DO INFORMATION AND COMMUNICATION TECHNOLOGY ACCESS AND INNOVATION INCREASE OUTSOURCING IN SMALL AND MEDIUM ENTERPRISES?

María Verónica Alderete
IIESS-CONICET Universidad Nacional del Sur, Bahía Blanca, Argentina

_____

ABSTRACT

In this paper we present an econometric model to determine whether an SME (Small and Medium Sized Enterprise)'s probability of outsourcing depends on their levels of innovation and information and communication technology use. The predictions of the econometric model are tested by means of a LOGIT model using a cross section sample of an Argentinean SME for the year 2006. The model predicts that the level of innovation of an SME will significantly influence its probability of outsourcing. Besides, it stresses the negative incidence of the information and communication technologies (ICT) access on the outsourcing decision.

Keywords: outsourcing, small and medium sized enterprises, innovation, information and communication technologies, and transaction costs.

1. INTRODUCTION

Although outsourcing is hardly a new idea in management, the volume, extent and character of outsourcing have been changing rapidly. During the last years, a large number of firms are decentralizing their operations by retaining core competences (Prahalad and Hamel, 1990) and obtaining additional needs from the market.

Outsourcing is not a new task. Since the 1980s, many of the trends and pressures in outsourcing have been experienced, although some of them have changed. Nowadays, there are two different features from that period: there is no 'hiding place' or geographical boundaries for this task settled in almost every country, with a few exceptions. Furthermore, the potential impact on the economic performance is probably greater than in the past.

_____

"We live in an age of outsourcing. Some firms have gone so far as to become "virtual" manufacturers, owning designs for many products but making almost nothing themselves (Grossman and Helpman, 2005)". According to Grossman and Helpman (2005) outsourcing means more than just the purchase of raw materials and standardized intermediate goods. It means finding a partner with which the firm can establish a bilateral relationship and having the partner undertake relationship-specific investments so that it becomes able to produce goods and services that fit the firm's particular needs.

Small and Medium Enterprises play a significant role in developing economies by generating new employment opportunities and making significant contributions to the national / global economy. However, the sector confronts some obstacles. Nowadays, the digital economy and dominance of regional and global supply chain system prevail, and many SMEs facing traditional hardships of finance and procedural delays are lagging behind due to obsolete technology and production process, information asymmetry and lack of knowledge management capacity. Many SME face limited growth as a result of their owners' lack of experience in some functional areas of the firm. This phenomenon leads to an inefficient management of these areas. Outsourcing is an alternative solution to this problem that leads not only to cost reductions but also to SME growth. The contractor firm can focused on its core competences.

The challenges are not merely simple 'make or buy' decisions, but also responses to what some have declared as the new round of globalization in which not only typical manufacturing jobs are being sent offshore, but also upscale tasks, such as research projects, technical service support functions, engineering and even financial analysis are being placed in so-called developing countries. "Outsourcing is now high on the list of the things that many savants believe well-run organizations must consider, so that it is now as much a management fad as a reasoned decision, offering important augmentation to the current organizational design, or even giving rise to new enterprise designs (Jenster et al, 2005)".

Outsourcing has been growing in many industries throughout the world. The technological revolution that has taken place in last decades has allowed for a significant drop in the costs associated with finding information, transport communication and business coordination, lowering the transaction costs and increasing the possibilities for outsourcing (Díaz Mora, 2005; Díaz Mora and Gandoy Juste, 2008). It has also been argued that new information, production and managerial technologies create opportunities for the introduction of new forms of organizing production, as inter-firm collaboration and networks, in which the sub- contracting firm has a major role to play.

In spite of the increasingly use of outsourcing of production activities according to the business press and academic literature, empirical research about its determinants remains very limited: Bartel et al (2008) in the US manufacturing industry; Islam and Sobhani (2008) in the manufacturing industry in Bangladesh; Díaz Mora and Gandoy Juste (2008) in the traditional Spanish manufacturing; Kimura (2001) and Tomiura (2004) for Japanese manufacturing industry, Görg and Hanley (2007) and (2004) for the Irish electronics industry, and Holl (2004) for the Spanish manufacturing industry, Navarro (2002) in the Spanish banking sector.

By deepening on the outsourcing determinants, we establish which the main limitations an SME could find to develop this strategy are. There are limited studies on outsourcing in SME. One of the contributions of this paper is leading with the idea that

ICT tools are different in nature and, therefore, they may have a different effect on the propensity to outsource.

First, this paper analyses small and medium sized enterprises (SMEs) outsourcing decision with special emphasis on innovation and ICT diffusion. The paper presents reasons behind subcontracting practices as well as recent trends, opportunities, benefits and problems for SMEs derived from their subcontracting activities. By deepening on the outsourcing determinants, we establish which the main limitations an SME could find to develop this strategy are. Besides, we estimate a logistic model to provide some empirical evidence of the explanatory factors of SME outsourcing decisions based on an SME sample from Bahía Blanca, Argentina. We emphasize on the level of innovation and ICT endowments as the main explanatory factors of outsourcing.

2. THEORETICAL FRAMEWORK

Outsourcing refers to the delegation of certain functions to providers outside the enterprise, basically through the hiving-off of non-core activities and functions for the enterprise (usually functions that can be treated as a commodity). The search for an external provider is largely based on costs, provided a minimum level of quality is obtained.

According to UNIDO, subcontracting can be defined as an economic relationship where one entity (the main contractor) requests another independent entity (the subcontractor) to undertake the production of parts, components, sub-assemblies or the provision of additional services that are necessary for the completion of the main contractor's final product, always in accordance with the main contractor's specifications (UNIDO, 2003).

The OECD defines subcontracting as a situation when one enterprise (the contractor), contracts another enterprise (the subcontractor), for a given production cycle, one or more aspects of product design, processing or manufacture, construction, maintenance work or services, where this output is generally incorporated into the contractor's final products. The subcontractor must adhere strictly to the contractor´s technical and/or commercial specifications for the products or services in question (OECD, 2005).

There are different explanations for the outsourcing strategy. Most of them are that outsourcing is a response to unpredictable variations in demand (Abraham and Taylor, 1996), an opportunity to take advantage of the specialized knowledge of suppliers (Abraham and Taylor, 1996), and a method to save on labor costs (Abraham and Taylor, 1996; Diaz-Mora, 2005; and Girma and Gorg, 2004). In this paper, we examine the first two explanations and complete the theoretical framework of subcontracting with two approaches. The first is the transaction cost approach. On the basis of the assumptions on bounded rationality and opportunism in human behavior, the transaction cost approach characterizes transactional environment by introducing uncertainty, frequency in transactions, and relation-specific assets (Williamson, 1981, 1982). Taking these characteristics into consideration, a firm decides whether to internalize certain transactions or not.

In light of the transaction cost theory, decreasing costs of search, evaluation and monitoring of suppliers should lead to a shift away from firms and toward markets as a form of organizing economic activity (Coase 1937, and Williamson, 1985). Outsourcing occurs under conditions of low asset specificity, low uncertainty and a low frequency of transactions (Mol, 2005). Subcontracting arrangements can be interpreted as one of the devices to save transaction costs.

The second approach comes from the analysis of the capabilities of the firm. The knowledge-based (Grant, 1996; Kogut and Zander, 1992) and resource-based (Barney, 1999; Quinn, 2000) explanations of outsourcing suggest that a firm will outsource those activities in which it is not particularly specialized or that are 'non-core' because the firm is less capable of performing those activities. In particular, we focus on the role played by innovation activities and information and communication technologies.

Dobrzykowski et al (2010) develop a case analysis where a firm's successful sourcing decisions can be explained by resource based view (RBV) and value co-creation theories. RBV is shown to provide an internal view of the firm considering its core competencies, while value co-creation illuminates the external perspective considering the role of customers when making sourcing decisions.

Juntunen et al (2010) analyze the trade- off between lower cost and good service level. They find that, in the short run, trade-off does not exist, but there may be a propensity to trade-off in the long run.

Souza and Bacic (2000) analyze the different aspects that must be considered in the decision to outsource in a multidisciplinary manner. In particular, the authors focus on the possible causes of outsourcing programmes' failure, such as "the herd effect" (outsourcing is in fashion for many managers), lack of knowledge of the relevant variables of the decision model "to produce or to buy", the manager's lack of attention to some strategic aspects such as the future of some variables (fixed costs of the future structure, and productive capacity, among others), or the qualification of the employees (level of education or training).

2.1. Outsourcing and Innovation

There is no conceptual agreement on the relationship between innovation and outsourcing. In R&D intensive industries, scale advantages are usually sufficient to allow for more vertical integration. Furthermore, innovative activities may be hard to appropriate if they are not performed inside the firm. There can also be an increased risk of opportunism under these conditions, especially where the R&D concerned is of a proprietary rather than a generic nature (Williamson, 1985).

On the contrary, outsourcing levels should be on the rise in the context of R&D intensive firms, since there is an increasing inter-sector technological specialization and buyer–supplier relations have become more effective vehicles for exchanging technological know-how (Dyer and Nobeoka, 2000; Dyer and Singh, 1998).

Industries increasingly use cooperative relations with outside suppliers to obtain technology in known but non core areas. This relational view perspective (Dyer and Singh, 1998) establishes that much of a firm's innovation now occurs in conjunction with outside suppliers rather than inside the firm. Dyer and Nobeoka (2000) detail through their case study of Toyota how new technology is developed through dedicated

buyer–supplier relations. This new model of inter-organizational relations as a means to innovation is superseding traditional in-house development (Mol, 2005).

Mazzanti et al (2007) show that in the district-like context analyzed, the firms' innovativeness correlates positively with the complexity of the outsourcing strategies, being innovative in Reggio Emilia requires the outsourcing of ancillary activities, in order to refocus on the business core.

Mol (2005) uses an Ordinary least squares (OLS) regression to test the effect of R&D intensity and a set of control variables on the industry average level of outsourcing in a set of manufacturing industries in The Netherlands in the early 1990s. Mol (2005) suggests R&D intensity as a proxy for innovation since it is performed in order to generate innovations, particularly of the technological type. He argues that being R&D intensive has traditionally been seen as an impediment to outsourcing and shows that R&D intensity became a positive predictor for changes in outsourcing levels. However, to compensate for the loss of internal technological capabilities, firms increasingly rely on partnerships with outside suppliers that can act as an effective substitute to the internal generation of knowledge and innovation (Ding 2001; Dyer and Nobeoka, 2000; Dyer and Singh, 1998; Hagedoorn, 1993).

Bartel et al (2009) study Spanish manufacturers from 1990 to 2002 and conclude that outsourcing does increase with technological change. According to Bartel et al (2009), the firm's expectations with regard to technological change in its production process is a significant explanatory variable of the probability of outsourcing production. Firm's investment in R&D or its patent registrations can be good proxies for technological change to the extent that R&D (or patenting) is used to adapt exogenous changes in the production technology to the specific requirements of the firm. Companies that invest in R&D expect innovation and technological change to be part of the business environment. They argue that spending on R&D is linked to outsourcing. Companies with positive percentage of R&D spending were more likely to outsource than those that did not choose to invest in R&D.

Görg and Hanley (2007) analyze empirically the link between international outsourcing and innovative activity at the level of the individual establishment. They find evidence for positive effects between outsourcing and innovation. However, they show that outsourcing increase innovation activity. It is easy to show presence of reverse causality – maybe more spending on innovation leads firms to sub-contracting. Because of the presence of endogeneity, we are not talking about causality between outsourcing and innovation but we analyze a relationship between them. This paper will analyze the reverse relation, how innovation affects the outsourcing decision.

2.2. Outsourcing and size

Firm size is included as an explanatory factor because it affects the scale at which a firm can produce internally if it chooses not to outsource. Scale economies are widely held to influence firms' outsourcing decisions, particularly for functions that have relatively high fixed costs. This suggests that smaller firms should outsource more to take advantage of the scale provided by specialized vendors (Ono and Stanko, 2005). Small firms would be expected to be more likely to outsource because it may not be optimal for them to carry out all steps in the production process because of the costs of maintaining specialized equipment or skills in-house (Abraham and Taylor, 1996). As Abraham and Taylor (1996) suggest, the cost savings derived from outsourcing can be

obtained by two ways: first, exploiting the economies of scale in producing these specialized components or phases which are being contracted out (outsourcing for specialization) and, second, turning fixed costs in variable costs and gaining flexibility if there are frequents fluctuations in the product demand (outsourcing for capacity).

The specialization motive for outsourcing introduces firm size as a determinant of this strategy. There may be economies of scale in the production of specific inputs and, in this sense, size variable has to be considered to control for this scale economies effect. Since small and medium enterprises will have more difficulty reaping the minimum efficient scale, they will opt more intensively for outsourcing.

Large firms often take a different role in the supply chain, by primarily becoming an assembler and not a producer, and may therefore outsource more (Mol, 2005). Besides, large firms may have more bargaining power with suppliers, encouraging them to outsource. However, since we are going to analyze SME in this paper, this would not be the case since the largest firm is of a medium size.

2.3. Outsourcing and export activity

Having a superior set of internal capabilities, for instance, human resources, also makes it less likely that firms will outsource activities since they will want to fully exploit these internal strengths. Since the ability to export products is an indicator of company strength, more export intensive industries possess more internal capabilities and may therefore outsource less.

However, competition between firms stimulates outsourcing (Cachon and Harker, 2002). More export intensive industries will be faced with a more competitive environment and will therefore seek to outsource more. Relatively efficient firms seem to contract out for other reasons such as penetrating export markets and focusing on innovation (Bakhtiari, 2011).

McLaren (2000) supports the idea that open international markets lead to larger markets that promote matching between specialized suppliers and firms willing to externalize production. In this sense, the international market would increase outsourcing attractiveness.

Criscuolo, Haskel, and Slaughter (2005) and Salomon and Shaver (2005) argue that this variable controls for the possibility that export-active firms may also be more R&D and innovation intensive (Görg and Hanley, 2010).

2. 4 Outsourcing and ICT

We are not referring to the outsourcing of informatics services or ICT outsourcing. We want to study the influence of ICT use on the decision to outsource.

Much of this thought surrounds the ability of information to create closer relationships by enabling chain members to participate together in a variety of functional activities which in turn, enhances organizational performance and competitive advantage (Langfield-Smith and Smith,2005; Zhang and Li, 2006).

ICT will introduce innovative ways of doing business, re-shaping firm boundaries and changing the constellations of value chains. The availability of powerful ICT at reasonable costs also increases the attractiveness of markets for intermediate goods and services (Malone et al., 1989 and Lucking-Reiley et al., 2001)

It has been argued that new information, production and managerial technologies are changing the balances of transition costs, creating opportunities (but also pressures) for the introduction of new forms of organizing production in which the sub-contracting firm has a major role to play (Wynarczyk, 2000). It is possible that the rapid chances in internet and communications technologies can lower the cost associated with seeking out suppliers and managing relationships with them.

Abramovsky and Griffith (2006) consider the impact that technology has over organizational form. They find that more ICT-intensive firms across firms within an industry purchase a greater amount of services in the market and they are more likely to purchase offshore than l ICT-intensive firms.

Improvements in ICT usage have resulted in two-front benefits; (i) efficiency improvements, essentially driven by better information flows translating into better material management, which resulted into the implementation of technologies such as electronic data interchange (EDI) and (ii) effectiveness improvements, driven by better information flows which resulted into re-engineering of the entire supply chain.

Clemons (1993) and Malone et al (1987) suggest that a primary benefit of the electronic exchange of information between organizations is the reduction in transaction costs. Clemons et al (1993) argues that information technology has the ability to lower coordination cost without increasing the associated transactions risk, leading to more outsourcing and fewer vertically integrated firms.

A study from DIW Berlin (2008) found that across all sectors, intensive ICT users are more likely to change their organizational structure and to outsource non-core activities.

Finally, if we consider the existence of transaction costs from externalization, outsourcing is more likely in industries with less technological requirements (OMC, 2005). The more standardized a production activity is, the lower the management costs associated to production control and coordination. The probability of outsourcing increases with the standardization level of the production activity (in traditional manufacturing).

Similar to this argument, Benfratello (2009) discusses the assumption that ICT facilitates the transfer of knowledge outside firm boundaries, and therefore, reduces outsourcing. As Leamer and Storper (2001) and Leamer (2007) emphasize, the transfer of competences depends critically on an important distinction between routine codifiable tasks and non-routine. Non-routine tasks (such as ICT using tasks) are more based on experience and are dependent on creative skills. In this case, tacit knowledge plays a key role in production decisions and cannot be easily transferred by outsourcing.

3. DATA AND THE ECONOMETRIC MODEL

We use a sample of 103 SME from the city of Bahía Blanca, Buenos Aires, Argentina. The database corresponds to the year 2006 from interviews made in 2007. According to information from Bahía Blanca, in 2007 the city counted on 679 industrial firms, with 99% SME.

The sample was constructed considering the natural stratification based on production specialization of the total number of firms. It collects information on different characteristics of the firm: owner socio-cultural characteristics, firm structural

characteristics (including relationships with suppliers, clients and between firms), and market and environment characteristics.

The classification of the firms by firm size responds to the number of employees. Alderete and Diez (2012) propose this classification based on the percentage frequency distribution of the firms classified by number of employees: Micro-firm (1 to 5 employees); Small 1 (6 to 10 employees), Small 2 (11 to 50 employees) and Medium (more than 50 employees). The 1985-1994 Argentinean Census used this classification: Micro-firms (fewer than 5 employees); Small (between 6 and 10 employees); Intermediate (between 11 and 50 employees) and Medium (More than 50 employees). Although this classification is not usually use in Argentine studies, it represents more properly this sample. Most of the firms are Small 2 (40,8%), followed by micro-firms (28,2%), Small 1 (25,2%) and Medium (5,8%) in order of importance. There are firms with different sizes, levels of productive specialization and; therefore, different degrees of complexity in terms of products and processes. Thus, there is not structural bias in the sample.

Next, we made a descriptive analysis of the firms considering some of the main explanatory variables from the literature. We analyze the relationship between each explanatory variable and the outsourcing conduct. Then, a logistic binary regression captures the significant explanatory variables of outsourcing conduct. Lastly, we elaborate some final considerations.

According to Table 1, 20.4% of the firms have outsourced some of their activities. Outsourcing of activities is on average low. Then, we want to know which industries outsource more.

Table 1: Outsourcing of any activities during the last 3 years

	N	Percentage	Accum. %
Yes	21	20.4	20.4
No	82	79.6	100.0
Total	103	100.0	

Source: The author.

Figure 1. Non-outsourcing
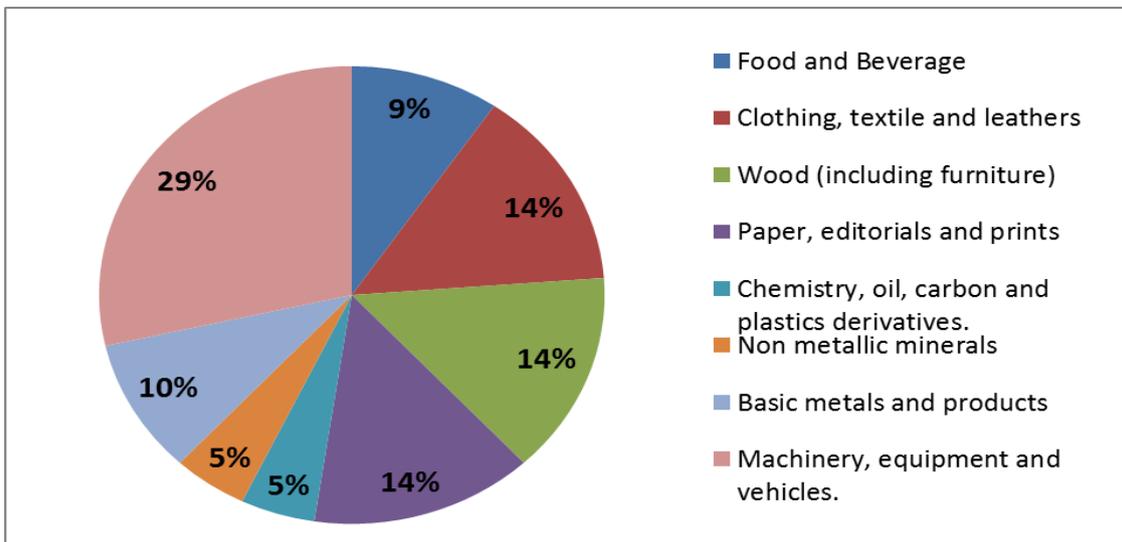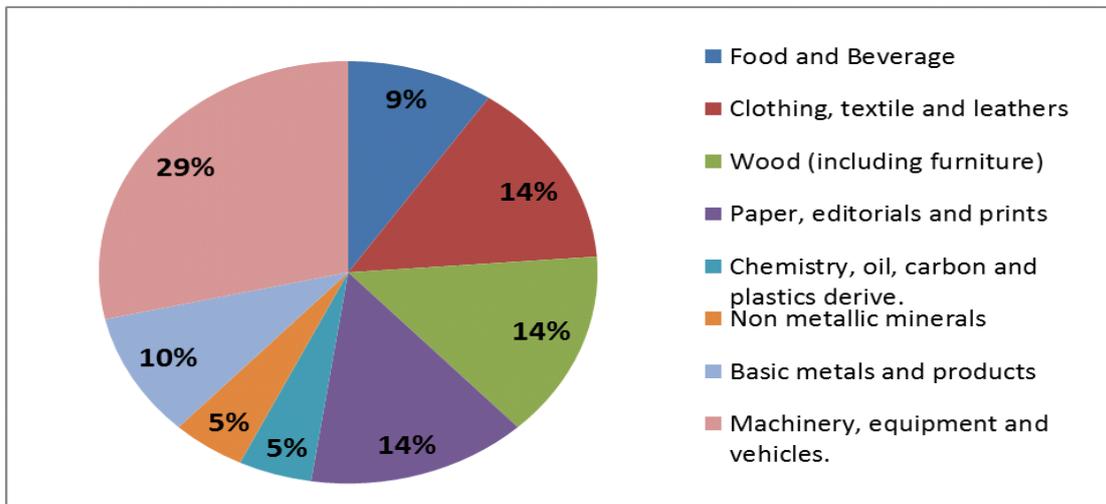
Source: The author.

Most of the firms (79.6%) have not outsourced any activity for the last three years. However, the most dynamic industries are Wood (42.9%), Clothing, textile and leather (37.5%) and Machinery, equipment and vehicles (37.5%) (Figure 1).

From Figure 2, we observe that outsourcing prevails in 2 Smallfirms (26.2%). Besides, Medium firms have not outsourced for the last years.

Figure 2 Outsourcing

Source: The author.

If we explore outsourcing activities (see Table 2), we can see that outsourcing parts of the manufacturing process is the most frequent (81%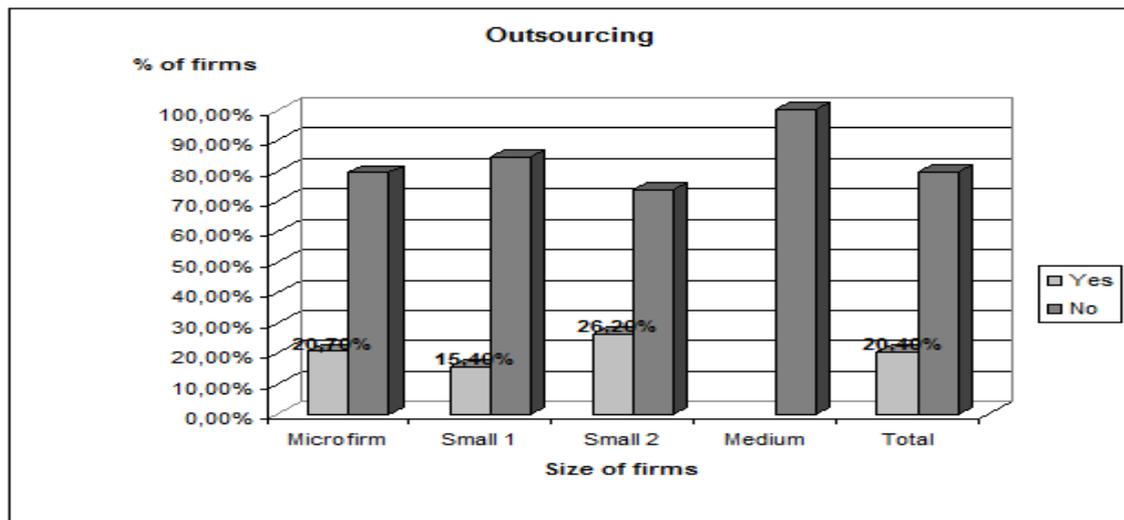 of outsourcing firms). Outsourcing of ICT services is only present in 3 cases. This result is linked to the relevant level of ICT access and use of the sample.

Table 2 Outsourcing activities

		N	Column % (Base: N total)
Outsourcing activities	Parts of manufacturing process	17	81.0%
	Commercial logistics	6	28.6%
	Maintenance	5	23.8%
	Others	4	19.0%
	ICT services	3	14.3%
	Management and accountability	1	4.8%
	Financial Management	1	4.8%
	Quality control	0	0%
	Total	21	

Source: The author.

ICT access is pretty disseminated among the firms, 77.7% of SME access Internet and e-mail. Besides, 42% of SME have a website presence. Access to EDI or Electronic Data Interchange systems, Extranet and Intranet are still low (20.4%, 19.4% and 1.9% respectively). Hence, the more complex ICT is the lower the percentage of firms with ICT access. Most of the firms use Internet to contact suppliers and clients, and banking and financial services.

If we classified the firms according to the level of ICT access (Figure 3), we observe that the higher the level of ICT access, the higher the proportion of firms outsourcing any of their internal activities.

Figure 3 Outsourcing and Non-outsourcing firms
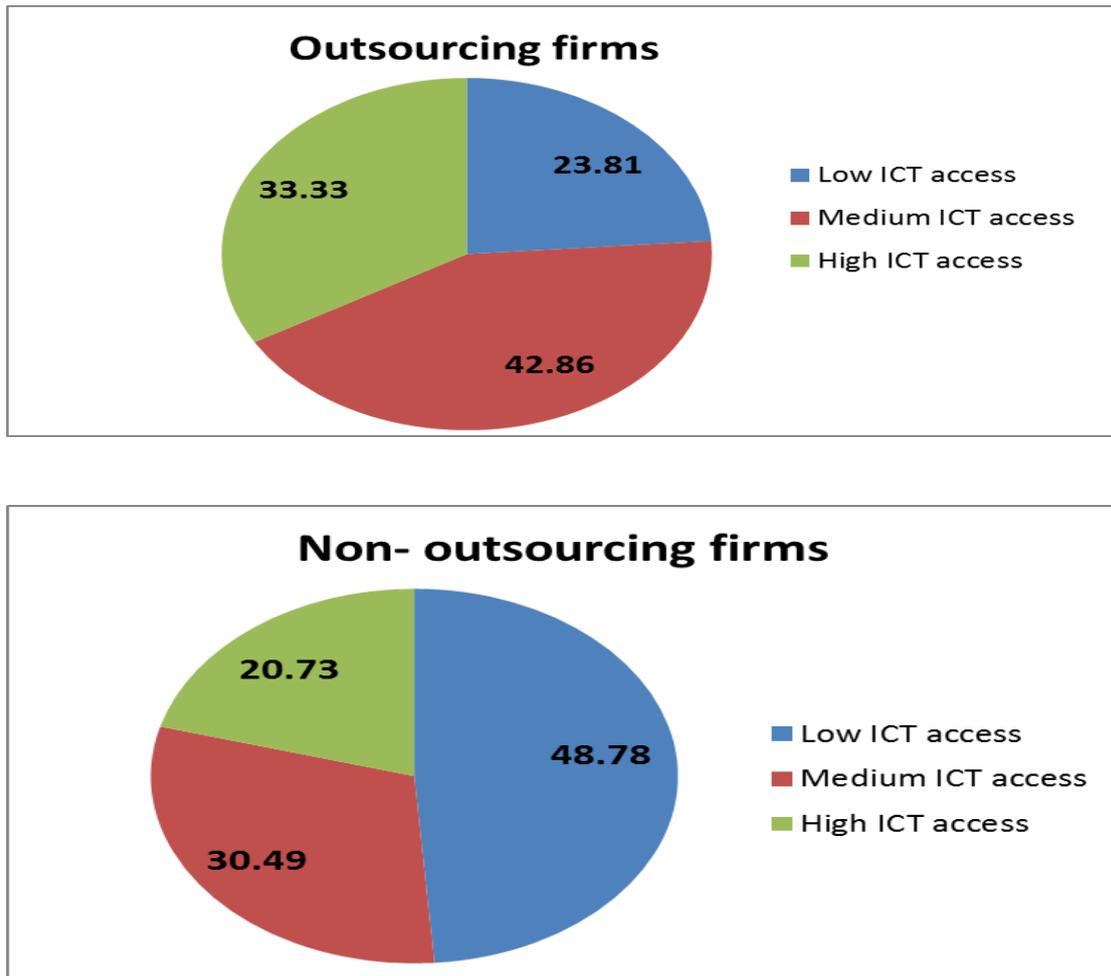
Source: The Author.

Even though the proportion of SME that have outsourced any of their activities is low, we can observe that the higher the level of product innovation, the higher the proportion of firms that have outsourced their internal activities (see Table 3). This monotonic pattern of innovation does not apply to process and organization innovation.

Table 3 Product Innovation

		Outsourcing				Total	
		Sí		N			
		N	Row%	N	Row%	N	Row%
Product Innovation	Change in some product recipient.	1	3.80%	25	96.20%	26	100.00%
	Change in some product inputs.	4	13.80%	25	86.20%	29	100.00%
	Change in some product process	1	16.70%	5	83.30%	6	100.00%
	New product for the firm, not for the market	7	26.90%	19	73.10%	26	100.00%
	New product for the market	8	50.00%	8	50.00%	16	100.00%
Total		21	20.40%	82	79.60%	103	100.00%

Source: The author.

Next, by means of a logistic regression model (logit), we will determine the simultaneous influence of a set of independent variables on the outsourcing conduct. We want to estimate which the explanatory factors of the probability to outsourcing are (see Descriptive Statistics in Table 1 from Appendix).

Dependent variable: outsourcing conduct; binary variable that takes value 1 if the firm has outsourced any internal activity and 0 otherwise.

The LOGIT model derives from a model of latent or unobservable variable. Let y* be the latent variable 'outsourcing conduct' that is determined by some independents observable variables through the following structural equation:

$$y* = \beta_0 + x\beta + e, \quad y = 1[\, y* > 0]$$

The relationship between the outsourcing conduct emerges through the following equation:

$$y = 1 \text{ if } y* > 0$$

$$y = 0 \text{ if } y* <= 0$$

In this paper we supposed that the error term e assumes a logistic distribution with Var $e = \pi^2/3$. Thus, the resulting LOGIT model equation is:

Independent variables:

Firm size: this variable represents mainly the number of employees.

Hypothesis: We suppose that the larger the firm, the higher the probability to outsource any internal activity.

Export: a binary or dummy variable that takes value 1 if the firm has exported any percentage of the sales and 0 otherwise.

Hypothesis: We suppose that an exporter firm has a higher probability to outsource any internal activity.

Innovation: this variable represents mainly product and organizational innovations made during the last three years. Information comes directly from the survey that asks enterprises if they have made any product, process or organizational innovation. Innovation is represented by two variables: Product and Process Innovation (Ipp) and Organizational Innovation (Iorg) from a Categorical Principal Components Analysis CATPCA (see Table 2 and 3 from Appendix).

Hypothesis: We suppose that the more innovative the firm, the higher the probability to outsource any internal activity.

E Investment: a binary or dummy variable that takes value 1 if the firm has invested in machinery and equipment during the last years. Firms' decision to invest in machinery and equipment might be a reasonable proxy for fixed costs and expectations with regard to technological change in its production process.

Hypothesis: We suppose that the more investments the firm makes, the higher the probability to outsource any internal activity.

ICT access: By means of a Categorical Principal Components Analysis (CATPCA), we identified a dimension or factor to represent the ICT access variable (see Table 4 and 5 from Appendix). This bundle represents some ICT access variables such as telephone/fax, e-mail, Internet, Intranet, Extranet, EDI.

Hypothesis: We suppose that the more access to ICT, the higher the probability to outsource any internal activity.

Firm Age: it represents the owners' experience in some functional areas of the firm. Since it is linked to the firm size, we add it as a control variable.

Hypothesis: We suppose that the younger the firm, the less the probability to outsource any internal activity.

Industry: We group firms into 8 different industries: Food and Beverage; Clothing, textile and leather; Wood (including furniture); Paper, editorials and print; Chemistry, oil, carbon and plastic derivatives; Non- metallic minerals; Basic metals and products, and Machinery, equipment and vehicles.

4. RESULTS

We take into account the potential industry unobserved heterogeneity by adjusting standard errors for clustering. We estimate different models according to the innovation variable and ICT variable inclusion (see Table 4). Innovation appears to be a significant factor for outsourcing decision. Similar to many authors (Bartel et al, 2009; Dyer and Nobeoka, 2000; Dyer and Singh, 1998) the more innovative a firm is, the more likely to outsource the firm will be. Much of a firm's innovation occurs in conjunction with outside suppliers (Dyer and Singh, 1998) to take advantage of the specialized knowledge of suppliers (Abraham and Taylor, 1996). This also confirms the Resource Based explanation of outsourcing (Barney, 1999; Quinn, 2000).

In model 1, we include Ipp (innovation in product and processes). Ipp is significant in this model, and increases the probability of outsourcing. Ipp loses significance once we include the organizational innovation variable (Iorg). Iorg is significant in all the models estimated, with a negative sign.

ICT access is strongly correlated with outsourcing activities. Contrary to many case studies (Abramovsky and Griffith, 2006; Lucking-Reiley et al., 2001; Wynarczyk, 2000), the less advanced in ICT access a company is, the more likely it is to outsource some of its business activities (see model1 and 2 in Table 4). The intuition behind the negative effect of large ICT access on outsourcing decision is that the more frequently innovations in technology arrive, the less time the firm has to amortize the sunk costs associated with an obsolete technology. Outsourcing enables the firm to purchase from supplying firms that are using the latest technology and avoid the sunk costs of the latest ICT technology (Bartel et al, 2008).

Another reason for the negative relationship between ICT access and outsourcing comes from the complementarity between ICT capital and non-routine workers. As Leamer and Storper (2001) and Leamer (2007) emphasize, the transfer of competences depends critically on an important distinction between routine codifiable and non-routine tasks. The complementarity between ICT capital and workers performing non routine tasks increases the marginal productivity of non-routine inputs and therefore, their relative demand. This might make the standard offshoring option less attractive whenever this choice is driven by the abundance of routine workers.

Following the transaction cost theory, it might be argued that some of the components of ICT capital are characterized by high degrees of complexity and asset specificity and this in turn might make the outsourcing of part of the production process a less attractive option (Benfratello et al, 2009).

When using website or internet as ICT explanatory variables (see models 3 and 4 in Table 4), we do not observe a significant influence on the probability to outsource. This can be explained by the fact that Internet, mainly, is a basic information and communication technology whose access could not influence on the outsourcing conduct.

About the control variables, firm size is not significantly correlated with outsourcing activities. However, the positive sign between size and outsourcing follows Mol (2005) and is contrary to the negative relationship found in Ono and Stanko (2005) and Abraham and Taylor, (1996). Besides, as the export sign indicates the outsourcing activity appears to be influenced by export firms. Similar to Cachon and Harker (2002), more export intensive industries will be faced with a more competitive environment and will therefore seek to outsource more.

We do not find a significant impact of machinery and equipment investment on outsourcing activities in any model. Firm age is not a significant variable in Model1, contrary to the rest of the models. The mean predicted probability of outsourcing is 0.18 based on 76 observations.

Do Information and Communication Technology access and innovation increase outsourcing in small and medium enterprises?

317

Table 4

	Model 1		Model 2		Model 3		Model 4	
	Coef	z	Coef	z	Coef	z	Coef	z
Ipp	1.2338**	2.13	2.0804	1.51	2.0131	1.58	2.071573	1.63
Iorg			-1.002*	-1.85	-1.1108**	-2.20	-1.1543**	-2.16
ICT access	-.7842*	-1.84*	-.7680*	-1.76				
Website					.99721	1.01		
Internet							.3269743	0.38
Firm size	-.04516	-1.64	.0035	0.04	.00989	0.12	.0016347	0.02
Export	2.5624**	2.13**	2.8945	1.56	2.9740	1.64	3.3111**	1.99
E Investment	-1.0008	-0.99	-1.350	-1.11	-.96132	-0.88	-1.071534	-0.93
Firm Age	.01392	0.71	.0430**	2.47	.04118**	2.54	.03731**	2.54
Small1			-1.6315		-1.5889		-1.341337	
Small2			-1.5472		-1.4961		-1.206117	
Constant	-1.1642			-1.681***	-2.4018***		-2.129***	
N	76		72		72		72	
Prob > F	0.0033		0.0000		0.00000		0.0000	
Pseudo R2	0.2698		0.3347		0.3179		0.2970	
					(Std. Err. adjusted for 6 clusters in industry)			

Source: The author. Results obtained after 5 iterations.

Next, we focused on some significant explanatory variables. To study the impact of each variable on the probability of outsourcing, we compute the predicted probability under two possible values of the independent maximum and minimum variables (Table 5). We want to analyze the variation in the predicted probability when the independent variable takes a maximum or minimum level, without specific values for the rest of the variables which are considered at their average levels.

Table 5 Innovation and ICT

	Max	Min	Difference
Innovation	0.3249	0.0171	0,3078
ICT	0.0382	0.6605	-0,6223

Source: The author.

We can observe that the difference in the probability of outsourcing between the maximum and minimum levels of the variables is higher with ICT (-0,6223) than with innovation (0,3078).

5. CONCLUSION

The decision to outsource is conditioned by a set of firms' structural characteristics that leads firms with a better competitive position more likely to outsource.

In the econometric model described, the empirical results show that the more innovative in products and processes an SME is, the more likely to outsourcing a firm will be. Besides, organizational innovations lead SME to a lower probability of outsourcing.

One of the contributions of the paper is leading to the idea that ICT tools are different in nature and, therefore, they may have a different effect on the propensity to outsource. Contrary to many case studies, the less advanced in ICT endowments a company is, the more likely it is to outsource some of its business activities. The transaction costs theory can explain why a higher ICT access can reduce the outsourcing strategy.

This might happen because the SME avoids the sunk costs of the latest ICT technology by outsourcing. ICT investment are unlikely to promote outsourcing and, therefore, this transmission channel should not be a reason of concern for policy makers when designing public policies aimed at the diffusion of ICT.

However, it does not address the endogeneity problem of the ICT investment decision. Although the model includes many relevant variables, it does not analyze others mentioned in the literature of outsourcing, for instance, the structure of costs of the subcontractor firm (we lack information of unit labor costs). Besides, we omit the impacts of perceived benefits, perceived roadblocks, and perceived criticality on the attitudes towards outsourcing and social factors, such as trust. Some authors state the key role of trust for managing interfirm relationships, especially in their relationships with suppliers. However, the treatment of trust in the econometric model is still a challenge.

Even though the empirical model uses data from an emerging country city, results should be extend to the situation of SME from other countries. Although the size of the sample is appropriate for the statistical significance of the empirical model, we recognize that a larger one would be better. Moreover, it would be useful to analyze a panel data model. However, we must stress the difficulty in data analysis in developing countries. The inclusion of the ICT access variable is an important contribution to the analyses of SME outsourcing decision.

REFERENCES

Abraham, K. G. and Taylor, S. K. (1996). Firms' Use of Outside Contractors: Theory and Evidence. Journal of Labor Economics, Vol. 14, No. 3, pp. 394-424

Abramovsky and Griffith(2006).Outsourcing and Offshoring of business services. How important is ICT? Journal of the European Economic Association, vol.4, N°2-3, pp 594-601.

Barney, J. (1991) "Firm resources and sustained competitive advantage." Journal of Management, vol. 17, N°1, pp 99–120.

Bartel, A; Lach, S and Sicherman, N. (2009). Outsourcing and Technological Change. IZA (The Institute for the Study of Labor, Germany) Discussion Paper No. 4678.

Bartel, A; Lach, S and Sicherman, N. (2008). Brief synapses of The impact of technological innovation on outsourcing decisions. MIT Sloan Management Review, Cambridge.

Bartel, A; Lach, S and Sicherman, N. (2008). Outsourcing and technological innovations: A firm-level analysis. Working paper N°057.RIVAFE2 (Regional Comparative Advantage and Knowledge Based Entrepreneurship).

Bakhtiari, S. (2011). Efficiency and Outsourcing: Evidence from Australian Manufacturing. UNSW Australian School of Business Research Paper No. 2012-07

Bemfratello, L; Razzolini, T. and Sembenelli, A. (2009). Does ICT investment spur or hamper offshoring? Empirical evidence from microdata. Department of Economics and Public finance G Prato, Universita Degli Studi Di Torino. Working paper Na5. June 2009.

Cachon, G.P., Harker, P.T., 2002. Competition and outsourcing with scale economies. Management Science 48 (10), 1314–1333.

Clemons, E.K., Reddi, S.P.; Row, M. (1993). "The Impact of Information Technology on the Organization of Economic Activity: The "Move to the Middle" Hypothesis". Journal of Management Information Systems, December 1993.

Coase, R. (1937). The nature of the firm. Económica, vol. 4, N°16, pp. 386-405.

Ding, Hung-bin (2001) "Network and innovation: the impact of initial innovation conditions on interfirm network formation." Change Management and the New Industrial Revolution. Proceeding from the International Engineering Management Conference (IEMC), pp. 348 – 353.

Diaz-Mora, C. (2005). "Determinants of outsourcing production: A dynamic panel data approach for manufacturing industries". Documentos de Economía y finanzas internacionales 05/07. http://www.fedea.es/hojas/publicaciones.html

Díaz Mora, C. y Gangoy Juste, R. (2008). Outsourcing en las industrias tradicionales: determinantes de la estrategia. Revista Estudios Empresariales. Segunda época. N°1, p. 41-64.

Dobrzykowski , D; Tran, O; and Tarafdar, M. (2010). Value co-creation and resource based perspectives for strategic sourcing Strategic Outsourcing: An International Journal, vol. 3, Issue 2. Dyer, J.H. and Nobeoka, K. (2000). Creating and managing a high performance knowledge-sharing network: the Toyota case. Strategic Management Journal 21 (3), 345–367.

Dyer, J.H. and Singh, H. (1998). The relational view: cooperative strategy and sources of interorganizational competitive advantage. Academy of Management Review 23 (4), 660–679.

DIW Berlin (2008). An economic assessment of ICTadoption and its impact on innovation and performance. A cross sector e-business watch. Report from The European Commission, Enterpirse and Industry Directorate General.

EIM Business & Policy Research (2009). Final report. "EU SMEs and subcontracting". Grant, R.M., 1996. Prospering in dynamically-competitive environments: organizational capability as knowledge integration. Organization Science 7 (4), 375–387.

Grossman, G. and Helpman, E. (2005). Outsourcing in a global economy. Review of Economic Studies, vol. 72, pp. 135–159.

Girma and Gorg (2004). "Outsourcing, Foreign Ownership, and Productivity: Evidence from UK Establishment-level Data," Review of International Economics 12:817-832.

Görg, H., Hanley, A. & Strobl, E. (2004): Outsourcing, Foreign Ownership, Exporting and Productivity: an Empirical Investigation with Plant Level Data. Research Paper 04/08, GEP, University of Nottingham, Nottingham.

Görg, H. and Hanley, A. (2007). International services outsourcing and innovation: an empirical investigation. Research paper series, University of Nottingham. Electronic copy available at: http://ssrn.com/abstract=1048621.

Hagedoorn, J., 1993. Understanding the rationale of strategic technology partnering: interorganizational modes of cooperation and sectoral differences. Strategic Management Journal vol. 14, N°5, pp. 371–385.

Holl, A. (2004): Production Subcontracting and Location: Panel Data Evidence from Spanish Manufacturing Firms. Mimeo, Department of Town and Regional Planning, University of Sheffield, Sheffield. (Available in http://www.shef.ac.uk/tr1ah/spain03.pdf).

Jenster, P; Stener Pederson, H; Plackett, P and Hussey, D. Outsourcing-insourcing: Can vendors make money from new relationship opportunities?. John Wiley & Sons, May 2005.

Kimura, F. (2001). Subcontracting and the performance of Small and Medium firms in Japan. The International Bank for Reconstruction and Development/The World Bank, USA.

Kimura, F. (2001): Fragmentation, Internalization, and Interfirm Linkages: Evidence from the Micro Data of Japanese Manufacturing Firms. In L.K. Cheng $ H. Kierzkowski (Eds.), *Global Production and Trade in East Asia.* Boston: Kluwer Academic Publishers.

Kogut, B., Zander, U., 1992. Knowledge of the firm, combinative capabilities, and the replication of technology. Organization Science Vol. 3, N°3, pp. 383–397.

Leamer E.E., Storper M. (2001), The Economic Geographic of The Internet Age. NBER Working Paper n°8450, Cambridge, MA.

Leamer E. (2007). A flat world, a level playing field, a small world after all, or none of the above: a review of Thomas L. Friedman's the World is Flat. Journal of Economic Literature XLV, pp 83-126

Lucking-Reiley, D. y Spulber D.F. (2001) Business to Business Electronic Commerce. Journal of Economic Perspectives-Vol.15, N°1. pp.55-68.

McLaren, J. (2000): "Globalization and Vertical Structure", American Economic Review, 90, p. 1239-1254.

Malone, T.W., Yates, J.A., Benjamin, R.J., (1989). "The logic of electronic markets." Harvard Business Review 67/3, p. 166–170.

Mazzanti, M; Montresor, S. and Pini, P. (2007) Outsourcing and innovation: Evidence for a local production system of Emilia-Romagna. Innovation Management Policy Practice, Vol. 9, Issue: 3-4, Publisher: eContent Management Pty. Ltd, p. 324-342

Ono, Y. and Stango, V. (2005). "Outsourcing, firm size and product complexity: Evidence from Credit Unions". Economic Perspectives, 1Q, pp 2-11.

OECD, Handbook on Economic Globalisation Indicators, Paris, 2005b.

Prahalad, C. K., and Hamel, G. (1990) "The Core Competence of the Corporation", Harvard Business Review, vol. 68, No. 3, pp. 79-91.

Sadowski, B.M.; Maitland, C.and Van Dongen, J. (2002) "Strategic use of the Internet by small- and medium-sized companies: an exploratory study." Information Economics and Policy 14, 75–93.

Souza, M.C. A.F., and Bacic, M. J. (2000). ¿Por que os programas de terceirização falham?. Enfoque Reflexão Contábil, vol 19, Nº2, pp 16-27.

Tomiura, E. (2004): Foreign outsourcing and firm-level characteristics: evidence from Japanese manufacturers. Hi-Stat Discussion Paper No. 64, Institute of Economic Research, Hitotsubashi University, Tokyo

United Nations Industrial Development Organisation (UNIDO), International Subcontracting Versus Delocalisation A Survey of the Literature and Case Studies from the SPX Network, Vienna, Austria, 2003. Available on the Internet at: http://www.unido.org/fileadmin/import/18187_SPXversusDELOCinonedoc.pdf

Williamson, 0. (1975). Markets and Hierarchies: Analysis and Antitrust Implications. Free Press, New York.

Williamson, 0. (1981) "The Economics of Organization: The Transaction Cost Approach." American Journal of Sociology, vol 87, N°3, pp. 548-577.

Williamson, O. (1982) "The modern corporation." Journal of Economic Literature, vol. 19 (December), pp. 1537-68.

Wynarczyk, P. The role of digital networks in supply chain development. New technology, work and employment, vol 15, N°2.

Yun, M. (1999) "Subcontracting relations in the Korean automotive industry: risk sharing and technological capability." International Journal of Industrial Organization 17, 81–108.

APPENDIX

Table 1. Descriptive Statistics

Variable	Obs	Mean	Std.Dev	Min	Max
Firm size	103	18.18447	27.08257	1	150
Export	103	.0679612	.25291	0	1
Innovation*	103	.4136928	.2735988	0	1
E investment	76	.6052632	.4920419	0	1
ICT access*	103	.702763	.2024193	0	1

Source: The Author based on SPSS. * Variables obtained from CATPCA were indexed for the descriptive statistics.

Innovation

Table 2. Model Summary

Dimension	Cronbach's Alfa	Variance accounted for	
		Total (Eigenvalues)	% of variance
1	.463	1.446	48.197
2	.084	1.060	35.320
Total	.901(a)	2.506	83.518

Source: The Author based on SPSS. a Total Cronbach's Alfa is based on the total Eigenvalues

Table 3. Component Loadings

	Dimension	
	1	2
Type of process innovation	.850	-.235
Type of product innovation	.850	.237
Type of Organizational innovation	-.001	.974

Source: The Author based on SPSS. Variable Principal Normalization Used.

ICT Access

Table 4. Model Summary

Dimension	Cronbach 's Alfa	Variance accounted for
		Total (Eigenvalues)
1	.608	2.026
2	.283	1.309
Total	.840(a)	3.335

Source: The Author based on SPSS. a Total Cronbach's Alfa is based on the total Eigenvalues.

Table 5. Components Loading

	Dimension	
	1	2
Internet	.806	.409
Website	.762	.210
Intranet	.640	-.422
Extranet	.460	-.387
EDI	.309	.513
Type of connection	-.281	.712

Source: The Author based on SPSS. Variable Principal Normalization Used.