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Article

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Data Mining Association Rules of ICT's Adoption Factors by Greek Accountants

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Abstract
The purpose of this paper is to identify important adoption factors of emerging accounting technologies such as cloud based Accounting Information Systems (CbAIS) by Greek Accountants. Further, using association rule mining (ARM) techniques we evaluate the accountant's satisfaction regarding the accounting information systems (AIS) that they currently use as well as their understanding and view of new accounting technologies such as cloud based ERP. The results of our analysis indicate that Greek accountants utilize extensively information technologies (IT) in their day to day operations. It is apparent that the main concern regarding traditional computerized AIS is the cost, mainly hardware, software and maintenance cost. On the other hand cost reduction and simpler cost structures are some of the most profound benefits of CbAIS. Therefore, one may expect to identify an intense interest among the Greeks accountants to implement and integrate cloud computing technologies in their day to day work. However, the results of our research reveal a gap in the adoption of such technologies by Greek accountants. Using ARM we identify the most important factors who are hindering the implementation of CbAIS. The implications of this work are important for accounting software developers, the Greek accounting profession, the users of accounting information and government regulatory bodies.

Keywords: Association Rule Mining, Computerized Accounting Information System, Cloud Computing, Information and Communication Technologies.

JEL classifications: M15, M40, O30

Introduction

The main functions of an Accounting Information System (AIS), which is part of the more general corporate information system, are to collect and process financial and non-financial transactions and events in order to create valuable information to internal and external users of the system (Stefanou 2006; Hall 2012). Therefore, the primary purpose of an AIS is to transform raw data (transactions) to valuable information. The main elements of the AIS toward the creation of valuable information are, among others, accuracy; speed; consistency, relevance and completeness. In order to meet this basic objectives, accountants rely heavily on computerized systems transforming in this way the traditional AIS to Computerized Accounting Information System (CAIS), which is based on appropriate Information and communication Technologies (ICT), that is procedures, hardware, software, databases, networking and internet technologies.

In a holistic view, nowadays, the high competition and the volatile financial environment has forced many businesses to adopt and use information systems and technologies (Moorthy et al. 2012; Dillard 2008; Emmanouilidis & Economides 2010). The adoption and proper use of information systems resulted to noteworthy amelioration which helped these companies to improve their overall quality, performance and productivity. Information and communication technologies (ICTs) have great promise to reduce poverty, increase productivity, boost economic growth, and improve accountability and governance (The World Bank 2012). The key drivers for ICT diffusion to the economy are innovation, productivity and energy-saving (OECD 2012). Many studies reports the importance of ICT in productivity (Kretschmer 2012; Arvanitis & Loukis 2009; Strobel 2012; Dimelis & Papaioannou 2010), in innovation (Sapprasert 2007; Hempell 2005), in organizational performance (Gargallo-castel & Galve-Gorriz 2007), in the productivity and profitability of the service sector (Vu 2011; Hempell 2005), in accountability, both in the public and private sectors of the economy (Lindkvist & Llewellyn 2003; Weitzner et al. 2008; Stahl 2007; Nissenbaum 1994)

Recent Trends Towards Future Accounting Information Systems

In this work we attempt to identify the factors affecting the acceptance and utilization of three advanced technological approaches that may change the future of accounting. In particular, we are interested in exploring the view of Greek accountants about ERP, FOSS and Cloud Computing.

Enterprise Resource Planning (ERP)

According to Wieder et al, the emergence of ERP systems enabled companies to integrate three critical, for its performance, sectors: data, hardware/software and information (Wieder et al. 2006). On the other hand, information integration provides interchange of information between different departments. This has transformed the accountants into business consultants and system supporters which have put a lot of pressure on their new perception for work (Rom & Rohde 2007). Moreover, timely information facilitates decision making process, planning and controlling within an organisation making it more effective, (Lea et al. 2005). The incentives and the means for adopting new accounting practices like activity-based budgeting (ABB), product lifecycle costing (PLC) and balanced scorecards (Booth et al. 2000). Regarding Greece, Spathis in 2006 examined 73 companies and found empirical evidence which confirm the existence of a number of benefits derived from the implementation of ERP and focus on the following dimensions: organisation, operations, management and IT infrastructure. These benefits are related both to the reasons leading to the implementation of ERP and to the relevant selection of ERP modules. He also concluded that accountants nowadays must have sufficient IT understanding to preserve their position in a continuously changing work environment and therefore they should be alerted to update their methods and practices regarding these new systems, (Spathis 2006).

In a survey on twenty-six (26) Greek companies, Spathis and Constantinides, suggested that the adoption of ERP systems is driven by the needs of the increasing competitive environment in order to survive and succeed, (Spathis & Constantinides 2004). This further confirms that ERP systems are continuously becoming a necessary tool for firms to remain competitive in this new business environment. However, the implementation of these new systems had, many times, met obstacles by the employees who did not accept to change and by the employers who were dubious about making the investment because of its substantial cost, (Siriginidi 2000). However, the satisfaction of the ERP systems is increased after the implementation stage. For example, in another survey, Spathis and Ananiadis discovered that a year after the implementation of a new ERP system in a university,

users' satisfaction is higher compared to the expected from the pre-implementation period, (Spathis & Ananiadis 2005).

Free and open source software (FOSS)
An open-source program means that the source code of the program is freely available therefore it can be used, altered, improved, extended and redistributed by anyone. As a relatively new development in the information systems field, FOSS, has risen in popularity as it is regarded as the solution to the aforementioned problems (Goode 2005). Today open source software (OSS) represents a complex and radically new phenomenon that creates a lot of confusion and conflicting claims in the public discourse (Marsan et al. 2012). There is limited understanding about several features of OSS and their impact on its adoption and diffusion at the business level (Zaffar et al. 2011). On the other hand, a significant body of research indicate that the diffusion of the OSS depends on interoperability costs, support costs and duration of PS upgrade cycle. Moreover, there are interaction effects between network topology, network density and interoperability costs, which strongly affect the diffusion of OSS (Zaffar et al. 2011). Research indicates that IT specialists who are associated with firms that urge the adoption of OSS are positively disposed to the use of OSS (Marsan et al. 2012).
Organisations expect to perceive value from their hardware and software and thus are prepared to pay substantial purchase and support costs to gain efficiency and effectiveness benefits despite the difficulty of quantifying those benefits (Blair 1985; Goode 2005).

Cloud computing (CC)
The term cloud computing describes the organization of a computer network model that have the potential to meet real-time user needs for storage, computer power, and applications.
In our work, we consider a cloud computing as a system consisted of hardware, software, and procedures that can be rent for use in real time by a user (in our case an accounting department). Any member of the department will be connected to the system, at any time, from any place using a variety of devices (i.e. PCs, laptops, mobiles, etc.)

The idea of cloud computing is promoted as an innovative scalable technology that can be used for Web development (Armbrust et al. 2009), in which, based on demand, dynamically allocated virtual computing infrastructure as a service without requiring users to have knowledge, experience or control of the cloud infrastructure they use (Knorr & Gruman 2010).

The benefits for the Greek economy by the implementation of CC are the substantial reduction of IT spending, the increase of the productivity and the creation of new opportunities for business development. Also, CC allows the firms to focus on core activities and take advantage of the shared services which are offered by an experienced and trustworthy provider. However, the speed of adoption is crucial in order to maximise the benefits of the change (Danchev et al. 2011).

Literature Review

The increasing growth of ICT has influenced all the aspects of computing applications across firms. Furthermore, the business environment is becoming extremely complex with functional units requiring increasingly more inter-functional data flow for decision making, timely and efficient production control, inventory management, accounting, human resources, and distribution of goods and services. To confront these challenges, new AIS have surfaced in the market targeting mainly large complex business organisations. More specifically, they provide seamless integration of

information flow and enhance performance, quality, flexibility and responsiveness(Karsak & Ozogul 2009).

Despite the significant role of the ICT within a business and the impact on its success, not many researches and papers are undertaken and available for comparisons, conclusions and further discussion. Some researchers emphasise more on the management accounting side, while other researchers emphasise more on the information systems side. For example inter-organisational systems development will focus on widespread adoption of ERPs, web services, e-hub and enterprise portals, (Daniel & White 2005).

Worrell et al, point that AIS have mutual effect on management information systems (MIS), organisational behaviour, psychology, computer science and economics. He also mentions that Information Technology (IT) can be a strategic advantage for a company or a potential threat, (Worrell et al. 2013).

A lot of companies have suffered from the consequences of an IT glitch or security breach. These failures highlight the necessity for a coordinated organisational strategy to deal with the risks related with IT within the working environment. IT risk is the situation that an organisation's information systems cannot properly support the organisation in accomplishing its goals, secure its information resources and provide accurate and timely information to its users. IT risks influence both technical infrastructure and several business processes and managerial areas requiring the maximum attention and alertness of the managers.

Ghasemi et al., argue that the biggest impact of ICT on accounting is that enabled companies to develop and use computerised systems to track and record financial transactions, (Ghasemi et al. 2011). ICT networks and computer systems have reduced the time needed by accountants to prepare and present financial information to management. These systems allow companies to create accurate financial reports quickly and easily for timely management decisions. More thoroughly, modern accounting software improves tax preparation process, audit process, report preparation process and graphics preparation process. Also, the new technology enables companies to exchange documents electronically with each other (electronic data interchange), simplify the bank transaction (electronic funds transfer) and capture the electronic image of data. All these ICT technology advancements lead towards paperless offices.

Information Technology advancements such as on-line analytical processing (OLAP) techniques, artificial intelligence, web enabled transactions, smart agents and data warehouses have a major impact on the financial information accessed, retrieved and used in the decision making process (Stefanou 2006).

Sriram, notes that changes of the ICT have major impact on the accounting and financial systems, because AIS measure and report short-term information on tangible costs and benefits which are easy to quantify, (Sriram 1995). These changes were posed by the global competitive pressures and are designed to improve productivity, customer satisfaction and market share. The new situation demands from companies to focus to the external financial environment and compare their performance to the competitors' as well as the overall product attribute such as quality, reliability, warranty and after sales service. Traditional accounting practices are often ill-suited to measure the intangible and long-term benefits which are subject to a high degree of uncertainty and variability.

The significant impact of the ICT on accounting profession is also perceptible by their combination in teaching classes globally despite the

occasional problems due professors' handicaps by their own shortcomings and the inadequacy of the supplementary material (Ahadiat 2005). The Doost in 2002, notes that the ideal accounting professor must have sufficient cognition and experience of both accounting and computer science (Doost 2002). Professional accounting organisations require knowledge and usage of the modern technology tools due to the continuously increasing dependence of the businesses on information technology. The adoption of new ICT by companies may conceal undesirable issues such as network safety problems and significant risks related to the security of the AIS (Abu-Musa 2007). It is quite interesting and worrisome at the same time, that giants like Google had its Cloud Computing based systems attacked and hacked and these attacks will probably increase in the future as the usage of those new systems will increase too (Bisong et al. 2011). For these reasons, if AIS are to justify their existence, are required to be re-defined or "re-engineered" incorporating the new advancements (Stefanou 2006).

Association Rule Mining

Association Rule Mining (ARM) is an important and well researched technique of data mining that was introduced by [Agrawal et al. 1993]. The approach has been particularly successful in mining very large transaction databases and is one of the core classes of techniques in data mining. Association analysis identifies relationships between entities and/or between variables on large data bases. These relationships are then expressed as a collection of association rules in the form of IF-THEN statements concerning attribute-values(Agrawal et al. 1993). IF-THEN rules are one of the most popular ways of knowledge representation, due to their simplicity and comprehensibility (Klösgen & Zytkow 2002; Malthouse et al. 2003). Association rules are used in many applications and have become prominent as an important exploratory method for uncovering cross-relations of units in databases. Further, it may be used as a nonparametric regression where the model (functional form) created from categorical data. In our case we use ARM for questionnaire analysis to measure associations between questions answered by participants.

The operation of ARM takes two steps. In the first step the algorithm detects all frequent items in the database and in a second step establish strong association relationships (association rules) among the data.

A very simple association rule for our problem may be as follows:

High cost of Hardware ^ High cost of Software $\Rightarrow$ Low Satisfaction

In pseudo-code form the above rule is:
IF the cost of Hardware is high
AND the cost of Software is high
THEN the accountants are unsatisfied by the use of Computerized Accounting Information Systems (CAIS)

In general, the problem can be formulated as follows: Let $I = \{i_1, i_2 \ldots, i_n\}$ be a set of n categorical attributes called items and the attribute domains are binary, that is, $dom(i_i) = \{0,1\}$. Let $D = \{t_1, \ldots, t_m\}$ be a set of transactions, T, where each T, is a subset of I. An association rule is an implication in the form $X \Rightarrow Y$ where $X, Y \subseteq I$ and $X \cap Y = \varnothing$. Every rule is composed by two different sets of items, also known as itemsets, X and Y, where X is called antecedent or left-hand-side (LHS) and Y consequent or right-hand-side (RHS). The meaning of the rule is that X implies Y.

There are various algorithms that may be used to create the association rules, but one of the most widely used Association Algorithm is the Apriori (Agrawal & Srikant 1994). However, even in a relatively small sample there will be millions of relationships and therefore we need some measures to identify the most interesting/important ones. For example, if we consider only n = 100 attributes and rules with two items in antecedent and consequent, we have more than 23,500,000 possible rules.

That problem require statistical analysis to set the valid / interesting rules. Similar to regression there are various tests/measures regarding the validity / quality or interesting of the items / variables and the discovered relationships. There are various statistical measures that may be used to establish rule validity but the most commonly used measures are support, confidence and lift.

The support of an association rule is defined as the percentage of records that contain X ∪ Y to the total number of records in the database. When applied to large sample the support approximates the probability of occurrence of the rule.

$$support(X \rightarrow Y) = P(X \cap Y) = \frac{Number\ of\ transactions\ \ containing\ \ both\ X \text{ and } Y}{Total\ Number\ of\ Transactions\ \text{ in }\ D}$$

A high support of a rule means that the relative frequency indicating the co-occurrence of X and Y is high and therefore the rule is interesting first because it is statistically valid and secondly by the information that conveys to us. A frequent item has a greater support and therefore the support of an item may be viewed as a statistical significance of an association rule.

The confidence indicates how frequently items in Y appear in transactions that contains X and this way it measures the strength of the association (Bastide et al. 2000). For large samples confidence express the probability that a rule that contains X it will also contain Y. In other words, it is the frequency (or probability) of occurrence of B, conditionally on A being true.

$$Confidence(X \rightarrow Y) = P(X|Y) = \frac{P(X \cap Y)}{P(X)} = \frac{Number\ of\ transactions\ \ containing\ \ both\ X \text{ and } Y}{Number\ of\ transactions\ \ containing\ \ X}$$

The lift is a ratio between the relative frequencies (probability) of both X and Y occurring together, and the relative frequency (probability) of the same event but assuming the two items are independent. In essence, the lift is a measure of the relationship between X and Y, where a lift greater than 1 indicates a positive relationship and less than 1 a negative association between X and Y.

$$Lift(X \rightarrow Y) = \frac{Support(X \rightarrow Y)}{Support(X)\,Support(Y)} = \frac{P(X \cap Y)}{P(X)P(Y)}$$

Other interesting measures that may be used are: All Confidence (Omiecinski 2003); Cross Support Ratio (Xiong et al. 2003); Cosine (Tan et al. 2004); gini (Tan et al. 2004); Hyper lift (Hahsler & Hornik 2007); Hyper Confidence (Hahsler & Hornik 2007); Relative Linkage Disequilibrium (Kenett & Salini 2008), etc.

Research Approach & Results

The basic objective of this study is to identify factors that influence the satisfaction of Greek Accountant's from the adoption and utilization of computerized accounting infrastructure they use in their day to day work.

In other word we attempt to answer the following question:

"Which are the factors affecting the satisfaction of Greek Accountants by the current accounting information systems?"

In this work, we are not using any particular model regarding Accountants satisfaction but we let the empirical model to be created by the data.

Research Methodology

In this research we utilized an electronic questionnaire that was send to accounting firms, self-employed accountants and public servants. The questionnaire was e-mailed to 600 potential respondents and a sample of 133 questionnaires was e-mailed back (respondent rate 22%). The respondents live and work in the region of Thessaly, Greece. The active accountants in that region are (according to the Economic Chamber of Thessaly) 1211 so the size of the sample is appropriate for quantitative analysis.

The questionnaire is divided in three parts. The first part is related to demographic characteristic of our sample, such as education, accounting experience, size of accounting firm, etc. In the second part we obtained objective information regarding knowledge and utilization of accounting information systems. The final part depicts the subjective view of Greek accountants regarding information and communication technologies in accounting, (see tables 1-1, 1-2 and 1-3). The questions were based on theoretical development and previous research on the subject (see section "Recent trends towards future accounting information systems").

Table 1-1: Demographic Variables used in the Analysis

	Demographics	
Edu	Education	High school Professional training Bachelor Master
TOE	Type of employee	Owner of accounting firm employer Self-employed Public servant Employee
A.Exp	Accounting experience	0-5 years 5-10 years 10-20 years >20 years
SoAD	Size of accounting department	1-3 people 4-8 people 9-20 people >21 people
CS	Company size	1-10 persons 11-25 persons 26-100 persons 101-500 persons > 500 persons
HSUF	Hardware & software upgrade frequency	From 2 to 5 years From 5 to 10 years More than 10 years
MC	Monthly maintenance cost	Up to 1000 1000-5000 5000-10000 10000 or more

Table 1-2: Objective Variables used in the Analysis

	Objective Variables	
UoSaAS	Utilization of Standalone Accounting Software	Binary
UoCC	Utilization of Application based on CC	binary
UoFOSS	Utilization of Application based on FOSS	binary
KoERP	Knowledge of ERP applications	binary
KoCC	Knowledge of CC applications	binary
KoOSS	Knowledge of FOSS applications	binary
UOCCA	Utilization of CC Application	binary
RU	Remote users	binary

Table 1-3: Subjective Variables used in the Analysis

	Subjective Variables	
ASS	Accounting Software Satisfaction	seven-point Likert- scale
SoSM	Satisfaction of System Maintenance	seven-point Likert- scale
Hard.Cost	Hardware cost	seven-point Likert- scale
Soft.Cost	Soft.Cost	seven-point Likert- scale
ASU	Accounting System Utilization	seven-point Likert- scale
I.Sat	Internet Satisfaction	seven-point Likert- scale
I.Sec	Internet Security	seven-point Likert- scale
IinUoCC	How interesting / useful you find the ability to manage the accounting and computer applications used remotely (via cloud-Cloud);	seven-point Likert- scale

Mining Questionnaire Data

The first step in our analysis is to calculate frequency statistics for our data. We created frequency statistics for the most important/valid items (answers) with support 0.4 (see frequency figure 1). From the plot is evident that most of the accountants on our sample work as employees in small accounting firms. They are aware of ERP and OSS technologies but they don't use them in their day to day work. The upgrade frequency of hardware and software is very low at the time that they believe the cost for both hardware and software is fair. Finally, they share an average satisfaction about the computerized accounting systems that they use.

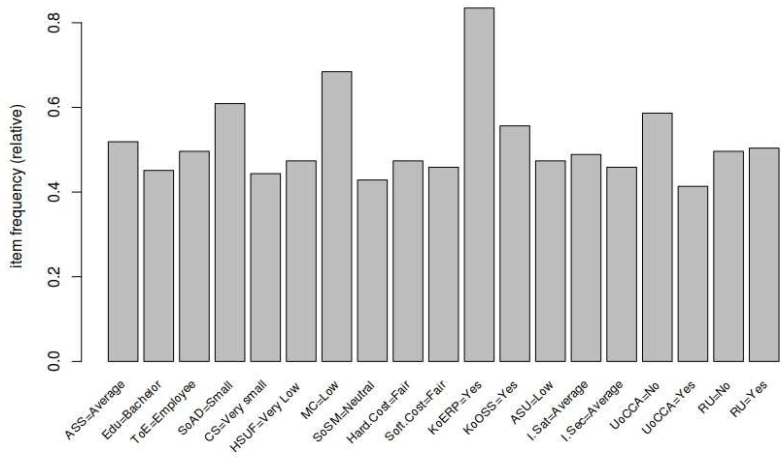

Figure 1: Item Frequency (with support 0.4)

Association Rule Creation

We already know that the level of satisfaction of most accountants, in our sample, regarding the accounting information systems they use, is average. However, we do not know yet what are the factors affecting and influencing the degree of that satisfaction. In order to answer that question we employ association analysis. In particular, we search for relations regarding the Accounting System Satisfaction (ASS). Therefore for the rhs of the rules that we will create we use ASS=Unsatisfied, ASS=Average, ASS=Satisfied and "ASS=Very Satisfied. We set a support number 0.05 and confidence 0.95, to get 990 rules. It should be noted that when the support for the created rules is 0.01 then the created rules are 949721 insignificant rules. In table 2 we present the ten most significant rules sorted by confidence, when the rhs for ASS is unsatisfied, average, satisfied and very-satisfied. Almost all rules created have at the rhs ASS=Average and only in one case/transaction the rhs of the rules is ASS=Satisfied.

The factors that may lead accountants to have an average feeling about the accounting software they use are presented in table 3. We can see that the rules created for ASS=satisfied are rather spurious since they are not correlated well with the findings of previous research or the theoretical development on the subject. On the other hand, hardware and software cost and low quality of internet experience are the most important factors that leads to average accounting software satisfaction.

Table 2: Ten most significant rules for ASS unsatisfied, average, satisfied, and very satisfied

	lhs		rhs	support	lift
1	{ToE=Self Emloyed,Soft.Cost=Extremely High}	=>	{ASS=Average}	0.05263158	1.927536
2	{Hard.Cost=High,I.Sec=Poor}	=>	{ASS=Average}	0.06015038	1.927536
3	{Edu=High School,ASU=Low}	=>	{ASS=Average}	0.06766917	1.927536
4	{Edu=High School,HSUF=Very Low }	=>	{ASS=Average}	0.06766917	1.927536
5	{ToE=Self Emloyed,Soft.Cost=Extremely High,I.Sat=Average}	=>	{ASS=Average}	0.05263158	1.927536
6	{ToE=Self Emloyed,Soft.Cost=Extremely High,KoERP=Yes}	=>	{ASS=Average}	0.05263158	1.927536
7	{A.Exp=Very high,I.Sat=Average,I.Sec=Poor}	=>	{ASS=Average}	0.08270677	1.927536
8	{A.Exp=Very high,SoSM=Neutral,I.Sat=Average}	=>	{ASS=Average}	0.06766917	1.927536
9	{I.Sat=Satisfied,I.Sec=Good,IinUoCC=Somewhat interested}	=>	{ASS=Satisfied}	0.05263158	3.243902
10	{SoSM=Neutral,Hard.Cost=High,I.Sec=Poor}	=>	{ASS=Average}	0.05263158	1.927536

Table 3: Most important factors for ASS = average and ASS = satisfied

ASS=Average	ASS=Satisfied
1. ToE=Self Emloyed, 2. Soft.Cost=Extremely High 3. Hard.Cost=High, 4. I.Sec=Poor, 5. Edu=High School, 6. ASU=Low, 7. HSUF=Very Low, 8. I.Sat=Average, 9. KoERP=Yes, 10. A.Exp=Very high, 11. SoSM=Neutral.	1. I.Sat=Satisfied, 2. I.Sec=Good, 3. IinUoCC=Somewhat interested

In Table 4 we present the rules that lead to low levels of accounting satisfaction with regard to AIS. Extremely high hardware and software cost, combined with low levels of internet satisfaction as well as concerns about internet security, leads the accountants on this group to have an overall unsatisfactory feeling about AIS they use. It should be noted however, that accountants in this group have very high accounting experience and therefore they are very demanding from the software that they use.

Table 4: Ten most significant rules for ASS unsatisfied

	lhs		rhs	support	lift
1	{Soft.Cost=Extremely High,I.Sat=Unsatisfied}	=>	{ASS=Unsatisfied}	0.02255639	8.866667
2	{ToE=Public Servant,I.Sat=Unsatisfied}	=>	{ASS=Unsatisfied}	0.02255639	8.866667
3	{SoSM=Unsatisfied,I.Sat=Unsatisfied}	=>	{ASS=Unsatisfied}	0.03759398	8.866667
4	{Hard.Cost=Extremely High,I.Sat=Unsatisfied}	=>	{ASS=Unsatisfied}	0.03007519	8.866667
5	{A.Exp=Very high,I.Sat=Unsatisfied}	=>	{ASS=Unsatisfied}	0.02255639	8.866667
6	{I.Sat=Unsatisfied,IinUoCC=Not really interested}	=>	{ASS=Unsatisfied}	0.03759398	8.866667
7	{I.Sat=Unsatisfied,I.Sec=Poor}	=>	{ASS=Unsatisfied}	0.02255639	8.866667
8	{Edu=Bachelor,I.Sat=Unsatisfied}	=>	{ASS=Unsatisfied}	0.02255639	8.866667
9	{HSUF=Very Low ,I.Sat=Unsatisfied}	=>	{ASS=Unsatisfied}	0.02255639	8.866667
10	{ASU=Low,I.Sat=Unsatisfied}	=>	{ASS=Unsatisfied}	0.02255639	8.866667

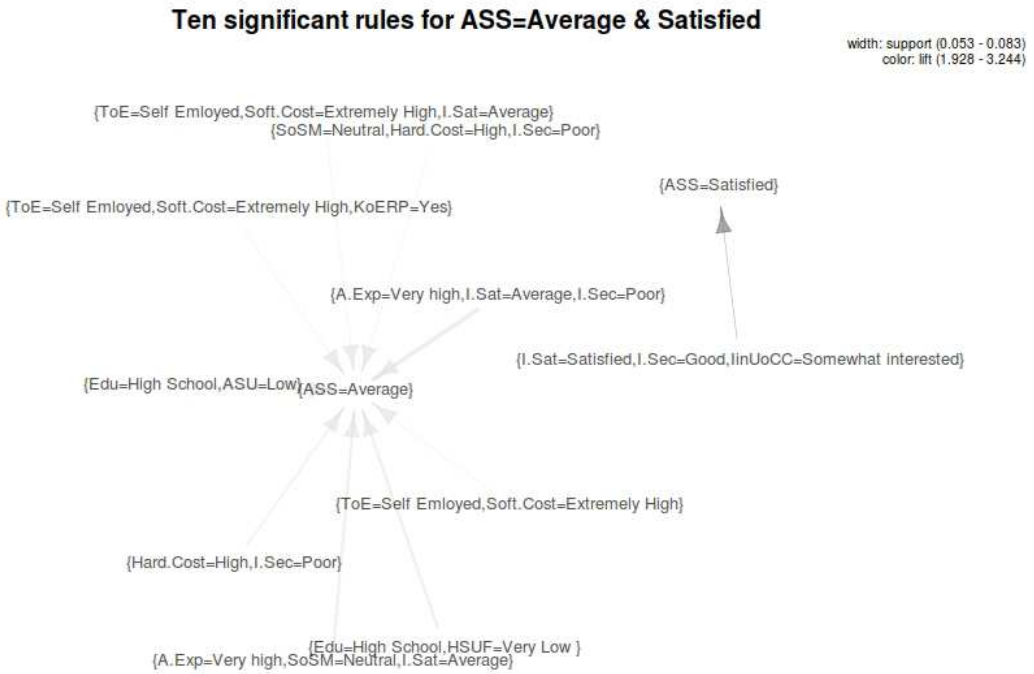

Figure 2: Ten most significant rules for ASS

In Tables 5 and 6 we present the rules that lead accountants to be satisfied and very satisfied from their AIS. In both groups, responders believe the hardware and software cost is fair, while they seem to be satisfied from the internet quality and cost. On the other hand they seem to be less experienced from accountants in the first two groups (ASS=unsatisfied and ASS average).

Table 5: Ten most significant rules for ASS satisfied

	Lhs		rhs	support	lift
1	{ToE=Self Emloyed,I.Sec=Excellent}	=>	{ASS=Satisfied}	0.03007519	3.243902
2	{SoSM=Satisfied,I.Sec=Excellent}	=>	{ASS=Satisfied}	0.04511278	3.243902
3	{Edu=Bachelor,I.Sec=Excellent}	=>	{ASS=Satisfied}	0.03007519	3.243902
4	{A.Exp=High,CS=Average}	=>	{ASS=Satisfied}	0.03007519	3.243902
5	{SoSM=Satisfied,IinUoCC=Not really interested}	=>	{ASS=Satisfied}	0.03007519	3.243902
6	{ToE=Self Emloyed,SoSM=Satisfied,I.Sec=Excellent}	=>	{ASS=Satisfied}	0.03007519	3.243902
7	{ToE=Self Emloyed,Hard.Cost=Fair,I.Sec=Excellent}	=>	{ASS=Satisfied}	0.03007519	3.243902
8	{ToE=Self Emloyed,I.Sec=Excellent,RU=No}	=>	{ASS=Satisfied}	0.03007519	3.243902
9	{ToE=Self Emloyed,SoAD=Small,I.Sec=Excellent}	=>	{ASS=Satisfied}	0.03007519	3.243902
10	{ToE=Self Emloyed,KoERP=Yes,I.Sec=Excellent}	=>	{ASS=Satisfied}	0.03007519	3.243902

Table 6: Ten most significant rules for ASS Very Satisfied (VS)

	lhs		rhs	support	lift
1	{MC=Average,SoSM=Very Satisfied}	=>	{ASS= VS }	0.02255639	16.625
2	{MC=Average,SoSM=Very Satisfied,I.Sat=Very Satisfied}	=>	{ASS= VS }	0.02255639	16.625
3	{Edu=Bachelor,SoSM=Very Satisfied,I.Sat=Very Satisfied}	=>	{ASS= VS }	0.02255639	16.625
4	{SoSM=Very Satisfied,I.Sat=Very Satisfied,I.Sec=Average}	=>	{ASS= VS }	0.02255639	16.625
5	{SoSM=Very Satisfied,Soft.Cost=Fair,I.Sat=Very Satisfied}	=>	{ASS= VS }	0.02255639	16.625
6	{HSUF=Very Low ,SoSM=Very Satisfied,I.Sat=Very Satisfied}	=>	{ASS= VS }	0.02255639	16.625
7	{SoSM=Very Satisfied,ASU=Low,I.Sat=Very Satisfied}	=>	{ASS= VS }	0.02255639	16.625
8	{ToE=Employee,SoSM=Very Satisfied,I.Sat=Very Satisfied}	=>	{ASS= VS }	0.02255639	16.625
9	{SoSM=Very Satisfied,I.Sat=Very Satisfied,RU=Yes}	=>	{ASS= VS }	0.03007519	16.625
10	{MC=Average,SoSM=Very Satisfied,UoCCA=Yes}	=>	{ASS= VS }	0.02255639	16.625

Table 7: Most important factors for ASS = {unsatisfied; average; Satisfied; very satisfied}

ASS unsatisfied	ASS average	ASS satisfied	ASS very satisfied
Soft.Cost=Extremely High, I.Sat=Unsatisfied ToE=Public Servant, SoSM=Unsatisfied, Hard.Cost=Extremely High, A.Exp=Very high, IinUoCC=Not really interested, I.Sec=Poor, Edu=Bachelor, HSUF=Very Low , ASU=Low.	ToE=Self Employed, Soft.Cost=Extremely High, Hard.Cost=High, I.Sec=Poor, Edu=High School, ASU=Low, HSUF=Very Low, I.Sat=Average, KoERP=Yes, A.Exp=Very high, SoSM=Neutral.	ToE=Self Employed, I.Sec=Excellent SoSM=Satisfied, Edu=Bachelor, A.Exp=High, CS=Average IinUoCC=Not really interested Hard.Cost=Fair, RU=No SoAD=Small, KoERP=Yes.	MC=Average, SoSM=Very Satisfied I.Sat=Very Satisfied Edu=Bachelor, I.Sec=Average Soft.Cost=Fair, HSUF=Very Low , ASU=Low, ToE=Employee, RU=Yes, UoCCA=Yes.

Conclusion and Further Research

We have applied data mining techniques in the form of association rules, for the analysis of questionnaire data regarding the ICT's adoption factors by Greek Accountant's in the area of Thessaly. The most profound factors affecting ICT adoption, utilization and finally CAIS satisfaction by Greek accountants are hardware and software cost concerns. In addition we found a strong relationship of internet satisfaction and AIS satisfaction. This may be attributed to the establishment of Taxisnet (the government portal for tax issues) that forced most of the companies (and not only the accounting firms) to rely heavily on internet in order to be able to communicate with the tax system.

Our approach is very flexible since it does not require a particular functional form of the model but the model is created by the data. Furthermore, this approach does not have the strict assumptions of normality and linearity that are usually assumed by regression and factor analysis. Finally, the results are easily to be understand by decision makers with little or no knowledge of advanced quantitative methods.

Finally, we would like to point out some of the limitations of our work. Firstly, in this paper we excluded most of the questions asked in the survey regarding the adoption of Cloud Based Accounting Software. The main reason for that option was size limitation on the paper. Secondly, our artificial restriction and focus only on the ten most important created rules may invalidate our results. Finally, we restricted our effort in the most commonly used interesting measures. In future papers we plan to cure the above mentioned problems.

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