Summer 9-4-2014

OPEN SOURCE SOFTWARE ADOPTION MODEL OSSAM

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Complete Research

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Abstract –

The paper examines Open Source software adoption phenomenon by individual in an organizational context. It aims to identify factors that may be involved in the adoption process. To do this, a conceptual model was exhibited from previous IT adoption theories. Comparing to previous studies, it includes technical and organizational factors that influence the individual intention to adopt an OSS. To validate theoretical constructs, an exploratory qualitative study was conducted, in a first stage, to adapt the model to the Tunisian context specificities. Thus, an Open Source Software Adoption Model OSSAM is obtained. In a second stage, a quantitative confirmatory study was made to validate OSSAM. Data gathered by a survey (205 professionals) was analysed under a structural equation modeling approach (Partial Least Square). Research results provide important theoretical and practical contributions in the IT adoption area.

Keywords: Open source software, adoption factors, qualitative study, structural equation modeling, OSSAM.

1 Introduction

OSS originality comparing to commercial software is due to many issues mainly the availability of source code, the development mode, developer's goals, support, users… Topics found in the literature are focusing on Business model of firms operating in open source sector, participant's motivations to OSS projects, OSS communities and OSS development (Fugetta, 2004; Hippel and Krogh, 2003; Brydon and Vining, 2008; Tiwari, 2010; Barahona et al., 2006; Scacchi, 2004; Scacchi et *al*., 2006 ; Edmund Koh, 2009; Crowston et *al*., 2010; Snow et *al*., 2011).

Concern given to Open Source Software (OSS), in our research, is justified by the rapid growth of their use over the world. Opportunities for skills development and innovations stimulation associated with OSS products deserve study and clarification. Constraints related to their diffusion and adoption require exploration and detailed analyses.

Indeed, Netcraft'statistics show that OSS products dominate the market since 1995 especially for the web server. In fact, untel April 2014 Apache gains the first place with 38% of the market share against Microsoft that owns 33%.

Our target is to identify reasons that could explain this considerable growth of the market share of OSS solutions. The first apparent one is the user's decision to adopt an OSS (Miralles et *al*., 2006). Thus, user's choice between an open source software and a proprietary one is an important issue and a critical determinant of the spread of such software in the world.

The current study focuses on this issue and explains the adoption behavior of OSS solutions by identifying relevant factors that can be involved in the adoption process.

Literature on the acceptance of Information Technologies (IT) is one of the most important areas investigated in the Managament Information Systems field (Venkatesh et *al*., 2003). However, most models studied individual factors while neglecting contextual and organizational ones. This idea was supported by Snook (2005) who argued that studies on technology acceptance considers potential users' subjective analysis and do not integrate external factors.

Our research is focusing in this limit and consider that individuals are not isolated from social interactions that occur in an organizational context.

Thus, throughout this research, we attempt to enrich existing theories of IT adoption by introducing organizational factors that could moderate the individual's intention to adopt a new technology (open source software). In other words, we are trying to answer the following question:

What are the factors that promote OSS adoption by individuals in an organizational context?

To address this issue, we tried to develop a theoretical model that explains OSS adoption behavior by individuals in an organizational context. Empirical validation of the proposed model in the Tunisian users' case involves two stages. The first one is an exploratory study (qualitative approach) that aims to adapt the theoretical model to organizations and users specificities in Tunisia. The second stage, is a survey (quantitative approach) which wants the generalization of results. To do this, a structural equation modeling (Partial least square) was applied to evaluate data.

2 Theoretical construct (conceptual model)

In most IT theories, adoption behavior is the explained variable. It is defined as the observable act of use in the adoption process (Azjen and Fishbein, 1975).

Previous studies in IS field showed that intention is the direct predictor of the adoption behavior (Venkatesh et *al*., 2003). In our model, we keep this relation and we assume that all adoption factors influence the individual intention which plays a mediator role in the model. Intention is defined as a set of instructions that give an individual to himself before opting for a particular behavior (Triandis, 1979). It captures the motivational factors that influence the behavior (Azjen, 1991).

Moreover, adoption behavior should be treated as a process (Miralles et *al*., 2006; Lee et Xia, 2006 ; Isaac et *al*., 2007; Jeyaraj et Sabherwal, 2008) that began at the individual level and continue to the organizational one. To identify factors involved in the adoption process, many theoretical analyses were conducted with respect to previous theories in IT adoption area and in innovation management (Van De Van, 1986).

The backbone of the model is mainly inspired from the Unified Theory of Acceptance and Usefulness of Technology UTAUT (Venkatesh et *al*., 2003). The strength of this model is shown in many studies because it synthesizes 20 years of researches in MIS and tests eight basic theories in this field (Hoffman et *al*., 2003).
At the individual level, the adoption's intention is determined by factors that are directly related to the technical features of the software. In fact, potential users facing two competitive solutions in the market (proprietary and OSS). The choice will be, normally, a rational one (Boudon, 2002). This idea agrees with Miralles et *al*. (2006) who assumed that decision makers rely on technological attributes to evaluate OSS solutions compared to proprietary ones. Given this reasoning, contextual and social factors will not be selected in this stage of the adoption process.

Furthermore, we restrict our choice to the factors that could be perceived before using the software. Thus, constructs like reliability and observability (Rogers, 1995) could be verified once the software is used.
Thus, we finished by choose the two following factors: **performance expectancy** and **effort expectancy** : two concepts that synthesize many previous constructs in IT adoptions models. They are assumed to be strong predictors of adoption's intention (Venkaesh et *al*., 2003).
In addition, we find it more reasonable to introduce the Total Cost of ownership **TCO**. This factor is significant in this particular case of technology (OSS) because it seems 'free' for many users.

Moreover, we attempt to integrate organizational factors giving that individuals cannot be separated from their organizational context. Those factors are assumed to be moderators ; they impact the transformation of the intention to an adoption behavior.
To identify relevant organizational factors, we referred to Van De Ven (1986)' theory that studied the innovation management in an organizational context. It underlined the following key factors: ***leadership, group pressure, organizational structure*** *and* ***physiological limitations***.
Van De Ven' theory is not exploited in the literature. As consequence, concepts embedded were not measured. Nevertheless, we attempt to reproach them with other operationalized constructs in the existing IT literature.
Group pressure was approached to conformity concept (Snook, 2005; Sajjad et *al*., 2009; Venkatesh and Davis, 2000…). **Organizational structure** refers here to the protection of existing practices, values and beliefs. Thus, it can be compared to compatibility construct (Rogers, 1995; Venkatesh et *al*., 2003) and facilitating conditions (Venkatesh & *al*., 2003). **Physiological limitations** describe complex decision situations where individuals create stereotypes as a defense mechanism to deal with complexity. This perspective fits with 'habit' (Triandis, 1979; Limayem et Hirt, 2003) and 'anxiety' constructs (Compeau and Higgins, 1995; Venkatesh et *al*., 2003). The last construct is the institutional **leadership** which is critical in creating a cultural context that fosters innovation. Measure of leadership is will established in the literature (Stogdill, 1963).

The OSS adoption model we want to create presents a continuum between an individual evaluation of the software solution (based on technical features) and organizational moderators. An illustration of the proposed model is shown in the figure 1.

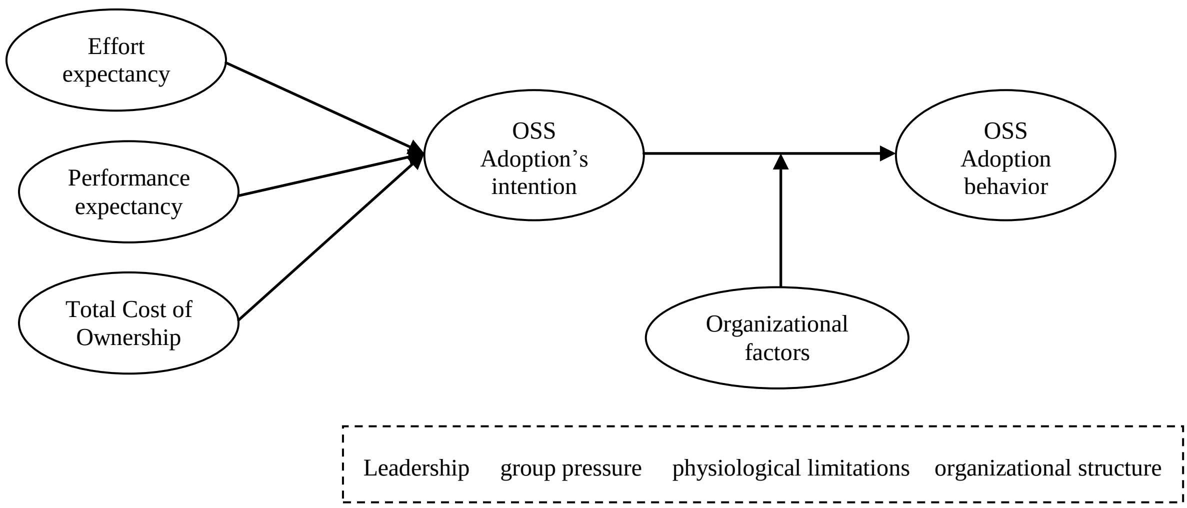

Figure 1 Research Conceptual Model

3 Research Design

The research approach presents different steps organized in a logical way to reach the research aim. In fact, we want to develop a model that explains the OSS adoption behavior by individual in an organizational context. Theoretical constructs leads as to develop a preliminary conceptual model based on previous IT adoption theories. To validate those theoretical constructs a qualitative study was conducted. Content analysis brought many modifications to the model. The new structure is called **OSSAM** as **O**pen **S**ource **S**oftware **A**doption **M**odel. To generalize results, a survey was carried out with 205 Tunisian professionals. Data was evaluated under PLS approach.

Thus, our research adopts a mixed research approach that defends complementarity of qualitative and quantitative methodologies (Johnson et Onwuegbuzie, 2004; Bryman, 1984; Jick, 1979…). This choice is justified by the relevance of the methodological pluralism to the MIS field (Kaplan and Duchon, 1988). It proves also and its appropriateness to the nature of our studies which is first exploratory (first stage) and then confirmatory.

4 Qualitative study results

We have achieved interviews with executives (24) in 14 Tunisian organizations during 2012. Data were processed via content analysis (Johnson et Onwuegbuzie, 2004).
According to qualitative study results, the preliminary model resulting from the theoretical reasoning has been modified.

At the technical factors level, the two initially construct (*performance expectancy, effort expectancy)* kept their role as a direct predictors of adoption's intention.

However, there was an emergence of some other factors: ***technical compatibility*** (at the software and the hardware levels as defined by Bradford and Florin, 2003); ***software quality*** and ***system capability*** (Gallego et al, 2008). Those constructs seem relevant because they are frequently mentioned by all interviewees.

Furthermore, according to interviewees, the TCO is not a very important criterion to select the suitable software solution. The cost ranks second comparing to software efficiency ; it gains an organizational preoccupation. As a consequence, we choose to move TCO to organizational factors.

Then, physiological limitations are also validated because all interviewees mentioned the constraints of the 'habit' (with the proprietary environment) and the 'anxiety' toward OSS use (as new tools). However, physiological limitations seem attached to individual's factors, not to the organizational ones. Thus, we decide to move it to individual determinants of OSS adoption's intention.

Before studying the validity of organizational factors, it is important to underline the emergence of a key factor in OSS adoption: individual's skills toward computer and especially toward OSS solutions. Going back to IT literature we found the '**computer self-efficacy'** concept (initially invented by Bandura (1986) and adapted to IS field by Higgins and Huff (1999)). It is defined as an individual's beliefs about his or her capabilities to use Computers. This construct is shown as an important determinant not only of OSS adoption but also in the perception of OSS technical aspects and the physiological limitations. In other words, technical features of OSS are more appreciated by skilled individuals. Furthermore, physiological limitations are high only for non-skilled people.

At the organizational level, many factors affect 'directly' the adoption's intention. Many interviewees said that the organizational context is very important ; it affects intention at the beginning of the adoption process. Thus, organizational factors do not play any role of moderator as we proposed above; they are rather direct predictors of intention.

Identification of organizational factors was a complicated task because they are interdependent and similar in some cases. As a consequence, we kept the previous factors (*group pressure*, *organizational structure*, *leadership*).

As at the technical level, there was an emergence of a new factor that seems relevant to OSS adoption ; it is the *social influence*. It was adapted to the model with respect to Yang (2009)' perspective which includes three dimensions: image, voluntariness and visibility. In fact, most interviewees showed its influence on OSS adoption.

Moreover, it is necessary to underline that the leadership variable is an organizational factor, but at the same time, it influences the organizational climate toward OSS adoption (positively or negatively). As consequence, leadership will be considered a direct predictor of intention and an independent variable that influences organizational factors (see figure 2 below).

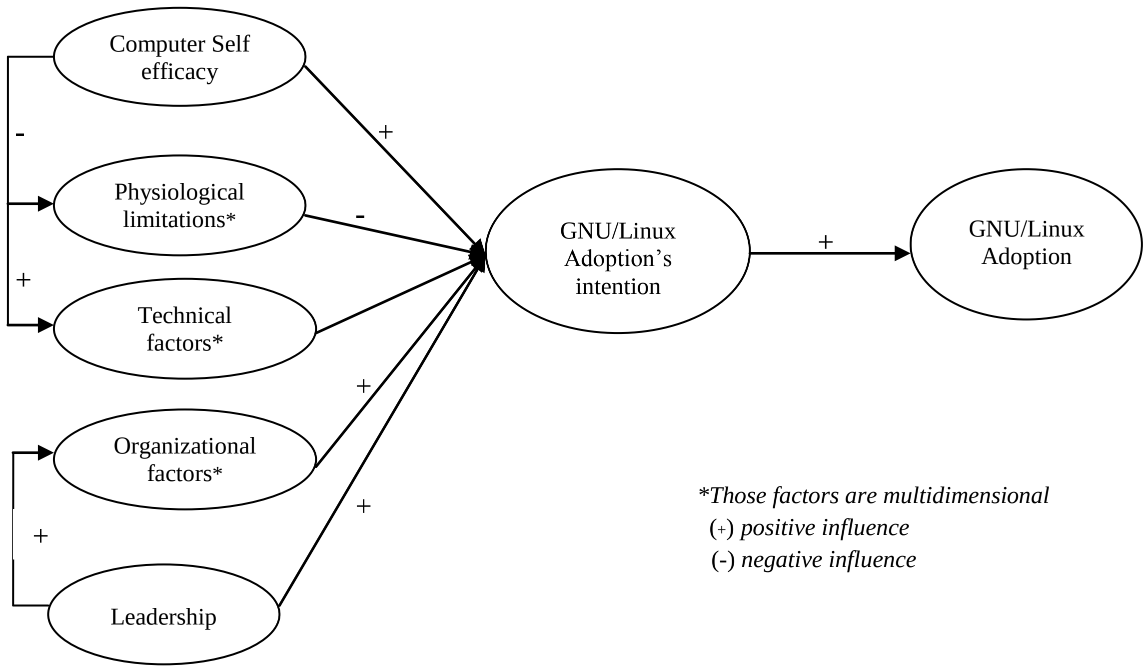

Figure 2 Open Source Software Adoption Model
(After the exploratory study evaluation)

Open **S**ource **S**oftware **A**doption **M**odel or **OSSAM** as discussed above contains technical factors, organizational factors, physiological limitations and computer self efficacy as direct predictors of the individual intention. Adoption behavior, the endogenous variable in the model, is directly predicted by intention. Thus, intention is a central mediator between all exogenous variables and adoption (figure 2).

Furthermore, as mentionned above most of OSSAM constructs are multidimensional. This architecture calls for hierarchical model analyses as suggested by Wetzels et *al*. (2009) ; It fits more with structural equation modeling and precisely Partial least square techniques (Henseler et *al*., 2009; Chin et *al*., 1995). Table 1 illustrates OSSAM hierarchical constructs.

Research hypothesis resulting from previous analysis are summarized in the table 2 below.

<Table 1 OSSAM hierarchical structure>

Adoption factors			References
3d order construct	**2nd order constructs**	**1st order constructs**	
		Computer self-efficacy	Higgins and Huff (1999)
	Physiological limitations	Habits	Limayem et *al*. (2003)
		Anxiety	Compeau and Higgins, 1995
	Technical factors	Performance expectancy	Venkatesh et *al*. (2003)
		Effort expectancy	Venkatesh et *al*. (2003)
		System capability	Gallego et *al*. (2008)
		Software quality	Gallego et *al*. (2008)
		Technical compatibility	Bradford and Florin (2003)
Organizational factors	Social influence	Image	Yang (2009)
		Voluntariness	
		Visibility	
	Group pressure	Conformity motivation	Snook (2005)
		normative influence	
	Organizational structure	Organizational compatibility	Venkatesh et *al*. (2003)
		Facilitating conditions	
		TCO	Murrain et *al*. (2004)
		Leadership	Stogdill (1963)
		Intention	Venkatesh et *al*. (2003)
		Adoption	Venkatesh et *al*. (2003)

<Table 2 Research hypotheses>

H1	Computer self-efficacy has a positive impact on GNI/Linux adoption's intention
H2	Computer self-efficacy has a positive impact on technical factors
H3	Computer self-efficacy has a negative impact on physiological limitations
H4	Technical factors have a positive impact on GNU/Linux adoption's intention.
H5	TCO has a negative impact on GNU/Linux adoption's intention
H6	Organizational factors have a positive impact on GNU/Linux adoption's intention
H7	Leadership has a positive impact on GNU/Linux adoption's intention
H8	Leadership has a positive impact on organizational factors
H9	Physiological limitations have a negative impact on GNU/Linux adoption's intention
H10	GNU/Linux adoption's intention has a positive impact on GNU/Linux adoption behavior

5 Quantitative study and SEM evaluation

The model was designed to test the adoption of GNU / Linux operating system. The survey was designed for professionals and concerned 205 Tunisians IT users. Data were collected using an online survey administered in Tunisia during 2012.The sample is enough to evaluate the model if we refer to researchers' recommendations in the PLS approach (Henseler et *al*., 2009; Roussel et *al*., 2002 ; Chin, 1998). The software used for the implementation of the PLS method is SmartPLS 2.0 (Ringle et *al*., 2005).

To carry out quantitative study under PLS approach we referred to researchers instructions in this area mainly to Henseler et *al*. (2009). Moreover, because of the hierarchical structure of OSSAM model, we also respect Wetzels et *al*. (2009) method in the validation of hierarchical models.

Thus, three steps are recognized in structural equation modeling : the first step is the validation of *the measurement model*. The second one is the evaluation of *the structural model* which carried out research hypothesis and path coefficient. The last step is the assessment of indirect relations even mediation or moderation effects.

5.1 Measurement model

The measurement model evaluation depends on the nature of the indicators (formative or reflective). If indicators are reflective, the classical theory of measurement (Chirchull,1979) is the main validation tool. If constructs are formative, we should apply another different approach (Jarvis et *al*., 2003). In the OSSAM model, all constructs are reflective except for the total cost of ownership TCO. This is resulting from intellectual analyses of constructs and previous studies findings (Crié, 2005; Gudergan et *al*., 2008 ; Lacroux, 2009…).

To validate OSSAM reflective constructs, one must consider the Cronbach Alpha (α) and the composite reliability. Indicators' reliability must also be evaluated through communality or AVE[1]

The report provided by SmartPLS demonstrates that the third order construct in the OSSAM model (organizational factors) had a low AVE (0.49 < 0.5). Likewise, problems were faced in the convergent and discriminant validity. Thus, it was better to omit this construct from the model. By doing this, indicator of explanatory power R^2 of the main variable in OSSAM (adopton behaviour) was enhanced (from 51.4% to 55.4%).

As consequence, OSSAM shows very good reliability (Cronbach α) for all constructs. Several values exceed 0.9. These is a very satisfactory results because α must be greater than 0.7 (see table 3).

Convergent and discriminant validity were also satisfied after the omission of the third order construct in the OSSAM model.

<Table 3 OSSAM constructs reliability>

	AVE	Composite Reliability	Cronbachs Alpha	Communality
Adoption	0,869388	0,930117	0,851201	0,869388
Anxiety	0,749170	0,899588	0,832551	0,749170
Computer self efficacy	0,726502	0,888225	0,811834	0,726502
Effort expectancy	0,658970	0,920236	0,895124	0,658970
Technical factors	0,508700	0,948591	0,942166	0,508700
Habits	0,806178	0,925766	0,879508	0,806178
Image	0,669954	0,889724	0,834980	0,669954
Normative influence	0,803779	0,942438	0,918485	0,803779
Social influence	0,545635	0,892210	0,857552	0,545635
Intention	0,936465	0,977884	0,966056	0,936465
Leadership	0,652710	0,943930	0,933156	0,652710
Physiological limitations	0,569619	0,887902	0,848341	0,569619
Conformity motivation	0,889128	0,960089	0,937647	0,889128
Performance expectancy	0,612955	0,903904	0,871176	0,612955
Group pressure	0,645695	0,927138	0,907991	0,645695
Software quality	0,749782	0,947258	0,932996	0,749782
Organizational support	0,720055	0,927505	0,901585	0,720055
visibility	0,861856	0,949258	0,919602	0,861856

[1] Average Variance extracted

Validation of a formative constructs requires different criteria satisfaction. First, the significance must be verified through the values of T obtained by the bootstrap technique (1000 samples 205 observations). Secondly, the VIF (Variance Inflation Factor) should be evaluated. Thirdly, the factor weight determined by the PLS regression should be examined. Finally, we have to check the significance of the structural relationship between TCO and intention. This last criterion is satisfied; the structural coefficient between the TCO and the intention is significant (-0142 ; p <0.1). Other criteria are showed in table 4 below.

<Table 4 TCO validity>

Indicator	VIF	Weights (PLS regression)	Significativity (T)
TCO1	1,897	-0,076188	0,536094
TCO2	1,630	-0,648445	4,857698
TCO3	2,546	0,099978	0,668412
TCO4	2,572	0,223876	1,174489
TCO5	2,773	0,236457	1,092108
TCO6	2,499	0,932404	7,048480
TCO7	2,873	-0,132501	0,627199

Indeed, the results show that there is not a multicolinearity problem since VIF values are acceptable (greater than 1). However, the loadings factor and their significance are not satisfied. Only two indicators seem significant: *material cost* and *updating cost*.

Thus, the TCO has not met all the criteria of validity. Statistically, this is not a valid construct. This can be justified by its exploratory nature. Indeed, its operationalization should be more detailed. However, we decide to keep it given its theoretical relevance in the model and for future research.

5.2 Structural model

5.2.1 Robustness of OSSAM: R2 and Q2 values

The evaluation of structural model begins by examining coefficient of determination R^2 and predictive relevance Q^2 for endogenous variable in the model. The table 5 below illustrates this.

< Table 5 R^2 et Q^2 values>

Constructs	R^2	Q^2
TCO		0,259932
adopt	0,562378	0,477032
anx	0,696149	0,521382
effipersinfo		0,726501
effoatt	0,692174	0,452709
fac tech	0,504533	0,255077
habit	0,768471	0,616037
img	0,742963	0,489467
inflnorm	0,829574	0,665792
inflsoci	0,058842	0,032071
intention	0,551660	0,515702
leader		0,652710
limitphysio	0,237202	0,134130
motivconf	0,695790	0,617817
perfatt	0,770585	0,469153
pression du groupe	0,004231	0,002689
qualt	0,803028	0,599787
supporga	0,028302	0,020245
visibl	0,714843	0,613913

The R^2coefficient is provided directly by SmartPLS after a regression. It is calculated only for endogenous variables. The purpose of PLS is to minimize the residual variance of the latent endogenous variables in the structural model; in other words, maximizing R^2. Thus, high values of R^2 indicate a great explanation power of the model.

According to the table 5 above, OSSAM explanation power is very satisfying. It explains 55.16% of the variance of intention to adopt GNU / Linux and 56.23% of the adoption behavior. Both values are good according to Chin (1998) and Henseler et *al*. (2009) especially when we consider the exploratory nature of the model (developed and tested for the first time).

In another hand, Q^2 values illustrate the predictive relevance of the model. According to Henseler et *al*. (2009) values of Q^2greater than zero are good. Values shown in the table 5 are very satisfying for most variables. The model has a significant predictive power particularly for adoption behaviour (0.477) and intention (0.515).

Those results demonstrate the ability of the model to predict the individual intention and the adoption behaviour of GNU/Linux. They are important for policy makers because they can identify most relevant factors to influence and stimulate users to adopt OSS solutions.

5.2.2 Hierarchical structure evaluation

According to the table 6 below, the structural coefficients between first-order constructs and second-order ones have high and positive values (greater than 0.8). Hierarchical relationships between constructs and their components are strong and important. Thus, the hierarchical structure of OSSAM seems very strong. It confirms the theoretical reasoning of constructs grouping.

Our research has a considerable theoretical contribution since those new proposed constructs are valid and have robust structural relationship. New concepts introduced are: physiological limitations, technical factors, group pressure. Social influence was previously used in research Callego et *al*. (2008).

<Table 6 Hierarchical structure validation>

	Second order constructs			
First order constructs	Physiological limitations	Technical factors	Group pressure	Social influence
Habits	0,876625			
Anxiété	0,834355			
Effort expectancy		0,831970		
Software performance		0,877830		
Software quality		0,896118		
Conformity motivation			0,834140	
Normative influence			0,910810	
Image				0,861953
visibility				0,845484

5.2.3 Path coefficients: research hypotheses validation

SmartPLS output after performing a regression and bootstrapping, gave data summarized in the table 6 below. Hypothesis (direct structural relations), structural coefficients (sign and magnitude), T values (significance) and validity result are noted.

<Table 6 research hypotheses validation >

H	Hypothesis	Path Coefficient	T Statistics (|O/STERR|)	Results
H1	**compselfeffic-> intention**	0,197121	2,848015***	**Confirmed**
H2	**compselfeffic -> techfac**	0,710305	20,614024	**Confirmed**
H3	**compselfeffic -> physiolimit**	-0,487033	8,604906	**Confirmed**
H4	**tech fac -> intention**	0,250798	2,225390**	**Confirmed**
H5	**TCO -> intention**	-0,142481	2,528530**	**Confirmed**
H6a	**group pressure -> intention**	0,087137	1,746157*	**Confirmed**
H6b	**socialinf -> intention**	0,247578	3,710865****	**Confirmed**
H6c	**orgasupp -> intention**	0,096510	0,933848 **n.s**	**Invalid**
H7	**leader -> intention**	-0,115880	2,607529***	**Invalid**[++]
H8a	**leader -> group pressure**	0,065050	0,859930 **n.s**	**Invalid**
H8b	**leader -> socialinf**	0,242575	3,533812****	**Confirmed**
H8c	**leader -> orgasupp**	0,168231	2,061017**	**Confirmed**
H9	**physiolimit -> intention**	0,038924	0,610894 **n.s**	**Invalid**
H10	**intention -> adopt**	0,749919	19,367065	**Confirmed**

*significative at p < 0.1 (t>1.64)
** significative at p < 0.05 (t>1.96)
*** significative at p < 0.01 (t>2.576)
**** significative at p < 0.001 (t>3.291)
n.s = non significative
[++]The structural coefficient was significant but the impact is opposite to that expected (negative), the hypothesis is invalidated

Thus, results show that most of tested hypotheses were validated. Four hypotheses were not verified; three of them have non-significant coefficients and one has an opposite sign compared to the proposed one.

Hypotheses related to the influence of computer self-efficacy (H1, H2 and H3) are well verified regarding sign, magnitude and significance. This result highlights the crucial role of computer self-efficacy as a determinant of OSS adoption.

Hypothesis 4 which reflects the impact of technical factors on intention is also validated with a 0.25 coefficient (p <0.05). It is the highest coefficients among those representing the impact of factors on the adoption intention.

Hypothesis 5 (the impact of TCO on intention) is also verified. Structural coefficient representing this relationship is -0.14 (p < 0.05). It seems important in OSSAM model. As consequence, the total cost of ownership is an obstacle to the adoption of GNU/Linux.

Hypothesis 6 related to the impact of organizational factors is divided into three sub-hypotheses. It articulates the impact of group pressure, social influence and organizational support on the adoption of GNU/Linux. Results show that the impact of group pressure and the social influence are well established. However, the impact of organizational support on the intention is not significant.

Moreover, the leadership seems a critical factor in OSSAM although hypothesis advanced (H7) was not verified. Remember that we tested democratic leadership style (consideration dimension as defined by Stogdill, 1963). Statistical results, as shown in the table 6, denounce the positive impact of leadership on adoption intention (-0,115, p <0.01).

Leadership is a core concept in OSSAM because its impact is not limited only on intention but also on organizational factors (H8). Due to the removal of 'organizational factors' construct, we addressed its impact directly on group pressure (H8a), social influence (H8b) and organizational support (H8c).
Results demonstrate that the impact of leadership on group pressure is not significant. Group pressure is then independent of the management style adopted.
On another hand, we find that the democratic leadership is a positive predictor of social influence (0.242, p <0.001) and organizational support (0.168, p <0.05). As consequence, the leadership creates favourable organizational climate to OSS adoption.

The last hypothesis that we check at this level examines the direct impact of intention on the adoption behavior. Structural coefficient related to H10 is the highest one in OSSAM (0.74). Adoption behavior of GNU / Linux is highly dependent on the intention to adopt it.

Figure 3 below illustrates the final structure of OSSAM after PLS assessment. It shows different coefficients according to structural relationship in the model. It demonstrates more relevant factors in the adoption process of OSS.

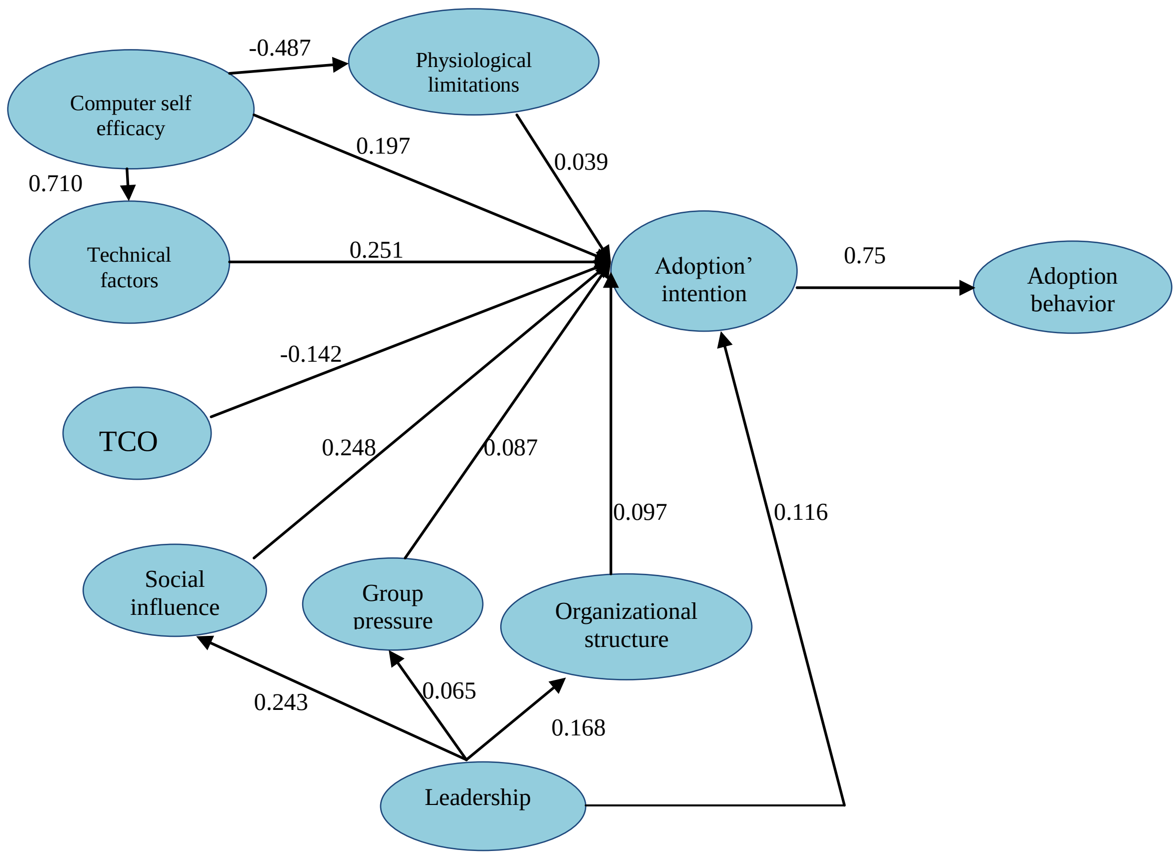

Figure 3 OSSAM final structure

6. Discussions and contributions of the research:

Our research has generated Open Source Software Adoption Model OSSAM that explains more than 56% of the adoption behavior of GNU/Linux. Research findings have shown its robustness after the empirical validation. OSSAM enriches previous studies in IT area because it articulates several factors of adoption: technical, organizational and individual ones.

The current research introduces new concepts to MIS studies. In fact, the hierarchical structure of OSSAM validates second order constructs: **technical factors**, **physiological limitations**, **group pressure** and **social influence**. Only social influence (as multidimensional) was used in previous studies (Callego et *al*., 2008). Other concepts are specific to the current research.

In another hand, the evaluation of the significance, the magnitude and the sign of structural coefficients (under PLS approach) showed that 60 % of the relations among variables were verified. Interpretation of results provides managerial implications and relevant theoretical contributions. Indeed, it identifies critical factors that influence the adoption of open source software in Tunisia.

Empirical results generated several factors that overcome in the adoption process. All identified factors are interrelated and occur in a simultaneous manner in the adoption process. That is why we decided to change the role organizational factors from moderator to direct predictor of intention.

According to our findings, we can say that technical factors, social influence and computer self-efficacy are the most important determinants of OSS adoption.

The current study demonstrated that OSS is limited to skilled persons in IT because of the crucial role of **computer self-efficacy** in the model. Indeed, the perception of the technical qualities of GNU/Linux is strongly influenced by the individual skills on computer. In addition, high skilled people in computer science find no difficulties to use GNU/Linux or another OSS. Statistically, the influence of physiological limits on adoption becomes insignificant in the presence of computer self-efficacy.

In OSSAM model, the leadership, another critical variable, was introduced. In the current study, we tested the democratic style and its direct impact on the intention and on organizational factors. The results showed that leadership style affects positively organizational support and social influence. However, its impact on group pressure was not significant. On another hand, the leadership is negatively related to intention. This allowed us to conclude that the democratic style helps to create a favorable organizational climate to adoption OSS. However, it is not a direct determinant of the adoption of OSS. This result is very important because the leadership variable was not included in previous models of IT adoption. It brings relevant managerial implications to organizations that want to adopt OSS concerning the appropriate management style.

Otherwise, the current study results (relevance of technical factors) suggest to managers to educate users about technical qualities of open source tools. They should demonstrate their usefulness even for end users. They must prove that OSS improves job performance and personal computer skills. Likewise, managers should reward the pioneer users of OSS tools to improve their image among their colleagues. Thus, they can encourage indirectly reluctant people to adopt OSS.

As in any research, this study has some limitations. First, some problems were faced in the measurement of TCO concept. The validity criteria of formative constructs as recommended by Henseler et *al.* (2009) were not all met at this level. Absence of an appropriate measurement scale for TCO since it was not included in previous models of IT adoption is the main reason.

Furthermore, the complexity of OSSAM limits its validation. Statistical treatments were heavy and difficult especially at the discriminant and convergent validity levels. This is due to the large number of items and the hierarchical structure of variables.

Despite these limitations, theoretical and practical contributions of this research are significant for IT adoption area. Findings open several questions that call for future researches. In fact, besides its application in other contexts, OSS adoption needs more focuses on the influence of leadership (autocratic), the group pressure and the social influence.

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