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An empirical investigation of determinants to buy application services from ASPs

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Abstract

The Application Service Provider (ASP) is a pivotal point in the organization of information systems, since it brings up a new paradigm: "make, buy or rent".

An ASP is a company, which manages and rents software to different users through an own data centre and network infrastructure, typically the Internet.

In this way, the application services can be easily and quickly upgraded, which allows to distribute only the needed applications to different users in different places, without the disadvantage of fixed costs for them.

This new challenge in the ICT arena aims to find its business on the capability to maximize scale and experience economies deriving from hardware and software management and maintenance, transferring this advantage to its clients, making them able to reduce ICT costs.

The paper tested three hypotheses explaining the rent propensity, which is the propensity to buy application services from an ASP. In particular, two of the three hypotheses were confirmed. The first one shows how the "gap" in internal IS capabilities positively affect the acquisition of application service from an ASP. The second hypothesis confirmed shows how the propensity to buy application services depends on the company capability to monitor and control costs referred to information systems.

The first implication is that application services are not bought exclusively for economic reasons. This becomes even clearer when competences for losing data and infrastructure control are taken into account. Some other several managerial and organizational implications stand out clearly in detail in the paper.

Keywords

Application Service provider, Asp, organization capabilities, internet, make or buy, organization, outsourcing, rent, resource based view, resource dependence theory, transaction costs, information system

1. Introduction

In the recent past, businesses which used to work with software applications had to compare costs linked to internal development and costs to acquire standardized external solutions. Now they have a new option: “to rent”, entering and using the needed applications via the Internet. The birth of the ASP is a consequence to the shift from the “make or buy” paradigm to the “make, buy or rent” one. An ASP (Application Service Provider) is a business, which manages and rents software to different users through an own data centre and network infrastructure, typically the Internet.

Until now theoretical studies about information systems have been focused on the choice between out-sourcing or in-sourcing. The “rent” option has never been recognized nor taken into consideration. This paper tries to provide a first contribution to the analysis of the phenomenon. In particular, this article tries to point out what is the interaction scheme between the factors influencing the choice to “rent” within the framework of the organization of information systems.

So, the research proposition of this paper is that the ASP model will thrive as soon as its advantages – economic, organizational, and strategic - become more and more obvious against

This research proposition, referring to three theories (Transaction cost theory, Principal-agent theory, Resource based theory) is expanded through several hypothesis with various independent variables.

Coherently with transaction cost theory and other studies in outsourcing field, the first hypothesis implies that the application services of an ASP would be bought only if its total costs, that is the sum of transaction and production costs, are less than the costs connected to the internal management of information systems or the “buy” option costs.

The second hypothesis, according to Resource-based theory, is founded upon the belief that a company lacking of internal IS capabilities, is very likely to acquire what it needs externally. That should be done buying application services from an ASP.

Coherently with the Principal - agent theory, the second hypothesis is that the choice to buy application services from an ASP could be the best one, when the monitoring of IS management costs is difficult or expensive in in-sourcing modality and that it would keep down agency costs too.

Differently from the first hypothesis, the application services are not bought only under economical considerations. Price is critical, but it is not the main issue. We argue that the “gap” in internal IS capabilities is the most important decision driver. It becomes even clearer when considerations on competences enter the field. A company with low IS competences would try to fill the gap buying application services, to move any technological complexity (hardware and software) outside its boundaries.

Also the third hypothesis is confirmed, by that meaning, buying application services is to be considered as a way to better control information system costs, and that it could be useful to share and load these costs on different company's areas using certain data concerning costs and utilization rate.

With the hierarchical regression, we highlighted further relevant mediation effects among the different independent variables.

The first mediation effect is produced by the “gap in IS capabilities” variable on the “production costs advantage” is to be interpreted as the prevailing of considerations related to the “gap in IS capabilities” on the ones related to costs advantage.

The second mediation effect is determined in the third model of hierarchical regression, with the insertion of the “performance measurability” variable is to be considered a consequence to the fact that a greater capability to “control/manage” a project gives more strength to the in-sourcing option, as it does to the acquisition of competences to make it internally.

2. Issue overview: the ASP breakthrough

2.1 The Internet and the birth of a new operator: the ASP

The wide spreading of Internet has brought deep changes to companies structure and to entire industries. The value chain idea, acknowledged as the sequential and integrated management of informative and physical flows, has been outpaced by a model where physical flows may exist without being coupled with the informative ones.

Until now, thinking about IS equipment, we have always seen companies owning the hardware infrastructure on which its software procedures run. Usually hardware and software were both inside the company. Even when a company outsourced its IS, the technological infrastructure was generally placed into the company and managed by the company's specialists.

With the Internet we now have the chance to split the management and maintenance of IT infrastructure (hardware and software) from its usage, moving from a one-to-one relationship to a one-to-many one, where different users share the same technological infrastructure.

This has given birth to the Application Service Provider (ASP), a new actor in ICT industry, which builds and maintains hardware and software architecture of the entire IS (or of its branches), allowing different companies, even at the same time, to log in and use “application services” through a common Internet browser.

2.2 What is an ASP

An ASP is a company which manages and rents software to different users through an own datacenter and network infrastructure, typically the Internet.

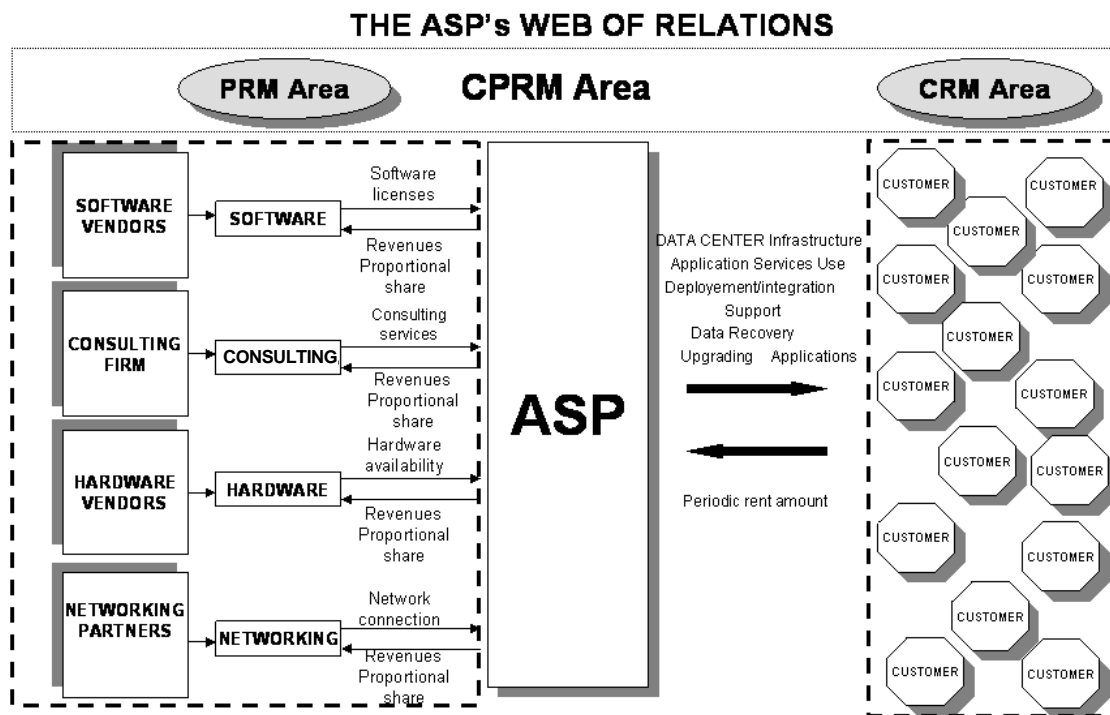
The ASP arises from the convergence of software and infrastructure (ICT) towards an “Internet-

From a technological point of view, an ASP concentrates in its own data center the whole applicative complexity and allows applications to be independent from clients, thus cutting down costs of software distribution (figure 1). The users of different applications clients log in a server farm via the Internet. Even problems and risks linked to data security, integrity and reliability should be fixed.

Actually, the ASP allows client companies to minimize complexity, costs and risks connected to the internal management of software applications in a “server farm”, making available even to small and medium enterprises really complex application services (as ERP¹ for instance). Last but not least, it does it quickly, error free and at low costs, without investments in software licences, in hardware and in specialised human resources for the customer.

The ASP's role is to set up a common interface for clients, managing relations with each actor involved in the service “production” and becoming the sole responsible before the client (figure

1). The client interacts only with the ASP. The web of links between the ASP with other firms, whose work keeps high the quality of service, is invisible to him. Therefore, the ASP shall coordinate the web of relations, and it should be managed by medium-long term contracts between the ASP and its clients.



2.3 The way up to the ASP

The birth of the ASP is a consequence to the shift from the “make or buy” paradigm to the “make, buy or rent” one. In the recent past, businesses which used to work with software applications had to compare costs linked to internal development and costs to acquire standardized external solutions. Now they have a new option: “to rent”, entering and using the needed applications via the Internet.

3. Research overview and approach

3.1 Introduction

The Application Service Provider (ASP) is a pivotal point in the organization of information systems, since it brings up a new paradigm: “make, buy or rent”.

Until now theoretical studies about information systems have been focused on the choice between out-sourcing or in-sourcing. The “rent” option has never been recognized nor taken into

consideration. This paper tries to provide a first contribution to the analysis of the phenomenon. In particular, this article tries to point out what is the interaction scheme between the factors influencing the choice to “rent” within the framework of the organization of information systems.

3.2 Research overview

This research proposition is summarized as follows:

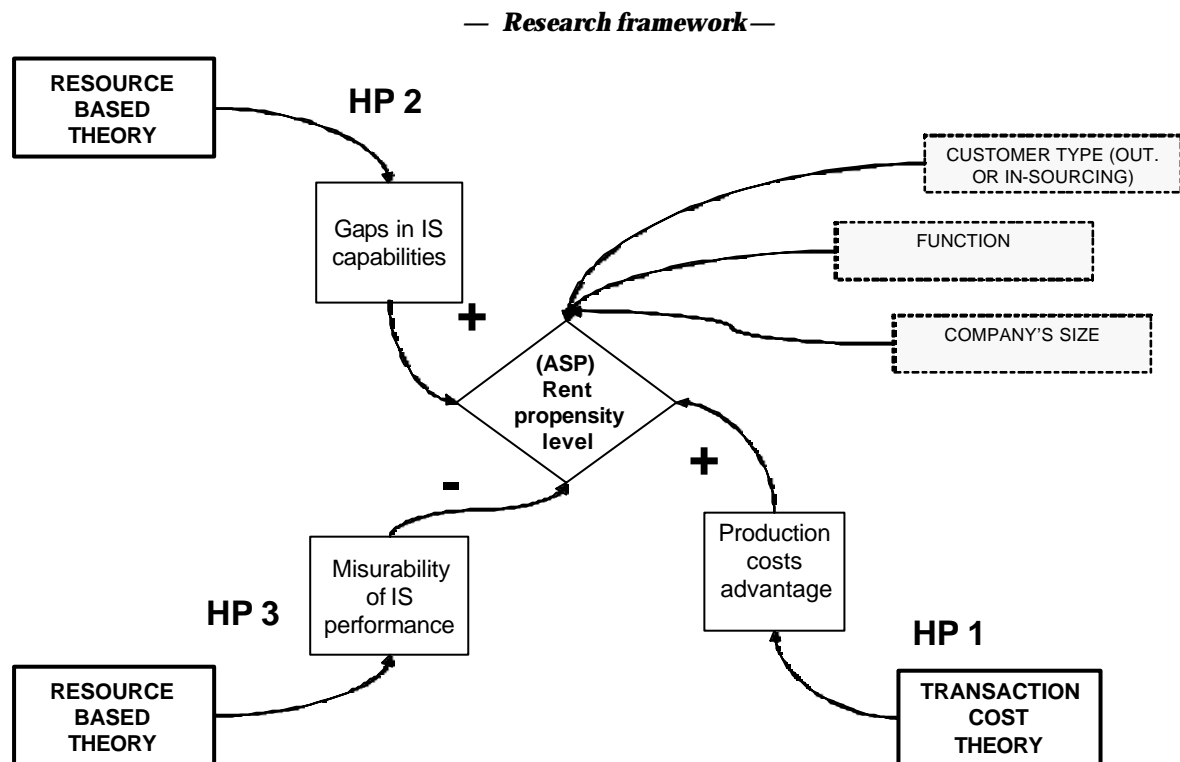


Figure 2 – Author's elaboration

The ASP model, that is the “rent” option within the framework of the organization of information systems, will thrive as soon as its advantages – economic, organizational, and strategic - become more and more obvious against the “make” or “buy” ones.

This research proposition, referring to a research framework (figure 2) with three theories (Transaction cost theory, Principal-agent theory, Resource based theory) is expanded through several hypothesis (figure 3). with various independent variables. Hereinafter we analyse the different theories used and we expand the research's hypothesis linked to each theory.

Research hypothesis

HP 1 – The bigger the advantage in terms of production costs with the ASP, the higher the “rent” propensity

HP 2 – The bigger the “gap in IS capabilities” the higher the “rent” propensity

HP 3 – The lower the measurability rate of the information system performance in in-sourcing modality, the higher the “rent” propensity

Figure 3 – Author's elaboration

3.3 Transaction cost theory

Born in the mid- 70's, the “Transaction cost theory” was built to explain decisions concerning different organizational (inter organizational) structures, in terms of minimization of transactions costs (Coase, 1937).

The basic analysis unit is made up of transaction costs, which are costs to acquire inputs needed to produce the outputs. Hence, only costs connected to the procedure of acquisition and placement are to be considered transaction costs.

A successful company is made up of its ability to manage transactions efficiently that is a company that manages to have lower total costs (production and transaction costs) than the competitors. Beside the previous economic analysis, the management should focus on the organizational planning issue more than on the technological one.

3.4 The “Transaction cost theory” and the ASP model

Taking into consideration the acquisition of application services from an ASP, we should compare production and transaction costs connected with each opportunity. The application services of an ASP would be bought only if its total costs, that is the sum of transaction and production costs, are less than the costs connected to the internal management of information systems or the “buy” option costs.

Coherently with what we have stated until now, referring to production costs as a proxy of total costs, the research aim is to test this hypothesis:

HP 1 – The bigger the advantage in terms of production costs with the ASP, the higher the

3.5 The “Principal – agent theory”

The Principal - agent theory (Jensen and Meckling, 1976), visualizes a company as a group of contracts. It is focused on issues related to the identification of the most efficient contract (task monitoring oriented or results monitoring oriented) to manage the “principal-agent” relation. The contracts define the ways rights of decision and action are shared among the company's agents.

A contract can task control-based or results control-based. The choice depends on “agency costs”, that is costs belonging to a possible misalignment between the “principal’s” target and the “agent’s” one. The basic trade-off of contracts’ balance is between a) Results measurement costs and risk transfer to the agent and b) Control costs (monitoring costs).

Agency costs use to grow up in agency’s relations featuring high environmental uncertainty, high-risk aversion, troubles in planning activities, difficulties measuring results and lengthy relations duration.

The main fault of the Principal - agent theory is that it does not take into considerations the cooperative nature of agency’s relations, instead holding the model of “rational man”, motivated only by material incentives.

3.6 The “Principal - agent theory” and the ASP model

Coherently with the Principal - agent theory, considering “in-sourcing” and “rent” solutions as two different contracts between CEO and Information System administrator, the research aim is to test this hypothesis:

HP 3 – The lower the measurability rate of the information system performance in in-sourcing modality, the higher the “rent” propensity.

The thoughts this hypothesis are that the choice to buy application services from an ASP could be the best one, if monitoring IS management costs is difficult or expensive in in-sourcing modality, and that it would keep down agency costs too. Buying application services, the total costs of information systems could be weighted and planned perfectly. As a result, these costs could be accurately redirected to the many revenues and costs centre of a company.

3.7 The “Resource-based View of the Firm”

The central concept of the “Resource-based View of the Firm” (Wernerfelt, 1984) is the centrality of resources' quality, which is acknowledged as the factor explaining different performances within an industry and moreover as the main driver of sustainable competitive advantage (Prahalad and Hamel, 1990; Wernerfelt, 1984).

According to this theory, resources are supposed to generate a sustainable competitive advantage only if they are distributed heterogeneously among industry’s competitors, not easy to be transferred, shielded from competitors, before and after the added value achievement that should be measured by incomes (Peteraf, 1993).

Identifying the managerial nature of resources, the distinction is between resources and competences (Grant, 1991a; Amit and Schoemaker, 1993). Competences, main component of competitive advantage, basically are knowledge-based routines (Nelson and Winter, 1982) rendered idiosyncratic by a lengthy accumulation process. Arranging and coordinating groups of tangible (such as financial and yielding capital) and intangibles resources (routines) the company’s processes turn out to work (Grant, 1991a and 1996a; Amit and Schoemaker, 1993).

Teece, Pisano and Shuen went beyond the routine’s idea and suggest the idea of “dynamic capabilities” referring to the “company’s ability to integrate, create and reconfigure external and internal competences to conform to environmental changes”.

The concept of “dynamic capability” leads the way to an issue concerning how routines use to evolve, that is the issue of organizational learning process.

3.8 The “Resource-based View of the Firm” and the ASP model

The “Resource-based View” allow us to observe the ASP model from the competences point of view. In particular, decisions concerning the choice of the ASP option are greatly influenced by the gap of IS capabilities to be filled to achieve a perfect system functionality (Grant, 1991). We summarize it as follows:

HP 2– The bigger the “gap” in “IS capabilities” the higher the “rent” propensity.

The hypothesis is founded upon the belief that a company lacking of internal IS capabilities, it is very likely to acquire what it needs externally. That should be done buying application services from an ASP.

4. Research Methodology

4.1 Introduction: Method and instruments

In order to validate the previous hypotheses, data was gathered through the use of written decision scenario using an experimental methodology that is the “lab experiment”. Although some scholars argue against experimental research, the usefulness of an experimental decision-based perspective has been demonstrated by a number of strategic process investigators (Mintzberg, 1978; Thomas and McDaniel, 1990) and is considered a promising method for enhancing understanding of competitive strategic decision-making (Schwank, 1995:489).

In our study, participants read a decision scenario that depicted a hypothetical situation in which a firm (the GDO Spa) urgently needing to renew its information system, have to choose whether to buy application services from an ASP or to apply the “make” or “buy” alternatives. The scenario included information in regard to the three alternatives. In the end, participants were asked to respond to many questions showing their agreement or disagreement with some statements explaining the “rent propensity” (dependent variable – table 1) and other independent variables (table 1).

Measurement items		Alfa	Factor Loadings
DEPENDENT VARIABLE			
Rent propensity PROPARENT			
y1	I would not hesitate in a chance to sign a contract with an ASP	.85	.790
y2	I would never apply to an ASP to rent application services I need		.796
y3	The ASP would help me to solve any efficiency issues related to an internal (own) IS		.817
y4	Acquiring application services from an ASP would fix any security and reliability trouble with our IS		.727
y5	The only way to guarantee high security and reliability level is to hold an internal IS		.815
INDIPENDENT VARIABLES			
Gaps in information system capabilitiesGINCAP			
x1	I believe that renting hardware capabilities from an ASP is the best way to keep the GDO's information system up to the company's need s	.83	.874
x2	I believe that renting software capabilities from an ASP is the best way to keep the GDO's information system up to the company's needs		.894
x3	I believe that relying on the professional level of the ASP technicians is the best way to have high quality resources at GDO's service		.826
Measurability of information system performace MPERIS			
x4	At GDO we can easily measure costs produced by own IS	.79	.760
x5	At GDO we can't define correctly costs produced by our own IS		.686
x6	To manage the IS in in-sourcing modality is not the best choise for GDO, it produces organizational troubles and high "hidden costs"		.843
Production cost advantage PROCOADV			
x7	At GDO we believe that the ASP shall reduce our hardware costs	.79	.886
x8	At GDO we believe that the ASP shall reduce our software costs		.779
x9	At GDO we believe that the ASP is able to reduce our costs related to specialized (in IS) human resourcess		.865

TABLE 1– Factor analysis

The scenario provided detailed information about a hypothetical firm in the retail (supermarket) industry. One criterion for industry selection was an industry with a large number of firm. We wished to create realistic scenario while not wanting respondents to make comparisons with real-life firms. The retail industry met this criterion well.

Before developing the scenario, we conducted an extensive search to identify typical information system problems faced by firms within supermarket industry. Scenario, four page long, included information about the firm, its background and organization history, the current decision situation and information about the three information system alternatives.

In order to refine the decision scenario an extensive pilot test of the instrument was conducted. Pilot study participants were also asked to evaluate the length of the instrument, the clarity of the questions, and to provide feedback in regard to the meaningfulness of the language used.

4.2 Measures

The sample cluster, after the reading of scenarios descriptions (proportionally distributed among the different groups members) had to answer:

showing their agreement or disagreement with some statements explaining the “rent propensity”

showing their agreement or disagreement with items explaining the other three dependent variables of the research framework ;

Some questions asked to the candidates are connected with the control variables included in the research framework (figure 2): size of the company, functions of main actors, type of customer (firm that has already outsourced or not).

4.3 Profiles and procedures

The scenario were submitted to 52 managers, from both technological and business areas, from various sizes firms (table 4), within about seven weeks. The time allowed to read and answer was strictly limited to 45 minutes. The mean recorded time stopped at 35 minutes.

We could identify some features of the candidates profiles. They do belong to each expected industries (30,4% manufacturing, 12,7% financial services, 27,5% other services, 3,9% public administration, 24,5% other industries, 1% not classified). They are mainly, but not exclusively, part of national companies or groups (77,5% national firms, 20,5% multinationals, 2% not classified) and they fit with each forecasted turnover classes. They come from every organizational areas (18,6% top management, 4,9% marketing, 5,9% sales, 7,8% logistics, 8,8% finance and administration, 25,5% information systems, 12,7% organization and human resources, 14,7% other organizational units, 1% not classified). We have either companies which has already outsourced (36,2%) either ones which did not do that (52%; 11,8% not classified).

— Turnover classes (in bill) —		— Industries —		— Organizational areas —	
0 - 10	26,5%	Manufacturing	30,4%	Top management	26,5%
10 - 50	16,7%	Financial services	12,7%	Marketing	4,9%
50 - 100	7,3%	Other services	27,5%	Sales	5,9%
100 - 500	11,8%	P.A.	3,9%	Logistics	7,8%
Over 500	10,8%	Other industries	24,5%	Finance & Adm.	10,0%
Not classified	28,8%	Not classified	1%	Pers. & Org.	12,7%
— Outsourcing —		— Company's type —		Sistemi Inf.	25,5%
Yes	36,2	National	77,5%	Other units	14,7%
No	52%	Multinational	20,5%	Not classified	1%
Not class.	11,3%	Not classified	2%		

Table 4 – Tables of features of the candidates profiles

5. Data and Results Analysis

5.1 Data analysis

We passed through two critical stages in the analysis of the data:

Factor analysis in order to validate the scales for which we could not rely upon literature;
 Setting a linear regression between valid factors and the “rent propensity” variable (calculated as mean of the values of its descriptive items). Then, identification and discussion, according to the hypothesis, of the coefficients sign, entity and possible mediation effects between the variables emerging from the hierarchical regression.

At first critical stage, we did a factor analysis in order to validate the scales for which we could not rely upon literature. The validation process was made of two steps. In the first step, we used the factor analysis to clean items related to each idea. In the second step, we did a confirmative factor analysis to verify if each items validated during the first step grew denser on its respective starting values.

In the first step, we used the factor analysis (table 1) on four variables groups, in order to clean items that should represent the “concept” to be measured. For every variable were extracted the factor with maximum loading factor (higher than .7) and with an Alpha (Cronbach) equal or higher than .7 .

During the second step of the validation stage, we realized a confirmative factor analysis of the yet validated scales (table 2) to verify if the structure of factors under the items was the same of the first analysis. The analysis confirmed the expectations.

Measurement items	Factor Loadings
INDEPENDENT VARIABLES	
Gaps in information system capabilities- GINCAP	
x1	.784
x2	.899
x3	.862
Measurability of information system performanceMPERIS	
x4	.861
x5	.855
x6	.540
Production cost advantage- PROCOADV	
x7	.848
x8	.789
x9	.772

TABLE 3 – Confirmative factor analysis

At the second stage, the final one, we set a hierarchical linear regression (table

3) between yet validated variables (“cost production advantage”, “gap in IS capabilities” and “performance measurability”) and the “rent propensity” variable (calculated as mean of the values of its descriptive items). We chose an hierarchical regression in order to consider mediation effects between independent variables.

Dependent Variable: PROPRENT		Standardized Coefficients		R Square	
Model		Beta			Sign.
1	(Constant)			.107	
	PRODUCTION COST ADVANTAGE	.328			.000
2	(Constant)			.424	
	PRODUCTION COST ADVANTAGE	.065			.000
	GAP IN INFORMATION SYSTEM CAPABILITIES	.888			.000
3	(Constant)			.525	
	PRODUCTION COST ADVANTAGE	.000			.970
	GAP IN INFORMATION SYSTEM CAPABILITIES	.620			.000
	MEASURABILITY OF IS PERFORMANCE	-.328			.000

→ Mediation effect 1 → Mediation effect 2

Table 2 – hierarchical regression with to evaluate mediation effects among the different independent variables (Author's elaboration)

5.2 Results and discussion

The last step in data analysis, i.e. hierarchical regression (table 3), allowed us to determine the supported hypotheses. In particular, two of the three hypothesis were confirmed:

HP 1 – The bigger the advantage in terms of production costs with the ASP, the higher the “rent” propensity; ➔ NOT SUPPORTED

HP 2 – The bigger the “gap in IS capabilities” the higher the “rent” propensity; ➔ SUPPORTED

HP 3 – The lower the measurability rate of the information system performance, in in-sourcing modality, the higher the “rent” propensity; ➔ SUPPORTED

The second hypothesis is supported ($\beta = .620$, $p < .000$), that is the agreement on the fact that acquiring application services from an ASP, depends on the “gap” in internal IS capabilities. A company with low IS competences would try to fill the gap buying application services, to move any technological complexity (hardware and software) outside its boundaries.

The third hypothesis too is confirmed ($\beta = -.329$, $p < .002$), that is that the propensity to buy application services depends on the company capability to monitor and control costs referable to information systems. By that meaning, buying application services is to be considered as a way to better control information system costs, and that it could be useful to share and load these costs on different company's areas using certain data concerning costs and utilization rate.

With the hierarchical regression, we highlighted further relevant mediation effects among the different independent variables.

The first mediation effect is produced by the “gap in IS capabilities” variable on the “production costs advantage” one. In particular, shifting from the 1st to the 2nd model of the hierarchical regression (table 3), the coefficient of the “production costs advantage” variable changes from positive to negative and loses significance (from $\beta = .328$ and $p < .018$ to $\beta = -.065$ and $p < .625$). Such a cut in the Beta value, after the insertion of the “gap in IS capabilities” variable in the regression, is to be interpreted from an economical point of view as the prevailing of considerations related to the “gap in IS capabilities” on the ones related to costs advantage. Actually, if you cannot manage a IS solution because you miss the necessary internal competences, any other consideration, included the ones concerning costs, will not ever come out.

The second mediation effect is determined in the third model of hierarchical regression, with the insertion of the “performance measurability” variable. The coefficient of the “cost production advantage” variable rises up in negativity and so in significance (from $\beta = -.065$ and $p < .625$ to $\beta = -.088$ and $p < .473$). The “gap in information system capabilities” variable coefficient rises too, but keeping the same significance level (from $\beta = -.686$ and $p < .000$ to $\beta = .620$ and $p < .000$). The variation of coefficients after the insertion of the “performance measurability” variable is to be considered a consequence to the fact that a greater capability to “control/manage” a project gives more strength to the in-sourcing option, as it does to the acquisition of competences to make it internally. After a first period of costs rises, it has to be hoped that in the mid run costs would decrease and have a big strategic impact.

5.3 Managerial implications

There are some managerial implications resulting from this research, in detail:

IMPLICATION 1 - Costs advantage isn't the only critical variable

IMPLICATION 2 - The propensity to buy application services depends upon the IS capabilities level of the buying company

IMPLICATION 3 - One of the main drivers leading to the acquisition of application services is the perceived accuracy in monitoring IT costs belonging to the chosen solution

IMPLICATION 4 - The ASP could discriminate prices according to the different IS capabilities level of each company or group of companies

The first implication is that application services are not bought only under economical considerations. Price is critical, but it is not the main issue. It becomes even clearer when considerations on competences enter the field. The second and the third implications are consequential to this first statement. The ASP should be structured keeping into considerations the company's peculiar features that drive to buy application services: lack of competences and evolution's stage of the accounting method. This two last statements, introduce the fourth implication, which is the chance to discriminate price and to segment customers according to their propensity to buy application services consequently.

5.4 Research limits and possible evolutions

An issue is that the ASP works within the Information and Communication Technology (ICT) industry. This industry is in quick and deep mutation; hence the research could be limited by the fact that managers or decision makers may buy application services only in order to increase flexibility. To prevent such a drawback, during the experiment building process we tried to make them fully enter into the determined situation, pushing them to give rational answer, strictly on the base of the information provided. This procedure helped to greatly increase the strength of the research.

Another limit is the total amount of collected data. We would have needed 100-150 total submissions according to the number of items exploding the different variables, that is ten for each item. We were able to collect 52 filled submissions. This is a quite big limit, but it should represent a further research opportunity. In our opinion the significance of variables could be greatly enhanced, as a result not yet supported hypothesis should be validated.

Moreover, another opportunity is to study the mediation effects yet emerged or emerging after further research.

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¹ ERP programs (Enterprise resource planning) are part of software developed to integrate all business process. ERP systems are software projected to autonomise the “organizational routines” (Nelson e Winter, 1982) and to model corporate strategical processes, from finance to sales, with the purpose of integrating internal corporate information and the sharing of this between the firm and its partners.