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Application Service Provisioning in SMEs: The Tough Job after the Hype

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Abstract

In the late 1990s the ASP (Application Service Provisioning) model was supposed to be the perfect solution for SMEs to reduce the cost and the risk of IT investments and to access high-quality services they could not otherwise afford.

In Italy, where the vast majority of firms are small or medium sized, the ASPs market has up to now failed to attract customers, with erratic sales and no real “killer application”. Nevertheless, after the “irrational exuberance” of the late 90s, existing ASPs are slowly starting to increase their sales.

The objective of this paper is to analyse the constraints on the growth of ASPs through empirical research, aimed at:

- understanding demand-side problems, especially related to the existing investments in IT and to the inability of adopting new services without incurring a time-consuming learning process;
- indicating relationships between the SME’s experience with IT and the likelihood to adopt ASP services;
- pointing out elements that may help to understand the next phase of the evolution of ASPs.

This research investigated a population of 438 manufacturing firms in the region around Turin, in Northwestern Italy, having between 50 and 1,000 employees.

1. Introduction

Application Service Provisioning has been considered one of the most promising areas of e-Business. Experts thought of Application Service Providers (ASPs) as the preferred solution for SMEs to reduce the cost and the risk on IT investments and to access high-quality services they could not otherwise afford. In the late Nineties almost 500 ASPs started their activity, but notwithstanding the robust cash injections they got from VCs, few of them are still healthy and in business [1,3].

The result of the hype was that ASPs largely failed to deliver expected high-quality customized solutions, also because they did not fully understand the difficulties that SMEs had in adopting and integrating their services within their existing IT infrastructure. As a result, the failure of ASPs was particularly significant in the SME market, just where the model was supposed to be most promising [1,2]. Such initial failure has caused many ASPs to shut down their operations. This has been associated to causes such

as:

- unrealistic expectation in revenues;
- flawed business models, with vague business propositions;
- difficult of execution against a complex delivery model;
- the absence of a killer application.

In Italy, where the vast majority of firms are small or medium sized, the ASPs market has up to now failed to attract customers, with erratic sales that only now are starting to show a slight growth. The objective of this paper is both to understand the reason of the present failure and to estimate the potential of the future diffusion of the ASP throughout an empirical research of firms’ issues and needs. The population of firms to be studied was chosen to be the members of the “Industrial Union of Turin”, the main local trade association, having a size between 50 and 1.000 employees; firms in this range were supposed to be the ones which may obtain the largest benefits from the adoption of ASP. The research was based on a questionnaire made up of different sections, addressing the magnitude of investment in IT, the applications already adopted, the perception of the ASP model and the willingness to adopt it in different functional areas. The company’s CIOs and CEOs received different sections. There were 104 valid replies (about 24% of the population).

2. Existing ICT Infrastructure

A major part of the questionnaire was aimed at understanding the current endowment of Information and Communication Technologies in the firms involved in the research. This allows us to understand the incremental nature of ICT adoption.

2.1. External Connectivity

Analysing the answers given by the firms, we have discovered that the external connectivity is not developed enough to sustain a generalized use of ASP. In fact, about 40 % of the firms have low-speed connections (less than 128 KB/s) and only one third may support ASP use with broadband. [Fig.1]

As predictable, low speed connections are more frequent in the smaller firms. Only among firms with total annual sales greater than 50 million € there is a significant percentage of broadband connections [Fig.2].

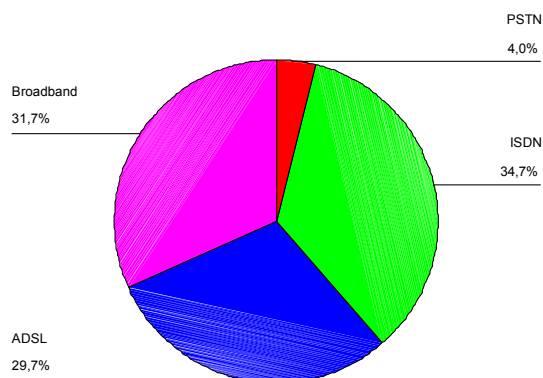


Figure 1: Speed connection to the Internet/Extranet

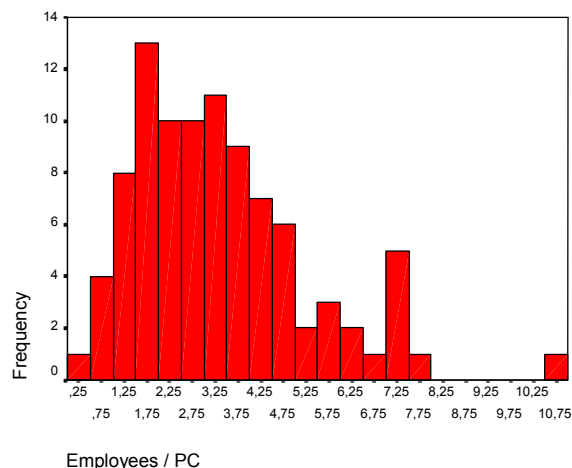


Figure 3: Distribution of PC density

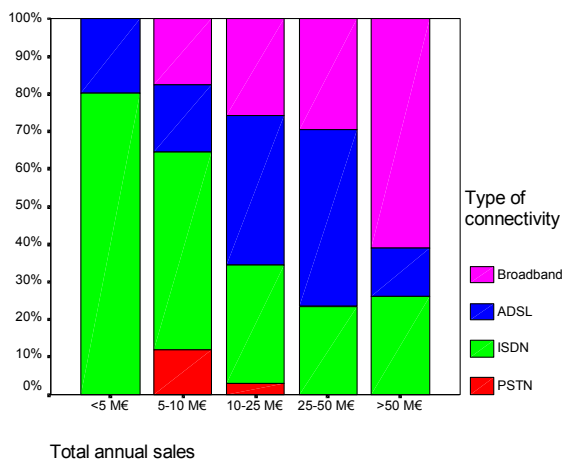


Figure 2: Connectivity vs. Total annual sales (significant at $p < 0.003$ according to G-K τ with “connectivity” dependent)

This bottleneck prevents ASPs from fulfilling one of their promises, i.e., the filling of the technology divide separating the larger companies from the smaller ones.

2.2. Diffusion of ICT in the Workplace

The diffusion of personal computers in firms is quite high. On average, firms have one PC for every 4.12 employees [Fig.3]. By adding terminals the figure becomes one workstation for every 3.07 employees.

This means that almost every employee is in some way “reached” or “reachable” by the IT applications. This figure is independent from the size of firms.

Moreover, almost all PCs (about 90% on average) are connected to the Internet. This implies that they easily be used as clients for centrally managed applications, as required by the ASP model.

2.3. Hardware and Software Architecture

We have observed that the client/server architecture is by and large the one with greater diffusion, either used alone or together with other solutions. There is also a certain utilization of Intranet architectures, in which clients are simple browsers. This experience with “thin clients” may facilitate the adoption of the ASP model [Fig.4].

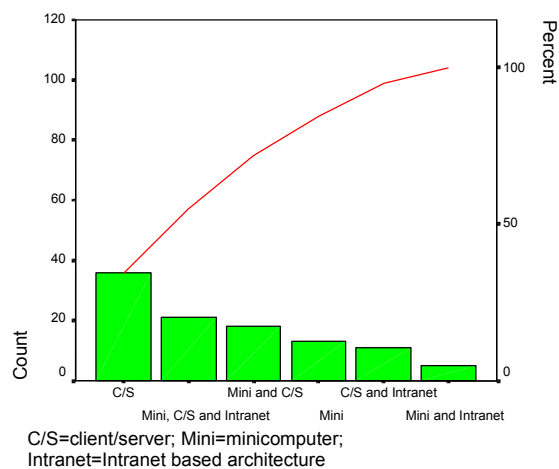


Figure 4: Hardware architecture

As expected, there is a strong relationship between the type of hardware architecture and firm size. Intranet-based architectures can be only found in firms with total annual sales higher than 50 million €. Smaller firms’ lack of experience could be another disadvantage for adopting and exploiting the ASP model [Fig.5].

From the point of view of business applications, almost 50% of firms have just adopted systems with native integration (i.e., ERP), while only 13.6% have non-integrated applications. The remaining firms had to integrate applications with custom software development [Fig.6].

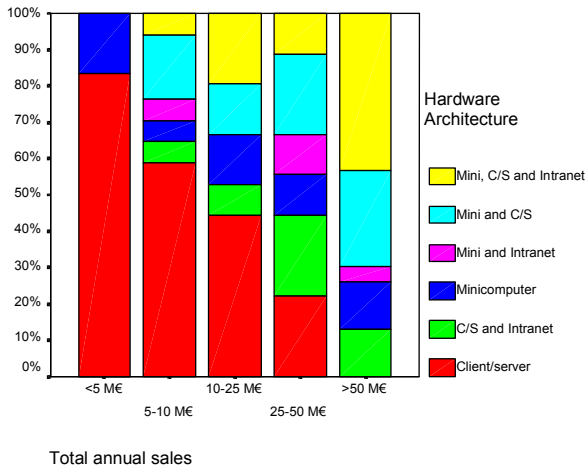


Figure 5: Hardware architecture vs. total annual sales (significant at $p < 0.001$ according to Lambda statistic with “Hardware Architecture” dependent)

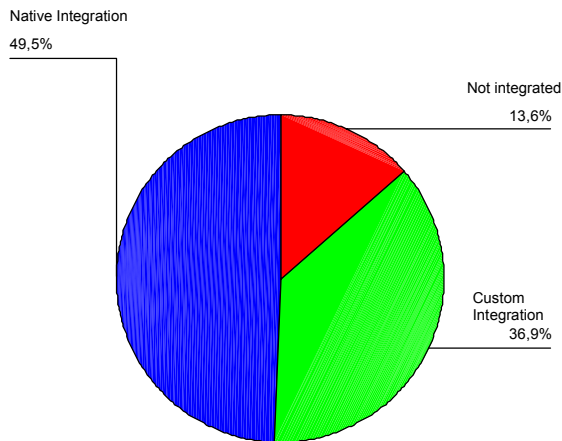


Figure 6: Level of integration of applications

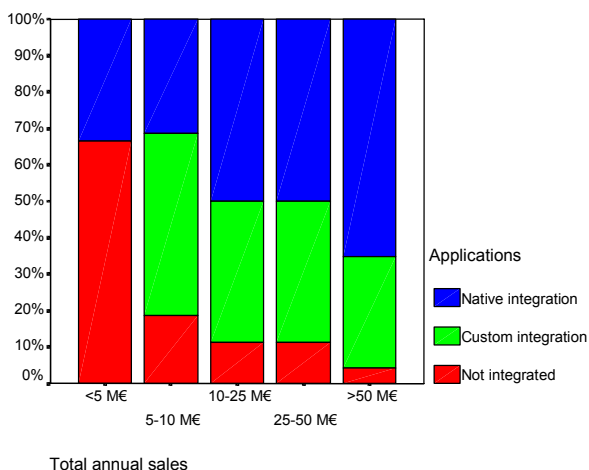


Figure 7: Type of integration vs. total annual sales (significant at $p < 0.009$ according to Kendall’s τ -b with “Applications” dependent)

Native integration is more common in the larger companies, even though it is noteworthy that none of the smallest ones (annual sales less than 5 million €) have attempted “customized integration” [Fig.7].

2.4. Available and Future Business Applications

By studying the diffusion of specific business applications in different functional areas, we see that only very few firms nowadays do not have specific applications supporting their activities [Tab.1].

Table 1: Business activity supported by specific applications

| Business activity | Percentage of actual adoption |
|-------------------|-------------------------------|
| Manufacturing | 87.5 % |
| Administration | 100 % |
| Sales | 76.9 % |
| Human Resources | 76 % |
| Product Design | 88.5 % |

In order to estimate the diffusion potential of a number of business applications we have also considered the will/use ratio [Tab.2].

Table 2: percentage of diffusion of some applications and will/use ratio

| Applications | Present adopters | Future adopters (in 2002) | Will/use |
|---|------------------|---------------------------|----------|
| Manufacturing | | | |
| MRP | 57,7% | 8,7% | 15,0% |
| Scheduling systems | 26,0% | 12,5% | 48,1% |
| Quality control systems | 47,1% | 10,6% | 22,4% |
| Production activity control | 61,5% | 10,6% | 17,2% |
| EDI – Electronic Data Interchange | 51,0% | 5,8% | 11,3% |
| Administration | | | |
| Accounting | 98,1% | 1,0% | 1,0% |
| Workflow and document management | 26,9% | 10,6% | 39,3% |
| Management of finances | 91,3% | 2,9% | 3,2% |
| Sales | | | |
| e-commerce | 5,8% | 8,7% | 150,0% |
| Catalogues and pricelist editing | 38,5% | 3,8% | 10,0% |
| Customer Database management | 68,3% | 4,8% | 7,0% |
| Newsletter editing | 25,0% | 5,8% | 23,1% |
| Sales force automation | 55,8% | 4,8% | 8,6% |
| Human resources management | | | |
| Payroll | 63,5% | 1,0% | 1,5% |
| Travel expenses | 34,6% | 1,9% | 5,6% |
| Recruiting, evaluation and training of H.R: | 38,5% | 1,9% | 5,0% |
| publishing of internal procedures on the Intranet | 19,2% | 4,8% | 25,0% |
| Product development and management | | | |
| EDM / PDM | 26,0% | 8,7% | 33,3% |
| Project management | 44,2% | 10,6% | 23,9% |
| CAD | 79,8% | 2,9% | 3,6% |
| CAM | 30,8% | 3,8% | 12,5% |
| CAE | 21,2% | 3,8% | 18,2% |

This is defined as the ratio between the number of firms who plan to adopt an application in the current year (2002) and the number of firms who have already adopted it. This may be considered to be a good indicator of the instantaneous growth rate for the application. Specifically, the ratio discriminates among applications approaching market saturation and the ones that are at the beginning of their diffusion process. This is relevant since the former could only be adopted through ASPs by substitution of existing installations, while the latter may diffuse directly through the ASP model.

Most firms do have a web-site, which is mainly used for offering information to customers and suppliers. Very few firms are however able to carry out transactions online [Fig.8].

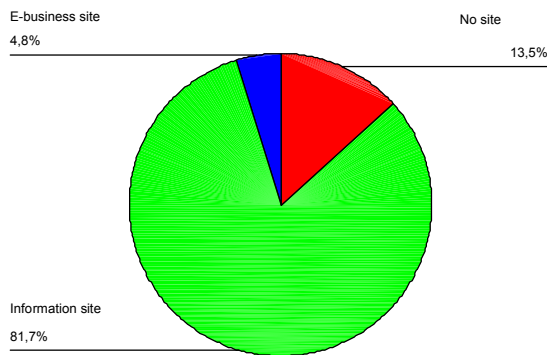


Figure 8: Web-site content

By considering the location in which the web-site is hosted, we notice that the dominant solution is through a service provider. Only 19.4% of firms have their web-site hosted on their own servers.

This type of outsourcing is generalized for the smaller firms, but is also very common among the bigger ones [Fig.9].

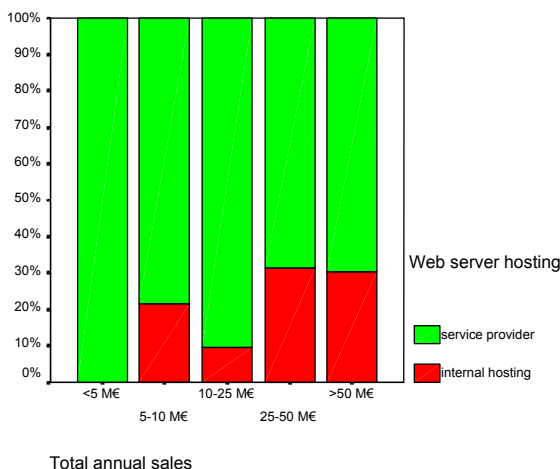


Figure 9: Web server hosting vs. total annual sales (significant at $p < 0.072$ according to Kendall's τ -b with "Web server" dependent)

This may be seen as the result of a high level of confidence with outsourcing. However, it may also be due to the fact that since the website is not able to perform transactions, it is not considered to be a mission critical application.

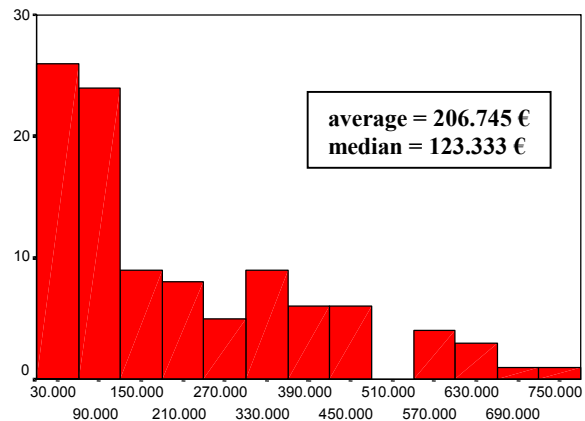
3. ICT Cost and Strategy

Another section of the questionnaire was aimed at understanding the cost of ICT and the assessment of the value it creates. The most relevant statistics follow.

3.1. ICT Total Cost of Ownership

The cost of ICT has been calculated by adding up annual costs for hardware, software, connectivity, human resources assigned to ICT, assistance and maintenance, consultancy and training.

This total annual cost is averagely 207,000 €, but the statistical distribution is strongly skewed by few high spending firms; in fact, the median value is much more lower and is equal to 123,000 € [Fig.10].



ICT annual total cost and dedicated personnel

Figure 10: Distribution of total annual expense for ICT

We have found that economies of scale in ICT are present. We have considered the number of PCs as an indicator of the size of firms' ICT functions and used the following Cobb-Douglas model:

$$y = b_0 x^{b_1} \quad (1)$$

where "y" is the total annual expenditure in ICT and "x" is the number of PCs and terminals. Minimum square estimation of a linearized version of (1) has given a parameter $b_1 = 0.8384$ (a value less than 1 indicates the existence of economies of scale) with a good level of correlation ($R^2 = 0.618$). To easily understand the entity of this value, this implies that every time the number of work places managed doubles, one can have 11% of savings.[Fig.11]

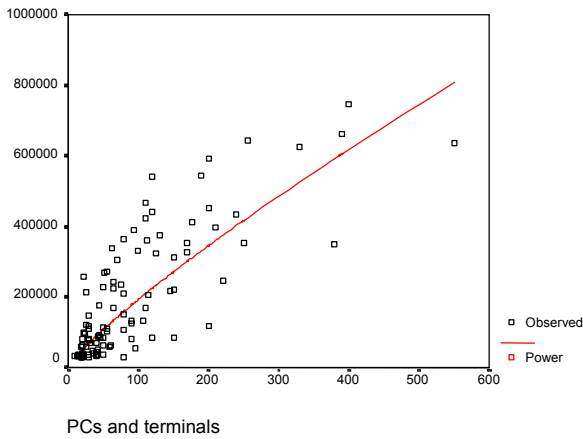


Figure 11: Annual ICT expenditure vs. number of work places

One of the most interesting findings of the research is associated to the analysis of ICT cost of ownership. This cost is very low, if divided by the firms' number of workstations [Fig.12] or by the number of employees [Fig.13] Thus measured, the cost of ICT is one order of magnitude less than the cost of the personnel using these technologies. In first approximation, it is evident that investments in ICT may return profits even for small improvements of productivity.

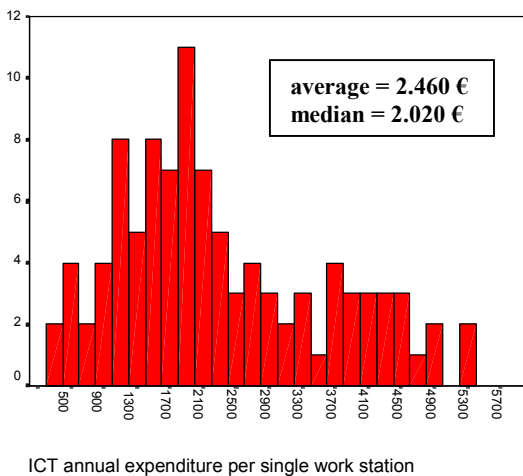


Figure 12: Distribution of the ICT cost for single workstation

Moreover, the relatively low cost of ICT may suggest that this may not represent a critical factor in determining firms' investment decisions. In fact, only 28% of CEOs recognize financial shortage as an obstacle to investing in hardware or software. Moreover, 62% of firms have stated that if savings in ICT were possible, the money would be spent in the same activity area. Another 15% of CEOs define the ICT budget to be "not so significant" if compared to the total amount of investments.

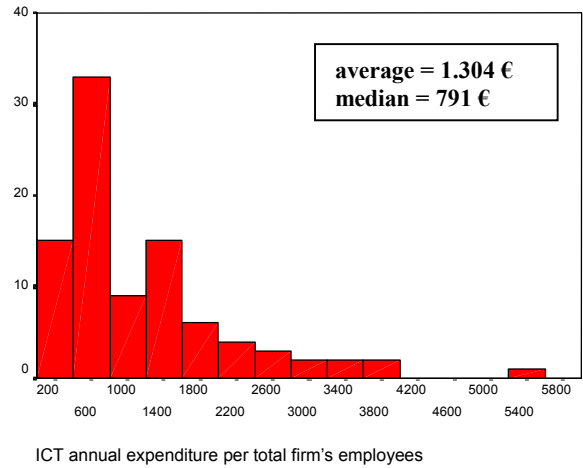


Figure 13: Distribution of the ICT cost for single employee

3.2. Perceived Value of ICT

Firms are usually pleased with the level of the service that their ICT equipment gives to operational activities [Fig.14]. This assessment is not correlated with the firms characteristics (i.e. size), but is correlated with the architecture adopted. Dissatisfaction is located in firms that have implemented the simpler hardware architectures ("pure" Client/Server or minicomputer) or which have not integrated their business applications [Fig.15 and Fig.16].

This does not explain whether the dissatisfaction is due to the architectural choice or to the fact that applications based on these architectures may be less up-to-date.

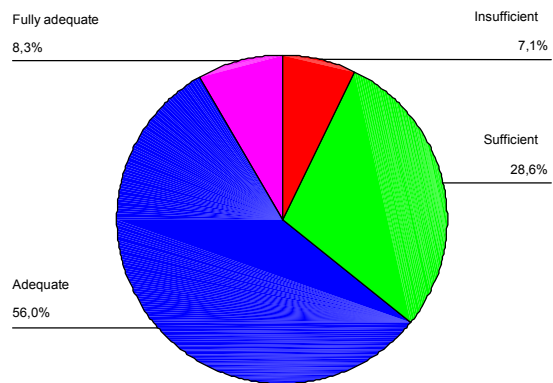


Figure 14: Level of service offered to the firm's operations

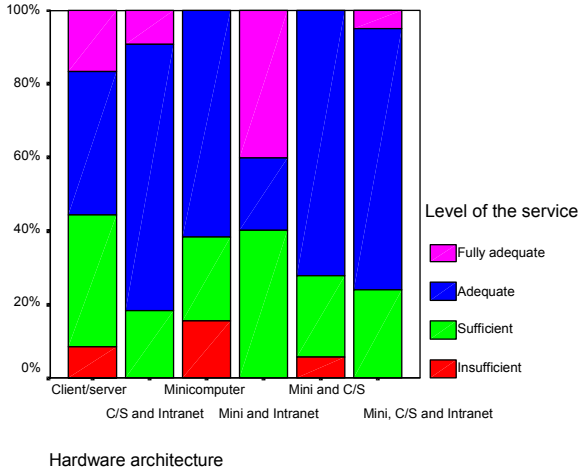


Figure 15: Level of the service offered to the operation vs. hardware architecture (significant at $p < 0.060$ according to G-K τ with “Level of Service” dependent)

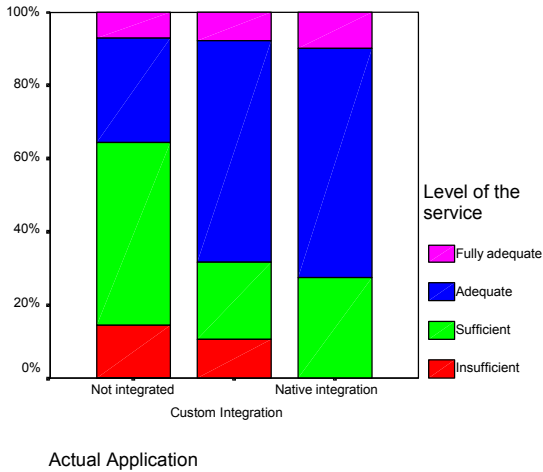


Figure 16: Level of the service offered to the operation vs. level of integration (significant at $p < 0.040$ according to G-K τ with “Level of Service” dependent)

We have asked both the CEOs and the CIOs to express their opinion about the cost of the ICT and the value it creates. The three options were “the value created by ICT is higher / equal / lower than its cost”. By comparing the answers provided by CEOs and CIOs we have noticed that an interesting correlation exists between the differences in the judgments and the annual expenditure per employees. CEOs are more satisfied than CIOs when expenditure is low and vice versa [Fig. 17]. This correlation may suggest that the higher management is more interested in keeping costs under control, rather than in their related returns.

Incidentally, CEOs generally state that it is difficult to evaluate ICT investments properly, especially because of their lack of tangibility [Fig.18]. This difficulty is especially found in the smaller firms [Fig.19]. This may suggest that alternative models for managing ICT, such as Application Service Provisioning, must be accompanied by tools helping firms to evaluate properly the cost of ownership and the ROI of their choices.

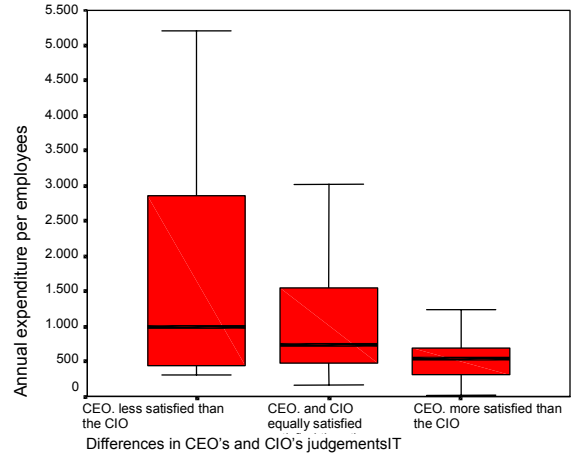


Figure 17: Differences in CEO's and CIO's judgments vs. annual expenditure per employees (significant at $p < 0.087$ with ANOVA)

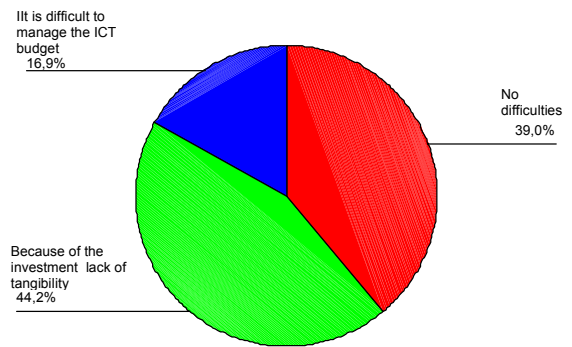


Figure 18: Difficulties in managing the ICT investments

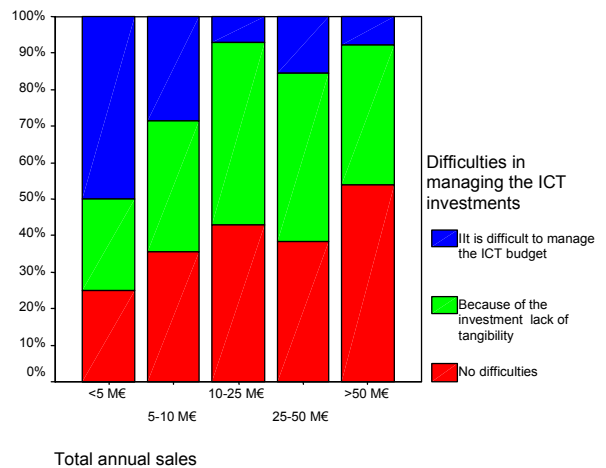


Figure 19: Difficulties in managing the ICT investments vs. total annual sales (not statistically significant)

3.3. The Evaluation of the ASP

In order to understand the way in which firms perceive the ASP model, the firms were asked to provide an evaluation of the importance of a number of advantages and disadvantages. The evaluations have been expressed in a Likert scale ranging from 1 to 5.

Firms generally do not give a high evaluation of potential advantages of ASP. The advantage that the firms are most interested in seems to be the external management of hardware and software upgrades [Tab.3]. The disadvantages that firms worry most about are related to losing control on confidential data and the risk of high future switching costs [Tab.4].

Table 3: Evaluation of potential ASP advantages

| Potential Advantages | Average evaluation |
|---|--------------------|
| Focus on core business | 2.10 |
| Easier access to new applications | 2.73 |
| External management of hardware and software upgrades | 2.76 |
| Continuous assistance | 2.56 |
| Proposal of new applications | 2.04 |
| Evaluation of applications | 2.55 |

Table 4: Evaluation of potential ASP disadvantages

| Potential Disadvantages | Evaluation |
|---|------------|
| Loss of control on confidential information | 2.96 |
| Switching cost for changing provider | 2.86 |
| Loss of control on a strategic area | 2.80 |
| Higher total cost | 2.68 |
| Worse service level | 2.40 |
| Lower reliability of hardware | 2.29 |
| Higher vulnerability to viruses | 2.44 |
| Higher vulnerability to hackers | 1.96 |

It is important to notice that the concentration of the evaluations between “2” and “3” means that firms are generally slightly sensitive towards both advantages and disadvantages. So, it has been considered appropriate to widen the analysis and to use Principal Component Analysis in order to define the “perceptual space” with which firms evaluate the concept of ASP.

The underlying conceptual model is a “lens model”, as used in marketing research [Fig.20]. In this model, the perception of the ASP solution is influenced by variables related to the firm’s strategic focus and by variables related to past experience with ICT. We then hypothesize that the perception of ASP influences the inclination towards adopting this paradigm and, specifically, of using ASP for new applications rather than for substituting existing ones.

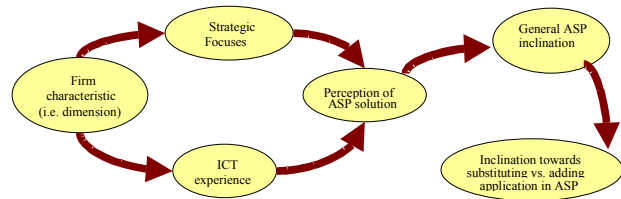


Figure 20: ASP perception (lens model)

Principal Component Analysis has shown the existence of three latent variables, or leading perceptive dimensions, that are able to explain the 61% of variance in firms’ evaluations. The following Tab.5 shows the loading parameters, which express the correlation between original and latent variables, after applying Varimax rotation. The most significant loading parameters are highlighted in grey. Looking at the table we have named “perception of advantages” the first latent variable (given by variables from 1 to 6), “perception of technological disadvantages” the second (given by variables 7 and 12 through 14), “strategic disadvantages perception” the third (given by variables from 8 to 11). To make analysis easier the latent variables have then been transformed into binary values “low” and “high”, so that each value comprises the 50% “lower” and “higher” firms.

Table 5: Factorial analysis on ASP perception

| Variable | Latent variable | 1 | 2 | 3 |
|--|-----------------|--------|--------|--------|
| 1. Focus on core business | | 0,639 | 0,197 | -0,171 |
| 2. Easier access to new applications | | 0,741 | 0,011 | 0,026 |
| 3. External management of hardware and software upgrades | | 0,693 | 0,141 | -0,024 |
| 4. Continuous assistance | | 0,715 | 0,316 | -0,055 |
| 5. Proposal of new applications | | 0,733 | -0,018 | 0,253 |
| 6. Evaluation of applications | | 0,763 | -0,003 | 0,141 |
| 7. Loss of control on confidential information | | 0,088 | 0,681 | 0,238 |
| 8. Switching cost for changing provider | | 0,172 | 0,147 | 0,664 |
| 9. Loss of control on a strategic area | | 0,088 | 0,404 | 0,616 |
| 10. Higher total cost | | -0,087 | 0,089 | 0,761 |
| 11. Worse service level | | -0,047 | 0,296 | 0,737 |
| 12. Lower reliability of hardware | | 0,177 | 0,833 | 0,233 |
| 13. Higher vulnerability to viruses | | 0,151 | 0,878 | 0,148 |
| 14. Higher vulnerability to hackers | | 0,074 | 0,896 | 0,213 |

The three new variables now allow us to locate the firms in the perceptual space and to understand their profile. The main correlations found are the following:

- The perception of advantages is higher in firms that affirm to compete in product innovation and in the firms with direct contact to the market (not producing for firms in the same group).
- The perception of technological disadvantages is

stronger in firms with lower overall investments.

- The perception of strategic disadvantages is stronger in firms with high overall investments and focused upon cost/price competition. There is also a generalized correlation of this perception with the level of the owned ICT (external connection speed, hardware architecture, level of integration of the applications): this fact may suggest that firms with a high profile ICT equipment have reached a stronger awareness about the importance of ICT activities and, moreover, being in a better position, they are more worried about the risks that an externalisation could cause.

3.4. The Inclination to ASP

In order to understand the inclination of the firms towards the possibility of adopting some applications in the ASP model, we have asked them to assess their interest using values ranging from 1 (low interest) to 4 (high interest).

Table 5: Interest in ASP supply

| Applications | Interest in ASP supply | No / low interest | High Interest |
|---|------------------------|-------------------|---------------|
| Manufacturing | | | |
| MRP | 1.79 | 75.3% | 24.7% |
| Scheduling systems | 1.88 | 72.4% | 27.6% |
| Quality control systems | 1.91 | 75.3% | 24.7% |
| Production activity control | 1.86 | 72.8% | 27.2% |
| EDI – Electronic Data Interchange | 2.21 | 60.0% | 40.0% |
| Administration | | | |
| Accounting | 1.99 | 71.3% | 28.7% |
| Workflow and document management | 2.05 | 77.0% | 33.0% |
| Management of finances | 1.54 | 88.0% | 12.0% |
| Office automation | 1.91 | 70.4% | 29.6% |
| E-mail server | 1.72 | 78.5% | 21.5% |
| Business website | 2.33 | 51.7% | 48.3% |
| Sales | | | |
| e-commerce | 1.94 | 70.4% | 29.6% |
| Catalogues and pricelist editing | 1.83 | 75.0% | 25.0% |
| Customer Database management | 1.82 | 77.5% | 22.5% |
| Newsletter editing | 1.88 | 70.5% | 29.5% |
| Sales force automation | 2.00 | 67.9% | 32.1% |
| Human resources management | | | |
| Payroll | 1.77 | 77.9% | 22.1% |
| Travel expenses | 1.83 | 75.0% | 25.0% |
| Recruiting, evaluation and training of H.R: | 1.82 | 71.4% | 28.6% |
| publishing of internal procedures on the Intranet | 1.79 | 75.8% | 24.2% |
| Product development and management | | | |
| EDM / PDM | 1.82 | 80.6% | 19.4% |
| Project management | 1.53 | 87.5% | 12.5% |
| CAD | 1.39 | 91.8% | 8.2% |
| CAM | 1.40 | 93.0% | 7.0% |
| CAE | 2.29 | 56.5% | 43.5% |

We also have asked to return value 0 for applications they are not interested in at all. The average values are quite low, but it is important to notice they are burdened by a number of very negative evaluations: if we consider only the percentage of firms that have expressed a high level of interest (values 3 or 4) we can find that according to the type of application, this goes from a disappointing 7% to a more promising 43% [Tab.5].

In order to have a concise measure of firms' inclination to ASP we have defined a "high" inclination when the firm has expressed a high interest for a number of applications greater than the number of applications for which it has expressed no or low interest.

We have found that the inclination is linked with the perception of ASP. Specifically, inclination is higher for firms with a high perception of the advantages (as one might easily assume) and in the firms with high perception of technological disadvantages (which shows that these disadvantages are not so important). Moreover there is not a correlation with the strategic disadvantages dimension. This could suggest that this perceptual dimension should not constitute a real hindrance for adoption of ASP.

3.5. Approaches to ASP

In most cases, firms declared ASP to be a possible solution for adopting new applications (75.5%) while only 24.5% of them claimed to be interested in the substitution of the present supply model.

This finding significantly bounds the potential of the ASP market for those applications that have approached saturation.

As expected, the type of approach is correlated to the inclination to the ASP model (firms with substitution strategy generally have higher inclination). Moreover, it is correlated to the level of services offered to operations by ICT. Inclination to substitute current applications is higher for firms where service level is not satisfactory (these firms are probably looking for better solutions) and for firms where it is fully adequate (one may hypothesize that firms with greater experience are more interested in innovative solutions) [Fig.21].

3.6. Inclination to the Outsourcing of ICT

In our research we asked CEOs to declare their strategy regarding the possibility of outsourcing ICT [Fig.22]. Most CEOs think it is better to keep ICT activities within the firm for the applications considered to be strategic (58.1%) or even for all applications (20.3%). Very few firms are inclined to a total outsourcing (12.3%), or to a choice based only upon financial considerations (9.5%).

Firms that expressed a greater inclination to outsourcing are generally stand-alone firms (not subsidiaries of a group), with total annual sales ranging between 5 and 50 million €, and have adopted the simpler hardware architectures.

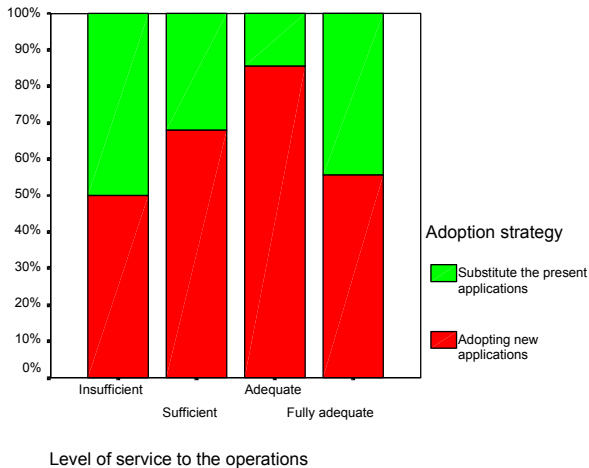


Figure 21: Adoption Strategy vs. level of service to the operations (significant at $p < 0.05$ according to G-K τ with “Adoption strategy” dependent)

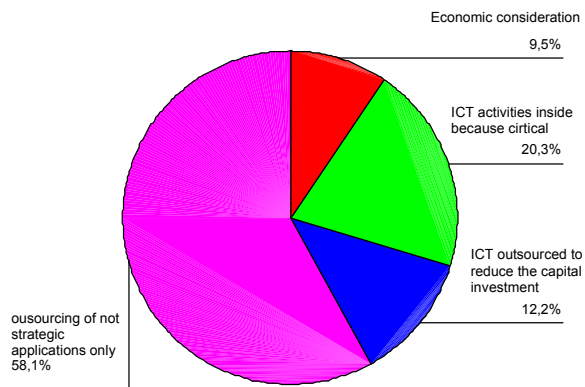


Figure 22: Inclination to ICT outsourcing

4. Concluding Remarks

These summarized findings lead to concluding remarks that can be relevant to the possible evolution of the ASP market:

- The initial ASP value proposition oversimplified IT needs and costs inside firms. Firms probably do not own “state of the art” applications, but what exists is the result of a long “learning by doing” process that makes it difficult to integrate ASPs offer with existing IT infrastructure.
- It is very difficult for ASP to pursue a “low cost” and/or “one-stop shopping” strategy. ASPs will have to offer initially “additional” applications, in order to gain customers’ trust and to build long-term relationships.
- The cost of customer acquisition is high, as is the cost for keeping service levels fixed in SLAs. The

importance of on-site services will probably compel ASPs to establish alliances with systems integration firms that already have a customer oriented structure;

- ASPs will have to invest more in making their customers conscious of the benefits of their services; results shows that there is a strong positive correlation between understanding of benefits and will of use;
- Lacking a killer application, differentiation strategies (focused on a small number of innovative, non-core applications) seem to be the most promising for ASPs. Research results show that - depending on the application - the fraction of firms highly interested in acquiring them through ASPs may range from a disappointing 7% to a promising 48%;
- The “hidden cost” of this choice is the risk to miss the promise of IT overall cost reduction and of applications integration;
- “Pure player” ASPs will suffer from competition from a wide range of competitors, including:
 - specialized suppliers of “traditional” services that will modify their offer according to the ASPs model;
 - systems integrators that already control firms’ IT infrastructure;
 - software vendors, that can easily start selling their products in ASP mode;
 - telecom providers, that will bundle Application Service Provisioning inside their broadband services.

In summary, these issues greatly reduce the expected profitability of the ASP model, which will probably require a long time before becoming acceptable. Questions to be addressed by future research are related to:

- the ASP’s ability to deliver value to SMEs, becoming a key factor for their growth;
- the survival of ASP as an independent market, since vertical integration could force *pure players* out of the market;
- the emerging structure of the business software value chain and the characteristics of firms that will control it.

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