

Determinants of the adoption of Cloud Computing by Tunisian firms: an exploratory study

Adel BEN YOUSSEF

(University of Nice Sophia-Antipolis, GREDEG-CNRS)

Walid HADHRI

(ISG Tunis, University of Tunis)

Teja MAHERZI

(University of Nice Sophia-Antipolis, GREDEG-CNRS)

**DATA DIGITAL BUSINESS MODELS, CLOUD COMPUTING AND ORGANIZATIONAL
DESIGN (PARIS NOVEMBER 24-25, 2014)**

OVERVIEW

- 1. Motivation of the paper
- 2. Research questions
- 3. Literature Review
- 4. Data, Sample description
- 5. Econometric Model
- 6. Results
- 7. Summary
- 8. Policy Recommendations
- 9. Extensions
- 10. To go further

1. MOTIVATION OF THE PAPER

Increasing digitalization of the MENA Countries (Tunisia - Ben Youssef and Mhenni (2003), Bellon et al. 2006 and 2007, Ben Youssef et al. 2012 and 2014)

Several Waves of ICT as GPTs (Bresnahan and Trajtenberg 1995, Helpman, 1998)

New opportunities for leapfrogging for Developing countries (mobile phone, mobile payment: M-pensa in Kenya)

Cloud Computing as the last wave of GPTs

What is Cloud Computing?

- * **Jaeger, Lin and Grimes (2008)**, define it as a “computing platform that is able to dynamically provide, configure and reconfigure servers to address a wide range of needs, ranging from scientific research to e-commerce”.
- * **Marston et al. (2010)** CC “is an information technology service model where computing services (both hardware and software) are delivered on-demand to customers over a network in a self-service fashion, independent of device and location. The resources required to provide the requisite quality-of-service levels are shared, dynamically scalable, rapidly provisioned, virtualized and released with minimal service provider interaction. Users pay for the service as an operating expense without incurring any significant initial capital expenditure, with the cloud services employing a metering system that divides the computing resource in appropriate blocks”.

Cloud Computing: who cares?

Cloud Computing worldwide (research on google trends)

<http://www.google.fr/trends/explore#q=Cloud%20Computing>

* Cloud Computing in France (research on google trends)

<http://www.google.fr/trends/explore#q=Cloud%20Computing%20France>

* Cloud Computing in Tunisia (research on google trends)

* <http://www.google.fr/trends/explore#q=Cloud%20Computing%20Tunisia>

2. RESEARCH QUESTIONS

- * What are the main motivations of Tunisian firms when they adopt CC?
- * Do they differ from those identified for other developing countries in similar research?
- * Do classical effects in matter of adoption of ICT work (Competition, Rank and Network Effects)?
- * Do Perceived advantages and perceived disadvantages have any impacts on the process of adoption?

3. LITERATURE REVIEW

- * **Firm size** is an important factor affecting the decision to adopt a new innovation such as CC. (J.Ranald et al. 2013).
- * **The competitive pressure** made that many firms have externalized their infrastructure of information technology to improve not only the effectiveness but also make it possible to offer low process like attempt to increase their part of the deal. (Ranald et al. 2013).
- * **The pressure of the business partner** is a main determining cause for the adoption and the use of ICT (Pan and Jang, 2008).

3. LITERATURE REVIEW

- * **Technology Readiness:** Firms, which have *the technology readiness*, are better prepared for the adoption of CC.
- * **Absorptive capacity of the firm:** Technological infrastructure and the human resources dedicated to innovation and technology (Bellon et al. 2006, Low and al, 2011) Levinthal and Cohen (1988).
- * **The top management support:** is regarded as a significant impact on the adoption of the new innovations of information technology. It helps the firms by overcoming any barrage and internal resistance to the change. (Ranald et al. 2013).

3. LITERATURE REVIEW

- * **Perceived Advantages:** The relative advantages of Cloud Computing also include: Quality improvement of the operations of businesses, realization of the tasks more quickly, increase the productivity and provides new business opportunities. (Oliveira et al. 2014), (Ranald et al. 2013).
- * **Perceived Disadvantages:** The perceived complexity of CC is a significant factor in the decision of adoption and can act as a barrier with the implementation of this technology. (Ranald et al. 2013).
- * **The Compatibility** is a crucial factor for the adoption of the new innovations in matter of information system. (Rogers 2003).

4. Data, Sample description

- ✧ Questionnaire: a face-to-face interview administered during the summer of 2014 in Tunisia
- ✧ Entrepreneurs or company directors
- ✧ Random sample of 350 Tunisian firms
 - ↳ Response rate of nearly 90%
 - ↳ *Only 311 usable surveys were retained*

5. Econometric Model

Cloud Computing Adoption

```
graph TD; A[Cloud Computing Adoption] --> B[Environmental and organizational context]; A --> C[Absorptive Capacity of the firm]; A --> D[CC Perceived Advantages]; A --> E[CC Perceived Disadvantages];
```

Environmental and
organizational
context

Absorptive Capacity
of the firm

CC Perceived
Advantages

CC Perceived
Disadvantages

DEPENDANT VARIABLE

The dependent variable is the adoption of CC.

This variable is dichotomy



1 if the firm adopt CC

0 if the firm don't adopt CC

Model: In order to study the determinants of CC adoption, we use a simple Logit econometric model.

Explanatory variables (1)

I. Environmental and characteristics of the Firm

Seniority	Birth Date of the firm	Firm age on years	Continuous variable
Size	Number of employees	The logarithm of number of employees	Continue variable
Competition	Number of competitors	The logarithm of number of competitors as estimated by the interviewee	Continue variable

II. Absorptive Capacity of the firm

Personal IT	The firm practice the policy (one computer per employee)	Binary =1 if Yes =0 if Not	Dichotomy
Centralized IT	The firm use the centralized computer (CPUliabilities)	Binary =1 if Yes =0 if Not	Dichotomy
ICT Manager Skills	Score of 5 ICT use by the manager	Binary =1 if Score=5 =0 if Not	Continue variable

Explanatory variables (2)

III. *Perceived Advantages*

Competitor	Cloud Computing allows it to be more competitive?	Binary =1 if Yes =0 if No	Dichotomy
Cost Reduction	Cloud Computing reduce cost	Binary =1 if Yes =0 if No	Dichotomy
Time Saving	Cloud Computing saves time	Binary =1 if Yes =0 if No	Dichotomy
Innovation	Cloud computing promotes innovation	Binary =1 if Yes =0 if No	Dichotomy

IV. *Perceived Disadvantages*

Complexity	The complexity of implementation of the Cloud computing service	Binary =1 if Yes =0 if No	Dichotomy
Knowledge	Problems related no knowledge of cloud computing	Binary =1 if Yes =0 if No	Dichotomy
Internet Connexion Problems	Problems with connection technologies	Binary =1 if Yes =0 if No	Dichotomy

6. Econometric Results

	Model 1		Model 2		Model 3		Model 4	
	Odds Ratios	<i>z-stat</i>	Odds Ratios	<i>z-stat</i>	Odds Ratios	<i>z-stat</i>	Odds Ratios	<i>z-stat</i>
I. Environmental and organizational context								
Age	0.9626**	-2.20	0.9584**	-2.40	0.9563**	-2.50	0.9512***	-2.66
Age ²	1.0003	1.64	1.0003*	1.90	1.0003*	1.85	1.0004**	2.18
Size	1.4439***	3.87	1.5273***	4.26	1.5242***	4.16	1.4648***	3.72
Competition	3.4056***	3.50	3.0575***	3.13	2.6815***	2.62	2.7051**	2.55
ICT Manager Skill	0.7709	-0.73	0.9012	-0.28	1.0317	0.08	0.9283	-0.19
II. Absorptive capacity								
Personal IT			0.2635***	-2.68	0.3586**	-2.04	0.2774**	-2.42
Centralized IT			0.5249**	-2.14	0.5269**	-2.05	0.6078	-1.54
III. Perceived Advantages								
Competitor					0.7140	-1.07	0.7857	-0.74
Cost Reduction					2.5958***	2.83	2.5515**	2.68
Saves Time					0.8900	-0.32	0.9506	-0.14
Innovation					2.4254**	2.46	2.5456**	2.48
IV. Perceived Disadvantages								
Complexity							0.0776**	-1.96
No Knowledge							0.3510**	-2.41
Connection							1.6741	1.58
LR chi2	37.63		47.57		62.93		75.31	
Prob > chi2	0.0000		0.0000		0.0000		0.000	

Results are presented as odds ratios

*: Significant at 10%, **: Significant at 5%, ***: Significant at 1%

Main Results

Our empirical results show **4** preliminary results:

- ① **Rank effect is confirmed:** We show that the adoption of CC depends on the size of the firm. The Size of the firm reveals the financial capacities of the firm, its human capital stock and its ability to manage the innovation.
- ② We found that **competition effect works**. The more the competitors adopt this innovation, the more the firm adopt it. Innovation may give the competitors radical advantage and hamper the competitive advantages of the firm. Since then, mimetic adoption in key sectors are observed. Cloud computing is diffused through sectorial patterns.

Main Results

- ③ CC adoption is pushed by the perceived **cost reducing aspect** of this technology. Moving from SAAG to SAAS was associated to the capacity of this technology to reduce the costs and to adjust it to the real needs of the firms (elasticity). Our study confirms that this cost reducing aspect works in the case of Tunisia.
- ④ The main perceived **disadvantages of CC** it is perceived complexity and the lack of knowledge about its purposes. CC is still a new innovation with little information about its purposes and most of Tunisian firms perceive it as a complex technology. Policies and managerial implications of our findings are discussed in the paper.

7. Summary

This paper seeks to identify the determinants of CC adoption by Tunisian firms. It is an exploratory study based on a sample of 350 firms.

Four main results were found. The adoption of CC depends on the size of the firm, its perceived cost cutting advantage, its perceived complexity and the adoption by competitors.

However, the results show that the adoption mechanism is not depending on its IT absorptive capacity.

8. Policy Recommendations

Our paper shows clearly that in the Tunisian case the main forces behind CC non-adoption are the lack of adequate skills (especially the skills of the managers) and perceived complexity of the technology.

One of the main argument, that works, for the adoption of this technology is to show their ability to save costs and to cut inadequate costs linked to over-equipment of ICT.

8. Policy Recommendations

Building the specific skills for the CC is challenging and important in order to raise the competitiveness of the Tunisian Economy.

Several countries like South Africa have engaged their selves in a national strategy called e-skills South Africa. The strategy aims at populating the national (South African) Cloud.

Tunisia needs similar strategy targeting the managers of the firms and more generally to adopt a National CC strategy.

9. Related Literature

- * (2015) “E-skills, Brains and Performance of the Firms: ICT and ability of firms to conduct successful projects in Luxembourg”, with Leila Peltier and Anissa Chaibi, *forthcoming, Journal of Applied Business Research* May/June 2015 (Volume 31, Number 3).
- * (2014) “Adoption of Information and Communication Technologies and New Organizational Practices in the Tunisian Manufacturing Sector”, *Economics Bulletin* Vol. 34 Issue 4, pp. 2237-2252. (with Walid Hadhri and Hatem Mhenni)
- * (2014) “The complementarities between ICT Use, New Organizational Practices and Workers Contextual Performance: Evidence from Europe in 2005 and 2010”. *Revue d’Economie Politique* (in collaboration with L. Martin and N. Omrani)
- * (2012) « Intra-firm diffusion of innovation: Evidence from Tunisian SME’s regarding Information and Communication Technologies”, *Middle East Development Journal*. (in collaboration avec H. Mhenni, & W. Hadhri). Vol. 3, Issue 3 : pp. 75-97.
- * (2012) «Adoption and Usage of ICT by Catalan Firms», «*Internet Econometrics* », New Palgrave MacMillan, Allegrezza & Dubrocard (ed.). Pp. 288-308. (in collaboration with Castillo, D. & W. Hadhri)

10. Extension (Cloud Computing and Innovation)

	Ordered probit with sample selection Innovation_CC		Bivariate probit CC	
	Coef.	<i>z-stat</i>	Coef.	<i>z-stat</i>
I. Environmental and organizational context				
Age	0.0123**	0.61	-0.0157	-1.38
Age ²	-0.0002	-102	0.0001	1.06
Size	-0.0294	-0.27	0.0004**	2.08
Sector: <i>Other</i>	Ref.		Ref.	
<i>Manufacturing</i>	0.0273	0.04	-0.0260	-0.07
<i>Less KIS</i>	-0.1109	-0.17	0.6068**	2.02
<i>Knowledge Intensive Services</i>	0.0314	0.04	1.1843***	3.70
Intellectual Proprety	0.7449*	1.84		
General ICT	0.1283**	2.22		
ICT Manager Skill	-0.1588	-0.44	-0.1627	-0.71
Competition	0.7883*	1.91	0.5186**	2.31
II. Absorptive capacity				
Perso_Cental_IT			-0.0145	-0.02
Coord_Employ	0.7850**	2.51	1.0317	0.08
tx_NbrEmlpoy_IT	0.7290*	1.66	0.3586**	-2.04
III. Perceived Advantages				
Cost Reduction			0.4205**	2.23
Saves Time			0.2322	1.03
IV. Perceived Disadvantages				
Complexity			-1.2159*	-1.72
No Knowledge			-0.4433*	-1.89
Connection			0.2596	1.34
# obs	81		311	
Prob > chi2	0.0000			