</td>
<td>0.4044</td>
<td>2</td>
</tr>
<tr>
<td>Outsource</td>
<td>45.25%</td>
<td>0.4979</td>
<td>2</td>
</tr>
<tr>
<td>Offshore</td>
<td>21.26%</td>
<td>0.4093</td>
<td>2</td>
</tr>
</tbody>
</table>