M-COMMERCE ADOPTION. TAM vs TECHNOLOGY PROVIDER PERSPECTIVE THROUGH COGNITIVE MAPS

López Catalán, Blanca, Universidad Pablo de Olavide
Díaz Luque, Pablo, Universidad Pablo de Olavide

ABSTRACT

Mobile commerce context has specific characteristics that affect technology adoption. This paper study the factors associated with the adoption of Mobile Commerce using a new perspective and a new methodology since Technology Acceptance Model (TAM) [1]. The design of this study has considered common limitations of previous relevant studies. TAM´s classical studies are based on subjective data from final user feedback. We suggest a new study "out of the box" based on information from interviews with industry providers: executives of an international mobile telecommunications company and an the president of an international content provider company. It is justified by two reasons: the privileged position of mobile industry managers in terms of knowledge about technology advances, market information and global market response, and the fact that this industry providers´ knowledge has direct effects on user behaviour through marketing actions: Publicity, Price, Promotion and Product. As a result technology industry is guiding final user behaviour affecting to adoption.

Cognitive maps add a qualitative perspective hardly found on technology adoption researches. This technique is used here to analyse the way managers construct their mental map about mobile adoption in order to compare it with TAM results. Cognitive maps technique make concepts appear freely from interviewed. Those concepts are connected trough arrows. It allows researchers to compare the built concepts from industry managers with TAM variables. The structured methodology insures internal validation and consistency.

The research questions we ask are: Which are the factors that affect MC adoption from the point of view of the industry providers? And are they coincident with the factors given by TAM literature?

Keywords: Mobile Commerce, Technology Acceptance Model, Cognitive maps.

1. INTRODUCTION

M-commerce has been defined as the use of wireless technology, particularly handheld mobile devices and mobile internet, to facilitate transaction, information search and user task performance in consumer, business-to-business, and intra-enterprises communications [2]. This definition shows that Mobile terminals potential are improving beyond the first value, the mobility. Services such us SMS, MMS, games, logos, Location based Services, Music, Mobile office, or e-mail are adding value in final user's daily life.

Mobile industry lives in a dynamic scenario. In the changing environment of mobile technology, most users are not aware of their needs related to technological advances. Their desires and behaviour are constantly directed by operators and content providers. Mobile operators have "…always taken every opportunity to promote the relative advantages…"[3] of their products and services. But the promotion of relative advantages is not enough. "The availability of complementary applications is equally important"[3]. This statement refers to content providers actions.

These two agents own the knowledge of the technology and the market. Their perspective is global about new services offered, about response rate and users´ profiles. Industry providers´ strategies have direct effects on user behaviour through marketing variables: Publicity, Price, Promotion and Product. It means that operators and content providers influence not only classical TAM factors (such as perceived usefulness, perceived easy of use and behaviour intention) but also variables from extended models such as image [4,5], perceived enjoyment [6,7,8,9] or external influence [4,10], among others.

In this sense, it is important to deepen expert opinions to review factors proposed by TAM and to discover new significant variables agreed by the suppliers. It will show up if there is a lack between both models offering a complete perspective of m-commerce adoption.

2. LITERATURE STUDY

Information and Communication Technologies (ICT) adoption has been studied from two main approaches. The first approach focuses on *adoption* from final user perspective. The second approach, focused on *diffusion*, stress characteristics of technology.

From an adoption perspective, Davis proposed Technology Acceptance Model (TAM) based on Theory of Reasoned Action (TRA) of Fishbein and Ajzen. [11]. Since then, TAM has received a great amount of attention. More than 150 relevant articles have been published in the last two decades. Several meta-analysis have made a review of them [12,13,14]. As a result of the general agreement of TAM in information system research community, we decide to contrast this theory in the specific context of Mobile Commerce.

To improve the explanatory power of original TAM, variables from other theories related have been combined in different studies without significant advances in its configuration. Table 1 shows principal theories applied to Mobile Commerce adoption and factors considered from each theory.

Table 1 Theories applied to Mobile Commerce Adoption and relevant variables.

Theory	Author	Year	Variables
Theory of reasoned action (TRA)	Fishbein and Ajzen [11]	1980	Attitude toward behaviour Subjective norm Behaviour Intention
Innovation Difussion Theory (IDT)	Rogers [15]	1983	Relative advantage Complexity Compatibility Trial ability Observables
Theory of planned behaviour (TPB)	Ajzen [16]	1985	Attitude toward behaviour Subjective norm Perceived behavioral control Behaviour Intention
Technology Acceptance Model (TAM)	Davis [1]	1989	Perceived usefulness Perceived easy of use Attitude Behaviour Intention

To analyse literature about user adoption of technology in Mobile Commerce, a general search of relevant articles until 2008 in ISI Journal Citation Reports was made. As keywords (TAM or Technology Acceptance Model) AND (Mobile or WAP) AND Adoption. All databases including in the following categories: Computer Science and Information Systems, Computer Science interdisciplinary applications, Telecommunications, Business, Computer Science, Software Engineering, computer Science, artificial Intelligence, Management, Operations Research & Management Science, Engineering Industrial and Information Science & Library Science. Three articles were not pertinent for this study. Analysing references, four significant articles from journals with blind revision were added. Appendix 1 shows the results.

Table 2. Variables´ frequency in previous studies.

Category	Variables	Frequency	Definition	Article
TAM	Perceived easy of use	12	The extent to which a person believes that using a particular application would be free of effort	[1]
TAM	Perceived usefulness	11	The extent to which a person believes that using a particular application would enhance his or her job performance	[1]
TAM	Behaviour Intention to Use	7	The user´s likelihood to engage in online transactions via Mobile Commerce	[1]
VAL	Perceived enjoyment	7	The extent to which the activity is perceived to be enjoyable, apart from any performance consequences.	[17]
EI	Subjective Norms/ Socialnfluence/Significant others	9	Person's perception that most people who are important to him think he should or should not perform the behavior in question	[18]
TPB	Attitude	6	No definition found	
VAL	Cost (or prize)	5	The possible expenses of using	[19]

			Mobile Commerce, i.e., equipments cost, access cost, and transaction fees	
VAL	Compatibiliy	4	The degree to which engaging in online transactions via Mobile Commerce is perceived as being consistent with the existing values, needs, and past experiences of potential adopters.	[20]
PC	Gender	4	Not necessary	
VAL	Image	4	The degree to which use of an innovation is perceived to enhance one's image or status in one's social system.	[18]
PC	Age	3	Not necessary	
TEC	Facilitating conditions	3	The extent and type of support provided to individuals that influence their use of the technology.	[21]
B	Perceived attractiveness	3	The extent to which the activity arouse interest or engage user's thought and consideration.	[7]
PC	Innovativeness	2	An individual trait reflecting a willingness to try out any new technology	[22]
TC	Perceived risk	2	The user´s subjective expectation of suffering a loss in pursuit of the desired outcome of using Mobile Commerce	[23]
PC	Prior experience	2	The quality of having used MC in past	Adapted definition
VAL	Relative advantage	2	The degree to which an innovation is perceived as being better than its precursor	[15,24]
PC	Self Efficacy	2	The belief that one has the capability to perform a particular behavior.	[25]
TC	Trust	2	Related to trustworthiness of the wirelss mobile environment. Absent of risk.	No definition
VAL	Value	2	Quality or performance. Consumer´s overall assessment o the utility of a product (or service) based on perceptions of what is received and what is given	[26]

Table 2 shows the 20 most important factors considered to explain Mobile Commerce adoption. These factors could be grouped in five categories TAM variables, Value Perceptions (VAL), Personal Characteristics (PC), External Influence (EI) and Technical Conditions (TC).

The hights frecuency of appearance in previous studies is the category **TAM variables**. It includes Perceived easy of use, Perceived usefulness and Behaviour Intention to use.

Value category is the second category in order of cumulative frecuency, very close to TAM variables. It is related to the idea of quality or performance. Value is defined as "consumer´s overall assessment of

the utility of a product or service based on perceptions of what is received and what is given" [26]. This group includes variables that express expected benefits: perceived attractiveness, perceived enjoyment, relative advantage, compatibility, image and value. It is interesting to realize as sensations seems to be important for TAM to predict behaviour intention to use. The reason is that TAM is based on users feed back, which is formed by personal experiences. It is what a group of variables preceded by "Perceived" reveal. The only variable expressing sacrifice to conform value is cost, also named price. This factor is one of the most important key for MC growth.

Personal Characteristics such as Innovativeness, Self efficacy, Prior experience, Gender or Age also affect final users´ adoption. They are usually presented as moderating variables. Variables from this category are presented half as times as Value or TAM variables categories.

The fourth category, very close to Personal Characteristics, is **External influence.** It reflects that different agents influence technology adoption decision. Include different terms as subjective norms, social influence or significant others. Describe "person´s perception that most people who are important to him think he should or should not perform the behavior in question"[18].

Facilitating conditions and Perceived risk (trust in other studies) could have been included in Value category considering risk as a sacrifice and Facilitation conditions as part of the perceived utility. However, because of the object, the **Technical conditions** category contains variables which are necessary, in some cases determinant, to adopt MC technology. This category is less usual than Personal Characteristics and External Influence.

Attitude, from Theory of reasoned action (TRA) and Theory of Planned Behabiour (TPB), is a single which frecuency is similar to technical conditions.

3. METHODOLOGY

1. *Analysing previous studies to improve design.*

In order to design the methodology, we analysed previous literature designs. As appendix 1 shows, all the studies were based on user feed back, and most of the subjects were students. Relating to methodology, all but two techniques applied were quantitative as shows Table 3. The most recurring method is SEM and factor analysis which is used to be associated with regression.

Table 3 . Methodology frequency

Article methodology	Frequency
Quantitative	**19**
SEM	8
Factor analysis	6
Regression	5
Qualitative	**2**
Conjoint analyses	1
Groups interviews	1

Most TAM´s projects repeat the same limitations. The intention is to avoid recurrent limitations and overcome weakness with the design of a new study. We try "to think out of the box." The three most common limitations of TAM collected in meta-analysis researches [14] are the following: limitation one is "self reported used" as indicator instead of "actual use". The user perception is not completely reliable as it is a subjective data. Real use should be the correct variable for the model. The second limitation is "the use of student subjects for convenience reasons." This point deteriorates generalizability of the findings. In fact, "76% of the research subjects of TAM were students whose average age was 20 […] 20% workers of about 30 early years old." That also implies a university enviroment. It does not let extrapolate the results of TAM. The third limitation is that TAM´ projets are focused on quantitative studies. In fact "only 3 of 101 were qualitative".

To overcome these three limitations, we propose changes in the research design. To avoid limitation one, the research is based on technology provider information. Operator and content provider managers are asked to explain technology adoption model from their privileged position. To overcome second limitation, their expert opinion is asked without any reference to students use, but general use. For third limitation we propose qualitative analysis to improve the comprehension of technology adoption. Qualitative analysis brings the opportunity to explore new factors, to comprehend reality and to review classical TAM afterwards.

Table 4. Limitations to avoid in research design

Limitation	Description	Solution
Limitation 1	Self reported use instead of actual use	Supply perspective.
Limitation 2	Use of student subjects	
Limitation 3	Quantitative studies	Qualitative perspective.

The qualitative perspective is introduced by the use of cognitive maps techniques. A cognitive map is the representation of an individual or group thinking about a problem at a point of time [27,28]. This technique is originally based in the Personal Construct Theory [29,30] that argues that the person's processes are psychologically channelized by the ways in which he anticipates events.

The methodology is derived through interviews and it represents the subjective world of the interviewee using arrows and words diagrams. It is consider a powerful way to show up the reasons that explain a behavior or a way of thinking, Some authors suggest that people do not know what they think until they hear what they say is particularly relevant to the construct. Moreover, the cognitive maps per se acts as a device for establish a compressive understanding of the issue [31,32].

This study uses cognitive maps to represent mobile technology suppliers and content provider managers way of thinking in terms of adoption. The map will show what industry think is the key to MC success by answering the question "Why do you think people use Mobile Commerce.?" The answer to this question is based on objective data about sales, market response and information about user´s profiles. Moreover, the interviews will contrast the definition of the variables given in the literature with the

definitions given by the providers to contribute to construct validity. Using this technique we will be able to compare TAM variables with the reasons given by the mobile industry experts.

There are others studies that explore mental maps of managers in firms operating in dynamics environment [33,34]. They suggest that the cognitive models of these managers must take into account significant new areas of opportunities or technological development, if they want to stay ahead.

2. *The research process.*

Special software to draw the cognitive map has been used in this work. It is Decision Explorer Software [35] developed by Banxia Software Limited. This software is used as a tool to facilitate data collection, produce and record ideas in addition to structure an analyze data. Concepts and ideas represented in short phrases are linked with arrows to express relationships between them as a mental map.

Sheetz et al [36] are critics with this software. They argue that the researcher bias can be introduced by the active participation in interview and adding concepts. In order to avoid this circumstance and reinforce the internal validation of the research we follow a complementary elicitation process suggested in other studies [37]. Moreover, not only one interviewer took place along the research process. The elicitation process was as follows: The first interviewer contacted with operator and content provider top managers. They were informed about the subject of the first interviews, how they would be driven and the specific question to answer so that they could think about it before the interview. Following, the two interviews took place separately. As result, two different cognitive maps were developed (Figure 1 and 2) with the minimum participation of interviewer and from an initial question: "Why people use Mobile Commerce.?" Later, each map was revised by each manager in two independent second sessions. The purpose was to verify the validity of the map, facilitate the discussion and avoid mistakes of interpretation. To reinforce construct validity and the posterior contrast with TAM, interviewed were asked to explain all factors appearing in each map.

Finally, a third interview took place with both top managers and a new interviewer to avoid subjective bias introduced by the first one, improving again internal validity. In this session interviewed were asked to agree factors that influence mobile commerce adoption. As a result Figure 3 shows the map of factors that experts consider influence in the adoption of MC. This interview was supervised by a high consultant of the industry as a method to ensure reliability. According with this third participant no more factors should be included, which is an indication of consistency. Again, interviewed were asked to explain all factors of the final map to compare with variables collected in the literature review. Results were the following:

4. RESULTS AND DISCUSION

4.1. Mapping content provider´s information

From the standpoint of content provider (Figure 1), consumers decide to adopt MC basically because of four key issues: needs of communication, needs of information, as a form of entertainment and as a method of social differentiation. These goals form usefulness concept in MC. The usefulness of the

information or entertainment depends on the availability of new and attractive contents. Communication is influenced by the new forms of communication that satisfy consumer expectations. From his own experience, the president declared Social diferenciation or image as one of the most important factors nowadays. He told the interviewer there is a typical consumer profile in this business who is willing to be the first to have the last content just to boast about it with friends or people in his/her work. In fact, data shows a great amount of dowloads and access on Fridays that are explained by this consumer behaviour, just to share with friends during the weekend. This behaviour is increasing each time. He recognized the great influence of advertising on the needs of social differentiation of potential consumers. The president pointed ease of use as a precedent of usefulness, which is given by telephone features and design. Easy of use is a classical variable that affect diffusion of any innovation, as can be an obstacle to consumer adoption. Adding network capabilities, expert showed a necessary condition, which was called Technology Capabilities. He pointed out "price and *technophobia* are issues almost overtaken."

Figure 1: Content Provider´s Cognitive Map
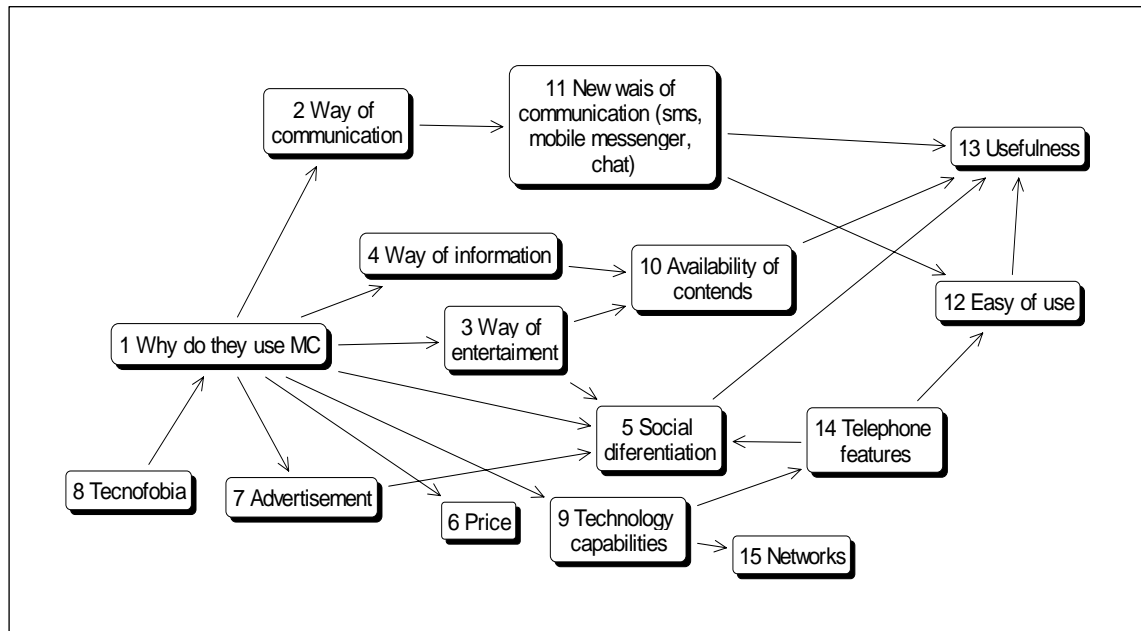
4.2. Mapping international mobile telecommunications company´s information

The top manager of the mobile telecommunication company clearly distinguished two types of needs: basic needs and requirements "not so basic". He considered basic needs: communication, information, the sense of security, and the need to "be available". He recognized as "not so basic" needs, which he called "utilities", image and entertainment. The creation of Image as a need is a goal for the industry. Using large amounts of advertising, customers start thinking the image they project to the society depends on the telephone they have and the innovativeness of the service they use: "Advertisement in this business is completely necessary. New tecnological products must be presented as needs for the consumers. Our enviroment is always changing. Our customers do not now what they need until we show them. Of course we investigate very much by focus groups and deep interviews, but finally, I recognize we hardly direct customer decisions. That is a fact." So, design and aesthetics of the

telephones are also focused in social differenciation direction. Finally, he pointed out that personal characteristics are basic to predict adoption, as the MC has a higher rate of success in young and middle-age men with active professional or personal lifestyle. Price, as with any product, is a basic factor. However, in the case of mobile telephony this factor is already overcome because of current tariffs costumers.

Figure 2: Mobile telecommunications company´s Cognitive Map
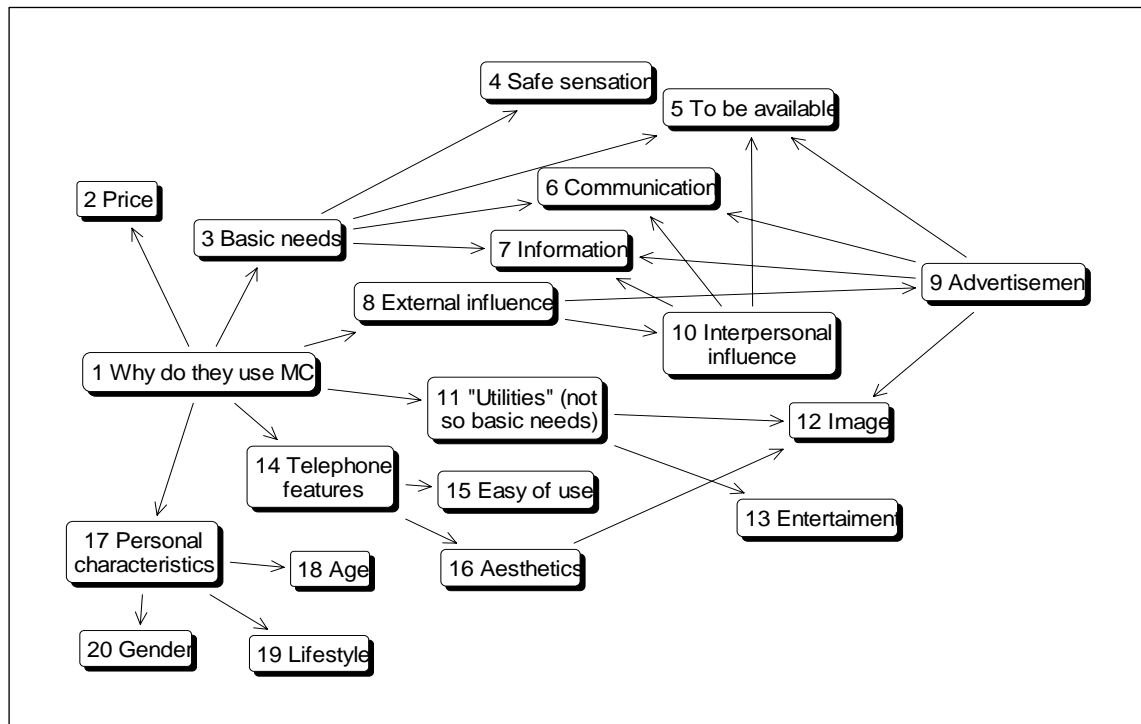
4.3. Mapping agreed information

Finally, in a common interview, both president and top manager agreed on the factors that influence the acceptance of MC (Figure 3). First, **usefulness** is manifested as the user acceptance factor that encompasses the needs of communication, information needs, and entertainment needs. A successful MC service is based on utility, which deeply depends on the availability of constant new and attractive contents for entertaiment and information.

Ease of use is a key factor that impact usefulness. Fluent navegation through intuitive telephone designs and applications get the consumer percepcion that using the service would be free of effort.

Social differentiation, also named "image", is definitively established as an essential factor. Nowadays, this innovation is perceived to enhance consumer´s status in his/her social system. That is why social differentiation becomes a relevant factor that affects final user's adoption. Image is influenced by the result of advertising and interpersonal influences such as family, friends or professional environment. Advertisement is the most powerful tool for telephone operator and content

providers to guide consumer's needs. In fact, MC is been byitself a new vehicle for marketing one to one and it is expected to be the near future of advertisement.

External influences also affect MC adoption directly, without social differenciation participation.

Lastly both executives agreed that, according with data, **personal characteristics** objectively influence on the use of mobile telephone services, highlighting age, lifestyle and gender. Experts ratified most of the users are men, middle age and active people, although the trend is recently changing and so the contents are changing too.

Price has always been considered a barrier to adoption, but nowadays experts declare it is completely overcome because of generalization of low rates.

Figure 3: Agreed Mobile Commerce Adoption Cognitive Map
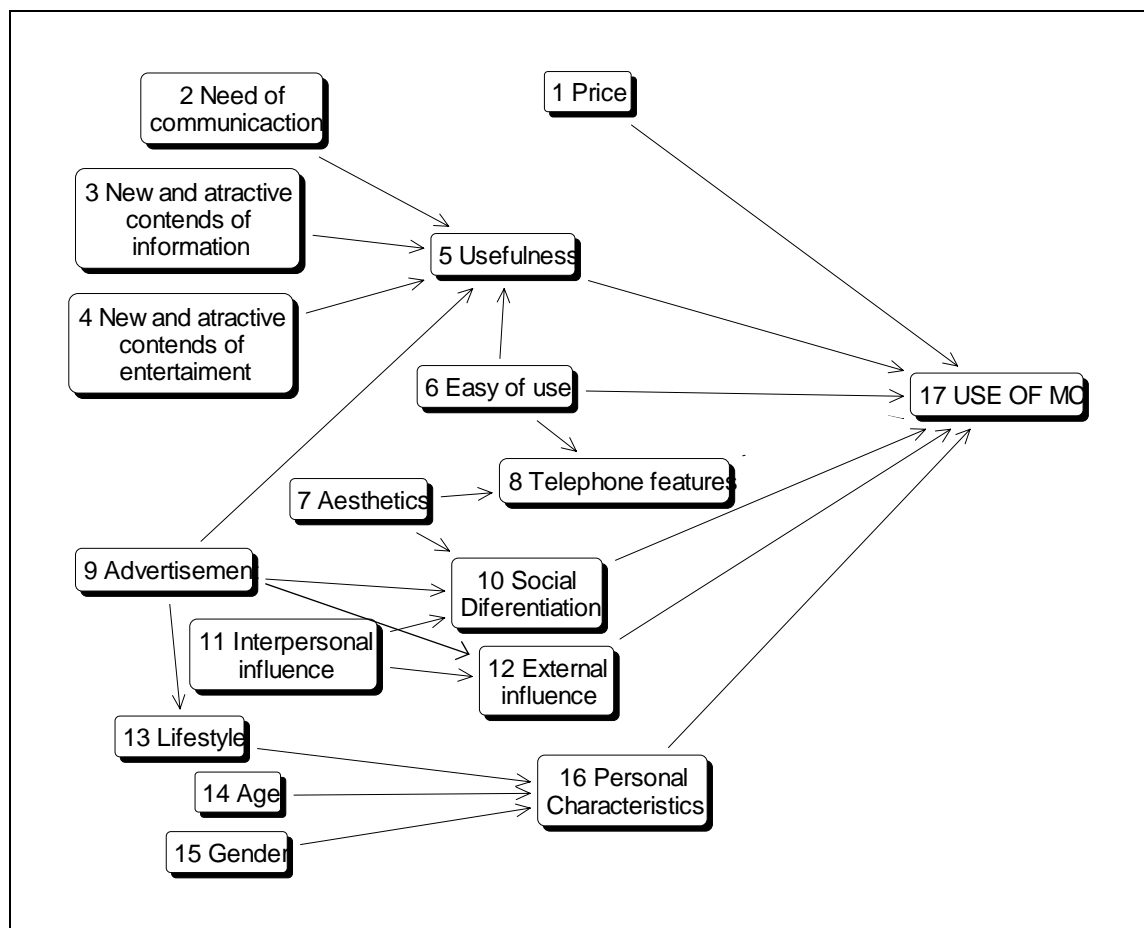
4.4. Comparing mapping results with previous studies categories

Table 2 showed variables that previous relevant articles demonstrated that affect MC adoption. These variables come from studies based on "self reported used". Comparing the results from those studies with expert maps, we find coincidences and new findings:

TAM Variables are present in industry map in terms of Easy of Use and Usefulness. It means TAM is able to explain MC Adoption nowadays, though TAM variables are not enough to understand the phenomenon completely.

Personal Characteristics is a prominent category in the cognitive map. Age, gender and lifestyle are stressed as one of the most important factors to predict MC adoption. In previous studies, other personal characteristics make appearance: innovativeness, self efficacy and prior experience. In this sense, innovativeness was argued by managers as part of a new lifestyle: "Technology is always in the heart of what we do, depending of how we are" Content provider also signed that typical profile of customer who is aware of new technical products or contents just to share with people who are important to him/her.

External Influence is a wide category in which previous studies include everytype of influence: subjective norms, interpersonal influence and social influence. Advertisement had not been reflected before as a factor that affects adoption. However, our three experts positively agreed advertisement as esential. As previous studies reflected user perceptions data, we may wonder if user´s are not concious about this fact, or if industry providers are wrong about the effectiveness of advertisement.

Technical Conditions category included trust and facilitating conditions in prior studies. Expert map reflects this category reducing it to telephone capabilities. In content provider´s map, he pointed out a factor called network which covered telephone features, safety and speed of the network. However, this factor was not agreed in the final interview. Experts did not emphasize the importance of it. During the last meeting, they argued that when a potential user, active in her/his lifestyle, with needs of information, communication or entertaiment, find the way to use MC (referring to technical capability), trust or risk are in a second place.

Value is defined as any utility of MC service and the necessary sacrifice. Though expert have not used this concept as a well-defined construct, quality, usefulness and user expectations have been named during all the interviews. If we had wished to construct Value as a concept, in the part of benefits industry providers would have include needs of communication, information, entertaiment or social diferentation. Meanwhile, previous studies would have also included perceived attractiveness, relative advantage, image or value. In the part of possible expenses of using MC, price or cost are recurrent in previous studies. Experts consider price is a passed factor, though they have decided to show it in the map because of latest adopters.

Attitude is not present in industry mental map though in previous studies does.

5. CONCLUSIONS

The research questions we asked were: Which are the factors that affect MC adoption from the point of view of the industry providers? And are they coincident with the factors given by TAM literature?

To answer these questions we have planned a research analysing classical TAM´s studies designs and their limitations. To avoid bias from final user´s perceptions derived from student subjects in most of the prior studies, we have asked three experts whose opinions and global visions are based on objective data. The position of these three managers, validated by the methodology used, let comprehend the global situation of the business. They have access to data of consumption, marketing strategies, customer profiles, marketing research and trends in I+D. The general consensus between them since the first interviews and the consideration of TAM and previous studies variables without interviewer participation, make possible to think of internal validity. To contribute to it, we have performed several techniques: iteration of interviews, iteration of interviewers, separate meetings, no influence in responses by interviewers, information to interviewed about the theme in advance, and confirmation of the maps. Validity in terms of construct validity has been considered as experts have been asked to define their own concepts. Those definitions have been contrasted with concepts from previous relevant studies and confirmed or slightly modified by expert. We can not guarantee external validity for the moment. This qualitative study has been design to understand factors that affect consumer adoption from supplier perspective. Although top manager consulted have relevant positions and belong to two international firms that operate in all over the world, we would like to conclude in future researches if there is an international pattern for MC adoption, or if this patterns act in a local way.

To the first research question: Which are the factors that affect MC adoption from the point of view of the industry providers? Final map shows basically six main factors that affect MC adoption from industry provider´s point of view: Price, Usefulnes, Easy of Use, Social Diferenciation, External Influence and Personal Characteristics.

To the second research question: Are they coincident with the factors given by TAM literature? As the results show, industry completely agrees in two main concepts: easy of use and usefulness. Global knowledge based on real data and priviledged position let industry providers managers cover not only reasons proceeding of TAM, but also great part of the factors reflected by user perceptions from previuos relevant studies, and their own point of view as suppliers.

The most important findings of this research are:

1. The discovery of **social differentiation** (or image) as a key factor for success in the adoption of MC. Although this factor had not emerged so far as critical factor for success, the experts place him without any doubt among the main factors explaining the use of MC. It will be interesting to consider what items make up the concept image, in order to influence him and cause greater acceptance.

2. The need for information and the need for entertainment are not enough to explain the adoption of this technology. Customers are extremelly demanding. **The importance of attractive and renewal content** of information and entertainment as a key element in customer satisfaction in MC. So that these needs become success factors, the contents must be continually renewed and attractive.

3. We have pointed out **which personal characteristics** are essential to predict the acceptance of the MC. It will be unavoidable to study the influence of these variables in each type of need that covers MC: information, communication, entertainment and even social differencition. Moreover, women are beginning to join the profiles of users of advanced mobile phone market. Not only in communication but also in entertainment and information. It is therefore necessary to explore their interests and their behavior for the development of new contents. This segment represents a significant market share. The authors have already started an investigation with these objectives.

4. The offer argues that **advertising** is an effective weapon to influence this type of consumers. Advertisement is able to consolidate needs and create new ones depending on the development of technology. It is necessary to study the impact of such a variable in the rest of the variables of the model to improve the design of advertising strategies.

6. IMPLICATIONS

This study contributes **TAM** and **Mobile Commerce** in three ways: support TAM results, face the expert opinion to final user's point of view giving a new perspective, and provides evidences to better understand success factors for Mobile Commerce adoption.

The above findings have significant implications for researches and practitioners. In the literature review, we have recopilated 20 concepts related to mobile commerce adoption with their definitions. In this list, researches can find a guide to consider and construct concepts previously tested. Concepts collected in the analysis of literature are of special significance because it gathers what users perceive as reasons for adopting Mobile Commerce. Also, the industry provider perspective has added value to adoption issue. Experts have showed new factors. Social differenciation has been positively revealed as the key to MC success. We think this statement should be seriously considered in future studies. External influence is a too wide variable whose importance should be studied. This methodology can be applied to other fields related to technology where asimetric information exists. **For practitioners**, this model can help determine potential adoption of new services. A complete vision of adoption will facilitate marketing strategies and will increase the posibilities of mobile marketing, which is shown as the future of marketing one to one.

7. REFERENCES

[1] F. D. Davis, Perceived usefulness, Perceived Ease of Use, and User Acceptance of Information Technology, MIS Quaterly, September 1989, pp.319-339.

[2] S.S. Chan, X. Fang, J. Brzexinski, Y. Zhou, S.Xu, J. Lam, Usability for Mobile Commerce across multiple form factors, Journal of Electronic Commerce Research, vol 3,2, 2002.

[3] T.S.H. Teo, S.H. Pok Adoption of WAP-enabled mobile phones among Internet users, Omega vol. 31, (2003), pp.483-498.

[4] A.L. Gilbert, H. Han, Understanding mobile data services adoption:demography, attitudes or needs? Technological Forecasting & Social change, vol.72, (2005), pp.   327-337.

[5] C.L. Hsu, H.H. Hsu, H.P. Lu, Adoption of the mobile Internet: An empirical study of multimedia message service (MMS), Omega, vol. 35, (2007), 715-726.

[6] Gordon H., Brumer, A. Kumar, Explaining consumer acceptance of handheld internet devices, Journal of Business Research, 58 (2005), pp.553-558.

[7] I. Ha, Y. Yoon, Determinants of adoption of mobile games under mobile broadband wireless access enviroment, Information & Management vol. 44 (2007), 276-286.

[8] H. Thorbjornsen, H. Nysveen, P.E. Perdersen, Intentions to use mobile services: antecedents and cross-service comparisons, Journal of the academy of marketing science, vol.33, (2005), pp.330-346.

[9] D. Cyr, M. Head, A. Ivanov, Design aesthetics leading to m-loyalty in mobile commerce, Information & Management, vol. 43 2006, pp. 950-963.

[10] P.E. Pedersen, Adoption of Mobile Internet Services: An Exploratory Study of Mobile Commerce Early Adopters, Journal of organizational computing and electronic commerce 15(2), 2005, pp. 203–222.

[11]I. Ajzen, M. Fishbein, (1980). *Understanding attitudes and predicting social behavior*. Englewood Cliffs, NJ: Prentice-Hall.

[12]W.R. King, J. He, A meta-analysis of the technology acceptance model, Information & Management,43, (6) 2006, pp. 740-755.

[13]Jeroen Shepers, Martin Wetzels, A meta-analysis of the technology acceptance model: Investigating subjective norm and moderation effects, Information & Management, 44 (2007) pp. 90-103.

[14] Y. Lee, K.A. Kozar, K.R.T. Larsen, "The technology acceptance model: past, present, and future", *Communications of the AIS*, Vol. 12 No.50, (2003) pp.752-780.

[15]E.M. Rogers, The Diffusion of Innovation (third ed.), Free Press, New York (1983)

[16]Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. In J. Kuhl & J. Beckman (Eds.), *Action-control: From cognition to behavior* (pp. 11-39). Heidelberg: Springer.

[17] G. Heijden, Factors influencing the usage of website: the case of generic portal in the Netherlands, Information & Management 40 (6), 2003, pp.541-549

[18] Venkatesh, V., and F.D. Davis (2000) "A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Field Studies" *Management Science* 46(2), pp. 186-204

[19] J.H. Wu, S.C. Wang, What drives mobile commerce? An empirical evaluation of the revised techonolgy acceptance model, *Information & Managemen,* vol .42 (2004)pp.719-729

[20] Xia, W., and G. Lee (2000) "The Influence of Persuasion, Training and Experience on User Perceptions and Acceptance of IT Innovation" Proceedings of the 21st International Conference on Information Systems, pp. 371-384.

[21] June Lu, Facilitating conditions, wireless trust and adoption intention, *Journal of Computer Information Systems* 46(2005) pp.17-24.

[22] Agarwal, R., and E. Karahanna (2000) "Time Flies When you're Having Fun Cognitive Absorption and Beliefs about Information Technology Usage" *MIS Quarterly* 24(4), pp.665-694

[23] P.A. Pavlou, Integrating trust in electronic commerce with the TAM:model development and validation, Proceedings of the Seventh Americas Conference on Information Systems, 2001, pp. 816-822

[24] Moore, G.C., and I. Benbasat (1991) "Development of an Instrument to Measure the Perceptions of Adopting an Information Technology Innovation" *Information Systems Research* 2(3), pp.192-222.

[25] Venkatesh, V., and C. Speier (2000) "Creating an Effective Training Environment for Enhancing Telework" *International Journal of Human Computer Studies* 52(6), pp. 991-1005.

[26]V.A. Zeithaml, Consumer perceptions of price, quality and value:a means-end model and synthesis of evidence, *Journal of Marketing* 52 (3), 1988, pp.2-22.

[27[C. Eden. Analyzing cognitive maps to help structure issues or problems. European Journal of Operational Research. Vol. 159. pp 673-686. (2004)

[28]. K. LAngfield-Smith, A. Wirth. Measuring differences between cognitives maps. *The Journal of the Operational Research Society*. Vol. 43. N. 12. pp 1135-1150.

[29] G. Kelly. The Psychology of of personal Construct . Norton and Company, New York. 1955

[30] G. Kelly. A brief introduction to Personal Construct Theory. *Academic Press*, London.

[31] C. Eden. Cognitive Mapping and Problem Structuring for System Dynamics Model *Building System Dynamics Review* Vol 10, pp 257-276. 1994

[32] C. Eden and D. Sims. On the nature of problems in consulting practice. *Omega* 7, 119-127.

[33] P.S. Barr, J.L. Stimpert, and A.S. Huff. Cognitive change, strategic action, and organizational renewal . *Strategic Management Journal*. Vol 15.pp. 15-36. 1992

[34] C.K. Prahalad, and R.A. Bettis. The dominant logic: a new linkage between diversity and performance, *Strategic Management Journal.* Vol 7 pp 485-501 1986

[35] Decision Explorer, An Introduction to Decision Explorer, Banxia Software LTD 2002.

[36] S.D. Sheetz, D.P. Tegarden, K.A. Kozar, I. Yigurs. A group support systems approach to cognitive mapping. Journal of Management Information System. Vol 7. pp. 31-57.

[37] S:M. Brown. Cognitive Mapping and Repertory Grids for Qualitative Survey Research: Some Comparative Observations. Journal of Management Studies Vol 29:3. pp. 287-307. 1992

Appendix 1. Articles published related to technology acceptance and mobile commerce from the perspective of adoption.

Title	Methodology	Subjects	Article_journal	Year
An empirical investigation of mobile ticketing sevice adoption in public transportation	Factor analysis, regression	others	Personal and ubiquitous computing	2008
Determinants of adoption of mobile games under mobile broadband wireless access enviroment	Sem	Students	Information & Management	2007
Value-based adoption of mobile internet:an empirical investigation	Factor analysis, multiple regression	Students-practitioners	Decision Support Systems	2007
User acceptance of wireless short messaging services: constructing perceived value	Sem	Students	Information & Management	2007
Adoption of the mobile Internet: An empirical study of multimedia message service (MMS)	Factor análisis. ANOVA	Internet users	Omega	2007
Design aesthetics leading to m-loyalty in mobile commerce	Sem	others	Information & Management	2006
Moderating Effects of Task Type on Wireless Technology Acceptance	Factor analysis and Regression Analysis	Students-practitioners	Journal of Management Information Systems	2006
Explaining consumer acceptance of handheld internet devices	Sem	Students	Journal of Business Research	2005
Adoption of Mobile Internet Services: An Exploratory Study of Mobile Commerce Early Adopters	Factor analysis	internet users	Journal of organizational computing and electronic commerce	2005
Exploring factors affecting the adoption of mobile commerce in Singapore	Multiple regression	Students	Telematics and Informatics	2005
Understanding mobile data services adoption: demography, attitudes or needs?	Factor analysis	Students and postgraduated	Technological Forecasting & Social change	2005
Facilitating conditions, wireless trust and adoption intention	Sem	Students-practitioners	Journal of Computer Information Systems	2005
Intentions to use mobile services: antecedents and cross-service comparisons	Sem	students and internet users	Journal of the academy of marketing science	2005
Determinants of adoption of third generation mobile multimedia services	Group interviews,Conjoint analysis,SEM	Users of third generation mobile	Journal of interactive marketing	2004
What drives mobile commerce? An empirical evaluation of the revised techonolgy acceptance model	Sem	Students-practitioners	Information & Management	2004
Adoption of WAP-enabled mobile phones among Internet users	Sem	others	Omega	2003
A test ot the Technology Acceptance Model	Multiple regressions and path analyses	ns/nc (subscriber list of a service provider)	Hawaii International Conference on System Sciences	2000