Innovation decision of Tunisian service firms: an empirical analysis

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Abstract

Innovation is widely recognised as a key driver of economic growth and competitiveness. But, some works focus especially on analyzing the determinants and the effects of innovation while distinguishing between its various types (product innovation, process innovation, radical innovation and incremental innovation). The analysis of the determinants is certainly important, but few research efforts testing the way in which firms make the decision to innovate. Based on a sample of 108 Tunisian service firms, the purpose of the paper is to explain the way in which firms make the decision to innovate: simultaneous (one-stage model) or sequential (two-stage model). We find that the two-stage model has a statistically-significant advantage in predicting the innovation. In practice, the sequential model illustrates well the innovation making-decision procedures.

Key words: Innovation, Decision making, Service sector.

JEL classification: L80, O31, O32.

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1 Introduction

Innovation activities have been regarded as the major driver of economic growth and competitiveness at both micro and macro levels (Schumpeter, 1934). The literature studying this topic shows that, in the long run, innovators will be more efficient and more productive relative to non-innovators (Mansury and Love, 2008). These findings are very interesting and justify the preoccupation of firms to promote innovation. More precisely, the innovation surveys demonstrate that, in developed countries, the product/service innovation is an event that takes an important place in the activity. For example, about 80% of the U.S companies introduce at least one new service (Mansury and Love, 2008) and almost half of the Irish firms introduce an innovation (Roper and Dundas, 2004).

Indeed, firms are more incited to introduce new products so as to attract more market share and therefore they tend to avoid not only the domestic competitors but also the foreign's. For instance, in the ICT sector, innovation is vital for the survival of the company. Furthermore, the introduction of new products allows the low-technology firm to capture additional market shares.

In the Tunisian context, firms give more importance to the academic research and technological innovation. The program called "*Pour la Tunisie de demain*"[1] is adopted by the Tunisian government in order to help Tunisian firms to face foreign competition. Through this program, Tunisia provides significant support to promote innovation and technological development. Doing so requires the support of innovative companies, the intensification of the cooperation projects, the implementation of several techno-parks and the establishment of the information society.

Actually, innovation has been widely studied in the economic literature. Some empirical studies focus on explaining the impact of innovation on performance (Crépon et al, 1998; Mairesse and Mohnen, 2003; Roper and Dundas, 2004; Cainelli et al, 2006). Other ones analyze the determinants of innovation and the role of external linkages while introducing external control factors such as size and age of the firm (Duget, 2003; Raymond and St-Pierre, 2010). The study of the determinants and effects of innovation distinguishes merely between two types of innovation: product innovation and process innovation. Other studies, particularly oriented towards the analysis of innovation in services, distinguish between radical innovation and incremental innovation.

In this paper, we focus on these two types of innovation: incremental innovation and radical innovation. The former signifies that innovation is going to be new to the firm but it has been already existed for the com-

1. For more details, see the report of the Ministry of Scientific Research and Competences Development in Tunisia.

petitors. The latter assumes that the firm is the first and the sole having introduced a new service on the market.

The recent works are not delimited to the analysis of the determinants of innovation, but they are increasingly oriented to the analysis of the innovation decision-making procedure. Du et al. (2007) examine this procedure for the case of Irish manufacturing firms. However, to our knowledge this type of analysis remains rather limited for emerging countries and more precisely for Tunisia.

Following Du et al. (2007), we attempt in this paper to answer questions: how do Tunisian service firms make the decision to innovate? Are these decisions simultaneous or sequential? Broadly speaking, we consider two alternative models of the innovation decision: the one-stage model (where the innovation choice is simultaneous) and the two-stage model (where the innovation choice is sequential).

The paper is structured as follows. The second section presents a brief literature review on innovation decision. Section 3 presents the econometric models. Section 4 contains a description of the data set and the variables used in the empirical analysis. The results of the empirical analysis are presented in section 5. The concluding section synthesizes the main empirical findings presented in the paper.

2 Analysis of innovation in services

2.1 Types of service innovation

Since before, innovation has taken an important place in the economic literature. Numerous are the studies that have identified the main patterns innovation takes. According to the OECD innovation report in 2005, innovations are classified into four categories: product innovation, process innovation, organizational innovation, and a marketing innovation. A product innovation is the introduction of some significant changes in the product characteristics. This category includes new goods as well as the improvements being added to an old product that has been already existed. Process innovation represents significant changes in methods of both production and distribution. The third category of innovation embodies the organizational innovations that are defined as the new organizational and management forms that firms adopt. The fourth category concerns the marketing innovation that takes the form of carrying on new commercialization method (for instance, change in the product design, product pricing method, etc.).

Gallouj and Weinstein (1997) consider products as a result of characteristics and skills series. In the same line with Gallouj and Weinstein (1997), Mansury and Love (2008) show that innovation patterns mainly developed for manufacturing industry may not apply easily to services. They insist on the fact that the traditional distinction between product and process innovation is less useful in the service context. The reasons behind this fact are related to the ambiguous nature of the services output and the simultaneous production and consumption of services.

Another research voice distinguishes between radical innovation and incremental innovation (Sundbo and Gallouj, 1998). This distinction has been the object of some empirical studies. For instance, Brouwer and Kleinknecht (1996) for Netherlands, Duguet (2006) for France, Lööf et al, (2003) for Finland, Norway and Sweden, Baldwin and Hanel (2003) for Canada and finally Mansury and Love (2008) for USA.

2.2 The innovation decision

Few studies address the question how firms make decisions to innovate. Thereby, Cabagnols and Le Bas (2002) explain the determinant of the choice between three types of innovation decisions: to innovate on product, to innovate on process and to innovate both on product and process. Specifically, these authors clarify the way in which French firms orient their decisions to innovate. But, one of the issues addressed by this new literature is whether it is a one-stage or a two-stage process. Du et al. (2007) test the performance of two models of decision making: the simultaneous and the sequential model. They find that the sequential model (two-stage innovation decision) is more efficient than the simultaneous model (one-stage innovation decisions).

To model the innovation decision-making, we apply the two models proposed by Du et al. (2007) based on two forms of decision making: The one-stage model and the two-stage model. We have interest in this paper to study the innovation in the service sector and, accordingly, to assess the decision to choose between incremental innovation and radical innovation. Thereby, our one-stage model (simultaneous decision) supposes that the firm faces four alternatives innovation choices: no-innovation, radical innovation only, incremental innovation only and both radical and incremental innovation. However, the two-stage model (sequential decision) assumes that the firm decides first whether or not to engage in any innovation activity and then it considers what category of innovation it would participate in (see Figure 1).

The econometric estimation of the two models parameters is based upon certain estimation tools of the discrete choice models. Indeed, the econometric estimation procedure depends on whether the choice of an innovation is sequential or simultaneous.

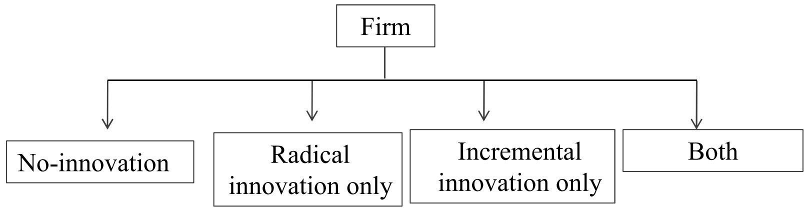

Fig. A: One-stage model

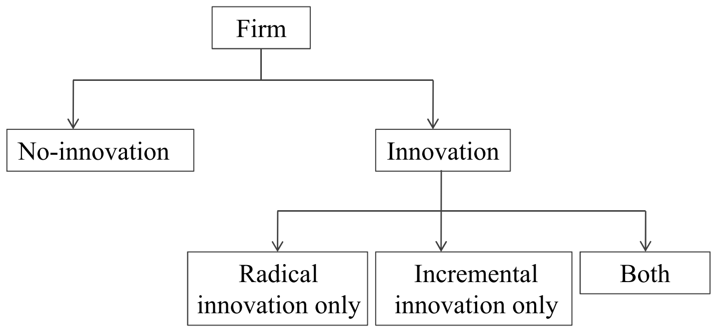

Fig. B: Two-stage model

Figure 1: Firms' decision tree of innovation activity (Du et al., 2007)

3 Models and estimations

3.1 One-stage model

Concerning the one-stage model, the innovation decision is considered to be a four-outcome discrete variable. For this reason, we use a Multinomial Probit model (MNP). This model alows relaxation of the Independence for Irrelevant Alternatives (IIA) proprety. It has the advantage of allowing a much more flexible pattern of error correlation. [2]

We assume that for ith firm faced with J choices, the utility U_{ij} of choice j is the sum of a deterministic component $X^{'}_{ij}$ and an unobserved random component ε_{ij}. The utility function is expressed as follows:

$$U_{ij} = X^{'}_{ij}\beta_{ij} + \varepsilon_{ij}, \quad [\varepsilon_{i0}, \varepsilon_{i1}, \varepsilon_{i2}, \varepsilon_{i3}] \sim N[0, \Sigma] \tag{1}$$

Where $j = 0$ represents the firm's decision to choose not to innovate at all, $j = 1$ if the firm introduced a radical innovation only, $j = 2$ if it introduced an incremental innovation only and finally $j = 3$ if it introduced both radical and incremental innovation.

2. For more details, see Greene (2003), Chapter 21, p728.

If the firm makes choice j in particular, then its utility U_{ij} is the maximum among the 4 utilities. Therefore, the statistical model is driven by the probability that choice j is made. It's expressed as:

$$\begin{aligned} P_{ij} &= Pr(Y_i = j), \quad \forall k \neq j, \\ &= Pr(U_{ij} > U_{ik}) \\ &= Pr(\varepsilon_{ik} - \varepsilon_{ij} \leq (X_{ij} - X_{ik})'\beta) \end{aligned} \tag{2}$$

The coefficient of vector β are estimated using the maximum likelihood method. The log-likelihood can be derived by attributing, for each firm, $y_{ij} = 1$ if alternative j is chosen by the firm i and 0 if not, for the 4 possible outcomes [3]. The log-likelihood is:

$$\begin{aligned} \log L &= \log\{\prod_{i=1}^{N}\prod_{j=0}^{3} prob(Y_i = j)^{y_{ij}}\} \\ &= \sum_{i=1}^{n}\sum_{j=0}^{3} y_{ij} \log prob(Y_i = j) \end{aligned} \tag{3}$$

3.2 Two-stage model

The two-stage model is the sequential decision of innovation. It assumes that the firm first decides whether or not to engage in any innovation activity and then it considers what category of innovation it would participate in. At the first stage, we consider a binary choice model in order to model the probability of whether or not the firm makes decision to innovate. Doing so, we use a Probit model because the dependant variable is binary.

$$prob(Y_i = 1|X_i) = \int_{-\infty}^{X'\beta} \phi(t)dt = \Phi(X_i'\beta) \tag{4}$$

where, $\Phi(.)$ is a commonly used notation for the standard normal distribution which is given by $F(X_i'\beta) = \Phi(X_i'\beta) = \int_{-\infty}^{X_i'\beta} \frac{1}{\sqrt{2\pi}} exp\{\frac{-t^2}{2}\}dt$. So, the coefficients are estimated using the maximum likelihood method:

$$\log L = \prod_{i,Y_i=0} prob[Y_i = 0] \prod_{i,Y_i=1} prob[Y_i = 1] \tag{5}$$

If the decision to innovate is made (the first stage) then the firm (at the second stage) will choose which type of innovation it wants to engage in. As in the first model, we consider again an MNP with three choices: (1) radical innovation only, (2) incremental innovation only and (3) both. The log-likelihood is:

$$\log L = \sum_{i=1}^{n}\sum_{j=1}^{3} y_{ij} \log prob(Y_i = j) \tag{6}$$

3. For more details, see Greene (2003).

4 Data and variable measures

Before describing the model and results therein, it's important to examine the main characteristics of the data and the indicators used in the empirical analysis.

4.1 Data

In this paper, we use data from a survey of 108 Tunisian services firms. Data were collected through a questionnaire which has been distributed to some Tunisian service firms. The questionnaire is a modified version of the third community survey on innovation CIS III and the second European survey on innovation 1997. The survey collects information that concerns the firms' innovation activities during the period 2005-2007 and some information on the innovation patterns (Sdiri and al., 2010). It involves information about the firm's features (size of the firm, firm vintage, skills, group-belonging, etc), their expenditure devoted to R&D and innovation activities and other information concerning the main innovation objectives.

Our sample has been stratified by NAT[4] size (7 classes by number of employees:1-6, 7-9, 10-19, 20-49, 50-90, 100-199, 200 and over). For each class, we associate a weight representing the weight of this bracket at the national level in order to obtain a more representative sample of the parent population.

Table 1 summarizes the determinants of this operation and it shows that 21.30% of respondents come from small firms (number of employees is lower than 6). Furthermore, this table reveals that 9.26% of firms interviewed claim that they introduce a radical innovation, 16.66% introduce an incremental innovation and 52.77% introduce both radical and incremental innovation.

Table 1: Distribution des firmes innovatrices selon la taille

Size	**Total**				**Radical innovation**	**Incremental innovation**	**Both**
	Number	**INS' firms**	**Corrected weight**	**%**	**(%)**	**(%)**	**(%)**
1-6	23	12649	549.956	21.30	20	5.55	24.56
7-9	17	785	46.176	15.74	0	16.66	15.78
10-19	18	713	39.611	16.67	10	27.77	15.54
20-49	13	509	93.153	12.04	30	5.55	12.28
50-90	10	230	23	9.26	0	11.11	7.01
100-199	10	167	16.7	9.26	10	11.11	7.01
$\geq$ 200	17	215	12.647	15.74	30	22.22	15.78
Total	**108**	**15268**	**215.04**	**100**	**9.26**	**16.66**	**52.77**

4. National Institute of the Statistics (INS): distribution of companies by activity and by number of employees in 2007.

4.2 Variable measures

Innovation in services

To analyze the determinant and the patterns of innovation, most of the previous studies have measured the innovation output by the number of patents or the percentage of new product sales (Mairesse and Mohnen, 2003). But, these indicators can't be used in our case. Indeed, the number of patents is not a good indicator for the emerging countries where the number of patents is extremely limited especially for service innovation. So, we use three other innovation measures.

- First, we measure the innovation output (INSERV) by a binary variable taking the value 1 if the firm has innovated over the previous three years and 0 otherwise. This measure is obtained by asking informants to indicate if the firm has introduced or not a new or a significant improved product and/or process;

- Second and for the one-stage model, the innovation decision is measured by a discrete variable with four outcomes (InDec). In this case, the firm faces four choices: (0) non-innovation, (1) radical innovation, (2) incremental innovation or (3) both;

- Third and in the two-stage model, the innovation decision is measured by a discrete variable with only three outcomes (InDecII).

Size and vintage of the firm

The relationship between the innovation and firm size has been thoroughly examined in many works. In this paper, we measure the firm size (SIZE) by the total number of employees in 2007 (in log form). The firm vintage (AGE) is determined by the date of its creation. More precisely, this measure indicates the number of years during which the service firm acts in the market until 2007.

Business type

TYPEACT is a variable that measures the business type. In this paper, firms interviewed are required to answer the question whether the service is intended either to firms "Business to Business" (B2B) or to individual customers "Business to Consumer" (B2C), or to both. This variable indicates how the firm choice to target two types of customers (i.e. individuals and professionals) affects the service innovation decision.

Education level

The availability of human capital inside the plant with an appropriate level of skills and knowledge in R&D activities is considered as essential internal resources that enable the firm to innovate. In fact, the education level represents, in one hand, an indicator of the know-how and skills level of an employee within the firm and, in other hand, a major determinant for making innovation activities. In this paper, our education level measurement (QUAL) is the number of workforce qualified [5] divided by the total number of employees in the firm.

Group membership
APP_GROUP is a dummy variable which takes 1 if the firm belongs to a group, 0 otherwise. When the firm is a member of a group, it has the advantage to benefit from competencies and technological experience of other firms of the group and then has an important opportunity to innovate (Paul et al. 2000). So, firms belonging to a firm group, allow it to have more information about some opportunities related to the market.

Cooperation and engaging in innovation activities
Cooperation plays a prominent role by enhancing the ability of the firm to innovate. In this paper, we introduce the variable cooperation (COOPER) as a binary variable indicating whether or not the firm has signed during the three years 2005-2007 cooperation contracts with external actors. This variable is introduced into the model to show that external relationships are crucial to promote innovation. The empirical results show that cooperation is positively related to innovation, implying that innovation activities require cooperation agreements with public or private agencies and with the other firms too (Cohen and Levinthal, 1990).

According to the innovation economic literature, the R&D investment is often considered as an important determinant for innovation activities. In this paper, and because of the unavailability of such measure, we consider a qualitative variable (ENGAG), i.e. the variable takes the value 1 if the firm questioned has developed between 2005 and 2007 at least one of innovation activities (including the intramural and extramural R&D) and 0 otherwise. These activities are identified in Table 2 below.

Table 2: Firm's innovation activities

Codes	**Activities**
R&Dint	Experimental R&D (R&D in house)
R&Dext	Acquisition of services of R&D (R&D external)
MACH	Acquisition of equipment related to the technological innovations
LOGC	Acquisition of software and other external technologies related to the technological innovations
FORM	Training of personnel related to the innovation process
MARK	Internal/external marketing strategy for service innovation

5. We consider as qualified, the percentage of the service firms' workforce with a bachelor's degree.

International orientation
According to the empirical works on the topic of innovation and international economic exchanges, we notice that not all firms are able to benefit from innovation. Thus, it is essential to moderate the relationship between innovation and performance by a firm international orientation of the firm. Thereby, the firm needs a certain level of international orientation or internationalization [6] in order that it can be competitive not only on the domestic market but also on the international markets. Therefore, it benefits from their new products and/or processes. In this paper, we measure the international orientation (INTER) through a binary variable that takes 1 if the firm is engaged in internationalization strategies and 0 otherwise.

The aims of innovation
In order to achieve its objectives, a firm has to take into account a certain number of actions that can incorporate the R&D and innovation activities. The introduction of the innovation objectives indicator in our regression is thus necessary. We consider a qualitative measure which is the importance (a five point's scale of *likert*) that a firm gives to a set of factors influencing innovation activities. In fact, firms were asked to answer five questions indicating the importance they attach to different objectives of innovation. These objectives we used in this study are: replace services that are removed (SERV_OBS), improve the service quality (QUAL_SERV), extend the line of the products (GAM_SERV), sustain the market share (PART_MAR) and decrease the production costs (RED_COUT).

5 Empirical results

Table 4 and 5 report the results of the econometric estimation of the models discussed above: sequential model and simultaneous model. These models highlight the innovation decision-making process in the Tunisian services sector. Further, they enable us to analyze the robustness of the two innovation decisions.

5.1 Test of significance of the models

More generally, the econometric specifications have a predictive power that exceeds 60% for the one-stage model and exceeds the 64% for the two-stage model (Table 3). The whole significance of our models is confirmed by the McFadden *R-squared*, is about 49% for the first model and about 51% for the second model. Also, we use the Akaike information criterion (AIC) and the Bayesian information criterion (BIC) to select the appropriate model (Table 4 and 5). Based on the McFadden *R-squared*, the information criterion and the prediction percentage, we note that the two-stage model has a statistically significant advantage than the one-stage model. In practice, the

6. For more details, see Kotabe et al (2002)

sequential model illustrates well the innovation making-decision procedures. This result has been also noted by Du et al. (2007).

Table 3: Prediction statistics

	Actual probability		**One-stage model**		**Two-stage model**	
	Number	%	Predicted probability	%	Predicted probability	%
0: Non-innovation	20	20.20	13	13.13	-	-
1: Radical innovation	10	10.10	3	3.03	4	5.06
2: Incremental innovation	16	16.16	4	4.04	4	5.06
3: Both	53	53.54	40	40.40	43	54.43
Number of observations 1-3	79				51	
Number of observations 0-3	99		60			
Correct prediction rate			60.60		64.55	

5.2 Determinants of the innovation choice

Having shown that the sequential model is a better procedure of the innovation decision-making, we analyze the main determinants affecting the choice between types of innovation.

Regarding the impact of firm size on the innovation decisions, the empirical results are divergent. In this paper, we find that firm's size has a positive and statistically effect on the probability of innovating, but at a decreasing rate. This result represents one of a number of findings in the empirical innovation literature. Similar effect has been noted by Du et al (2007) for the case of manufacturing industry. Further, our results reveal that the size of the firm is a powerful determinant that promotes more incremental innovation than radical innovation for both models (Table 4 and 5). Furthermore, our estimation results show that Business type (B2B type, B2C type or both) positively affects the probability to innovate. Providing services to a large customer encourages service firms to develop more their internal innovation. Actually, in order to cover the increasing and diversifying demand it faces, the service firm has to innovate so as to enhance its internal capacity.

An interesting result concerns the role of the cooperation variable (Table 5). We find that, when a firm cooperates with external partners (customers, competitors, universities, research centers...), its probability to innovate in services increases. This result is also noted by Becker and Dietz (2004). These authors show that cooperation with partners in R&D has a positive and statistically significant effect on innovation. Also, Mohnen and Therrien (2005) notice that the Canadian manufacturing firms are better off with innovation while cooperating with other companies. Moreover, we find that the international orientation of a firm abroad can promote the probability of innovation. In the same way, Kafouros et al. (2008) show that the internationalization process allows firms to promote their performance through the introduction of new products on the market.

Otherwise, we note that, for the both models, the variable ENGAG has no effect on the probability to innovate. However, the converse effect is noted by Du et al. (2007). The origin of the difference is related to the measure of the knowledge activities. They consider the R&D in plant (binary variable indicating whether or not the firm has developed R&D activities) as a measure of knowledge activities rather than a dichotomous variable introducing all innovation activities, including the R&D's.

For both models, our econometric estimations show significant effects concerning the importance service firms give to the innovation objectives. We find that service quality improvement, market share sustainability, and production costs reduction positively affect the probability to innovate. This result is also obtained in Sirilli and Evangelista (1998) for both manufacturing and service industries. In addition, we find that the probability of innovation would be positively affected by the extension of the services' line.

Table 4: Marginal effects of multinomial Probit model for innovation choice (first model)

Variables	Multinomial Probit Model							
	Non-innovation		**Radical innovation only**		**Incremental innovation only**		**Both**	
	dy/dx	SE	*dy/dx*	SE	*dy/dx*	SE	*dy/dx*	SE
Internal knowledge sourcing								
Engaging in innovation activities (ENGAG)	0.106	0.089	-0.033	0.030	-0.018	0.027	-0.05	0.102
External knowledge sourcing								
Cooperation (COOPER)	-0.186	**0.071****	-0.042	0.027	0.016	0.033	0.213	**0.088****
International orientation (INTER)	-0.026	0.019	-0.013	0.012	-0.000	0.012	0.039	0.028
Absorptive capacity								
Education level (QUAL)	0.054	0.110	-0.036	0.070	0.197	**0.110***	-0.036	0.070
Group membership (APP_GROUP)	-0.006	0.046	0.014	0.026	0.026	0.042	-0.005	0.077
Resources								
Size (SIZE)	0.069	0.052	0.024	0.035	0.087	**0.044***	-0.181	**0.075****
Size-squared	-0.002	0.005	-0.000	0.003	-0.009	0.006	0.013	0.009
Firm vintage (AGE)	-0.007	0.005	-0.004	0.003	0.001	0.002	0.009	0.006
Business type (TYPEAFF)	-0.026	0.019	-0.003	0.014	0.032	**0.016****	-0.012	0.036
The aims of the innovation								
Replace obsolete services (SERV_OBS)	0.033	0.021	-0.000	0.010	-0.005	0.011	-0.027	0.026
Improve service quality (QUAL_SERV)	-0.024	0.030	0.119	**0.059****	-0.016	0.027	-0.078	0.073
Extend the line of services (GAM_SERV)	-0.009	0.022	0.033	0.024	0.025	0.016	-0.049	0.037
Sustain the market share (PART_MAR)	-0.045	0.044	-0.126	**0.065***	0.013	0.021	0.158	**0.086***
Reduce production costs (RED_COUT)	-0.019	0.016	-0.014	0.015	-0.036	**0.013*****	0.070	**0.031****

Log-pseudolikelihood	-9443.120
Likelihood Ratio statistic	17204.014 [0.000]
AIC/BIC	18976.24 / 19093.02
R-squared	**49%**
Number of observation	99

*** significant at 1%; ** significant at 5%; * significant at 10%.

Table 5: Marginal effects of multinomial Probit model for innovation choice (second model)

Variables	Probit Model		Multinomial Probit Model					
			Radical innovation only		Incremental innovation only		Both	
	dy/dx	SE	*dy/dx*	SE	*dy/dx*	SE	*dy/dx*	SE
Internal knowledge sourcing								
Engaging in innovation activities (ENGAG)	-0.181	**0. 101***	-0.032	0.026	-0.019	0.023	0.051	0.038
External knowledge sourcing								
Cooperation (COOPER)	0.185	**0.087****	-0.036	0.033	0.014	0.027	0.022	0.047
International orientation (INTER)	0.034	**0.019***	-0.012	0.012	0.001	0.012	0.010	0.019
Absorptive capacity								
Education level (QUAL)	0.095	0.103	-0.032	0.066	0.151	0.104	-0.118	0.128
Group membership (APP_GROUP)	0.048	0.036	-0.018	0.023	0.026	0.033	-0.008	0.044
Resources								
Size (SIZE)	-0.045	0.046	0.026	0.033	0.087	**0.043****	-0.113	**0.054****
Size-squared	0.000	0.005	-0.001	0.003	-0.009	**0.005***	0.011	**0.006***
Firm vintage (AGE)	0.008	**0.004***	-0.003	0.003	0.001	0.002	0.002	0.003
Business type (TYPEAFF)	0.034	0.019	-0.012	0.012	0.026	**0.015***	0.010	0.019
The aims of the innovation								
Replace obsolete services (SERV_OBS)	-0.022	0.016	0.001	0.008	-0.005	0.009	0.004	0.013
Improve service quality (QUAL_SERV)	0.040	0.034	0.099	**0.045****	-0.009	0.023	-0.090	**0.051***
Extend the line of services (GAM_SERV)	0.025	0.024	0.031	0.019	0.023	0.015	-0.054	**0.026****
Sustain the market share (PART_MAR)	0.019	0.032	-0.109	**0.050****	0.005	0.018	0.103	**0.054***
Reduce production costs (RED_COUT)	0.029	0.015	-0.014	0.012	-0.028	**0.011****	0.043	**0.019****
Log-pseudolikelihood	-9.712		-5879.70					
Likelihood Ratio statistic	20860.39 [0.000]		11605.46 [0.000]					
AIC/BIC	-		18976.24 / 19093.02					
R-squared	**82%**		**51%**					
Number of observation	99		79					

*** significativité au seuil de 1%; ** significativité au seuil de 5%; * significativité au seuil de 10%.

6 Conclusions

In this paper, we have used a sample of 108 Tunisian service firms in order to explain the extent to which the service firms make their decision to innovate. More precisely, we have tested the robustness of two decision-making models. The first model studies the case where the firm takes a simultaneous innovation decision (a one-stage decision). The second one tackles a sequential innovation decision (a two-stage decision).

We have used in this paper the Multinomial Probit Model (MNP). The estimation results of the MNP, using the maximum likelihood method, show that the sequential innovation decision has a positive and statistically significant effect in terms of the innovation decision predictions. Furthermore, we have found that service quality improvement, market share sustainability, and production costs reduction positively affect the probability to innovate. Also, we have obtained that the cooperation agreements with external partners have a positive effect on the probability to innovate. This finding is often noted in the innovation literature.

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