

## **Knowledge Management Systems: evaluating confidentiality, trust, and privacy concerns**

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**Abstract:** Knowledge management improves the corporation value by recognizing the expertise and assets along with the management of resources. Knowledge management security is essential as organizations have to ensure the preservation of actual assets. Only authorized subjects must be allowed to execute different functions and operations within an organization. It is an investigated article, which aimed to evaluate the aspects and techniques; including confidentiality, trust, and privacy concerns, in knowledge management system. Moreover, it is further aimed to assess certain access-control techniques to efficiently manage the resources of knowledge management system. Mixed research design has been incorporated to evaluate the findings. Knowledge Management has been emerged with the advent of web, and is fundamental for data sharing and knowledge management. It has been further evaluated that transferring, storing and identifying knowledge are systematic approaches to achieve organizational goals. The knowledge management system can play a major role to support the knowledge management processes of an organization. Secure knowledge management can be crucial as organization share data, work mutually, and collaborate on various confidential projects. The study has provided some ways for integrating confidentiality, trust, and privacy.

**Keywords:** Trust, Knowledge Management System, Knowledge Management Strategy, Knowledge Management Tools, Knowledge Audit

### **1. Introduction**

Knowledge Management System (KMS) is an end product of complex synergic tools, which is relatively associated with smooth functioning of digital, technical, preemptive, and private data. Knowledge capital and intellectual capital are two viable assets that can be used for assuring progress in professional market [1]. Knowledge management results from the two identified capitals that are highly effective for the regulation of organization. However, the greatest knowledge value occurs, whenever it is shared unlike many other assets. It proves to enhance decisions and the development of facilities in regards of new knowledge. The information technology has been used to support the diversified preemptive activities of an organization to carry out its processes efficiently. It has been indicated that information technology is directly associated with the knowledge management that usually results in better services, cost effectiveness, secure data, reducing time [2]. Gigantic opportunities have been provided by the knowledge management system to assure the privacy and confidentiality of data for gaining the trust of stakeholders. The major function of knowledge management system is to manage confidential data of an organization from being misused. Therefore, it can be said that knowledge

management system is a recognized approach for handling private and exclusive data within and across organizations [2].

The foremost challenge of the knowledge management system is to maintain the security and privacy of highly sensitive data in an organization. There is a prominent requirement to protect the metrics, processes, and strategies of organization to have a secure knowledge management system. Knowledge management system is also helpful for developing security and confidentiality related strategies in regards of metrics [3]. Therefore, it was found essential to understand that IT professionals must identify those users or specified authorities to whom the knowledge can be shifted. Additional access techniques might be enforced by the professionals to assure reliability of KMS. Knowledge transfer and knowledge sharing operations are ought to enforce access security and control policies. There are several aspects of securing knowledge management, out of which confidentiality, trust, and privacy have been specifically focused in this study. These aspects have been focused as the secure processes are the requirement of knowledge management including secure processes for order management, purchasing and contracting. There are several control policies, which have been implemented and designed to pledge safe and secure management system [4]. Thus, it can be said that confidentiality and privacy of data plays a key role in developing trust of stakeholders apparently.

The study aimed to examine the nature of knowledge to be shared from the perspective of employees and IT managers. Three dimensions were the key focus of the study; including privacy, confidentiality and trust; and to examine different practices that can be managed through different access control techniques [4]. An overview of secure management system has been provided that focuses on the trust, privacy and confidentiality aspects by applying various techniques such as Usage Control (UC) and Rule Based Control Policy (RBCP) [4].

Different perspectives for the implications of KMS have been identified that led the practitioners and scholars to execute diverse strategies. Many of them believed that knowledge management system can be managed through information technology. This system can also be viewed as the socio-technical perspective, which can be carried out through optimization of social and technological aspects. Practical guidance is considered as a major need, which can be easily fulfilled through KMS for maintaining system.

The study further discussed the literature based on knowledge management system, confidentiality, trust, and privacy concerns, along with privacy management. The research methodology is based on both qualitative and quantitative research design. The data collection process has been mentioned, which effectively analyzed the results. The nature of knowledge to be shared from the perspective of employees and IT managers has been evaluated, which identified whether role-based access control (RBAC) model is better than Usage Control (UCON) Model or UCON is better than RBAC, which shows that both can serve as the tool for knowledge management system.

## **2. Literature Review**

Knowledge management system is an evolving approach within organizations to facilitate knowledge flows based on new technologies today, such as Internet of Things (IoT) [33]. In knowledge management system, confidentiality, trust, and privacy are three main aspects for managing the regulations of secure knowledge management. There is an important change in the process, culture, and substructure of an

organization [5], with the implementation of three major dimensions of knowledge management system that are trust, confidentiality and privacy. There are various factors that influence the knowledge management and benefit the organization from the best possible gain of a well-structured knowledge management procedure. Confidentiality, privacy, and trust have been identified as core aspects of KMS for better and secure regulative processes [6]. Knowledge sharing of a corporation is fundamental in order to get a competitive advantage. This means that an individual needs trust, privacy and confidentiality as main components to build a secure knowledge management system in an organization. There should be a negotiation of contracts about the knowledge sharing by the corporations, as they are required to trust the other associations before drawing up important contracts [7].

Systematic approaches also manipulate the knowledge management system to find, understand, and use knowledge to achieve organizational goals and also to transfer, collect and store knowledgeable data. The transferring of knowledge includes communities of practice, after action reviews, knowledge fairs, jobs aids and mentoring [8]. Another approach that is storing knowledge might include document repositories and management systems databases through different access control techniques. Identifying and collecting knowledge may comprise of documenting processes, best practices, knowledge audit, expert interviews, knowledge map and inventories. These approaches may assist to manage a secure knowledge management system to have a better and secure knowledge management system [8]. It may influence the knowledge management and benefit the organization.

### **2.1 Knowledge Management System**

There are several access control techniques that might be applied for the knowledge management to ensure the privacy concerns. These policies can be simple role-based UCON and read-write policies. The UCON and RBAC are chosen to discuss, as they are more important for the secure knowledge management. RBAC Model is a secure way of KMS [34]. The secure knowledge management system comprises of secure metrics, processes and policies. The secure semantic web and the protection of privacy data mining are the main technologies for the knowledge management and are included in the security technologies [9]. Trust management and access control are included in the knowledge management. The strategies and methods which are set by the organization for the sharing of information and protecting the intellectual property are included in the security strategies for knowledge management. The business processes for contracting, workflow and purchasing have to be incorporated in the knowledge management [10].

The influence of security on the knowledge management should be focused on the metrics for secure knowledge management. There should be experiments carried out, by the organization shaping the influence of protection on the metrics collected. Specifying the policies for security and representing the knowledge and also, the policies that are in understandable format has been included in the secure knowledge representation [11]. The languages that represent the knowledge such as the frames and rules, in addition to few of the more latest semantic web languages, are suitable for the policy and knowledge management. The languages might include the Resource Descriptive Framework (RDF) and ontology languages. The updating and querying the knowledge base are included in the tasks of Knowledge manipulation [11]. A secure knowledge transfer task and dissemination includes the transferring and disseminating the knowledge to official individuals.

The RBAC and its concept in knowledge management have emerged in the past years as a highly successful and deployed alternative to mandatory access controls and conventional discretionary. The main idea of RBAC is that the permissions and users are assigned to roles. Moreover, RBAC can be used for indirect permissions through roles [12]. In simple model of RBAC, there are two major elaborations. Role of hierarchy is considered as the first elaboration of system [12].

The permissions assigned to the junior analyst can automatically be inherited to the senior analyst. RBAC is particularly relevant to the information protection in a global as well as in a local environment across coalition [12]. The RBAC model also progressed into (NIST/ANSI) National Institute of Standards and Technology/ American National Standard Institute model first suggested in 2001 and was adopted formally as an ANSI standard in 2004. Only the aspects of RBAC that were established for standardization were captured by the NIST/ANSI. Therefore, it can be analyzed that these techniques and models might assist to have a secure knowledge management system in an organization.

## ***2.2 Confidentiality, Trust, and Privacy Concerns***

Confidentiality [36], trust [35] and privacy [37] concerns are the main dimensions that provides comprehensive framework for the access control of next generation unified by the UCON model and also the RBAC model. The obligations, authorization and conditions are the components of the decisions of UCON. Permissions are authorized in UCON attribute based model, the permissions are approved depending on the values of object and subject attributes [13]. In UCON, the concept of obligation is beneficial for the knowledge management [13]. The actions required to be performed are the obligations, required before the access is permitted source. The conventional approaches to the structures of RBAC management are heavy weight in concerning clear actions by human manager. The traditional approaches, where every administrative decision comprises a human in a loop in the decision making, are not measurable to the automated and flexible environment [14]. There is a need to develop the administrative models for RBAC with the goal of being seamless and less weight without the negotiation of security.

There are many issues that are applicable to knowledge management related to trust management and negotiation [15]. The idea of trust has been utilized in a large figure of different frameworks and with a variety of meanings, relying on how it is used. It is a complex idea about which there is no consensus present in the information and computer science literature, although its significance has been widely identified [16]. The trust is a belief that is influenced by the opinion of an individual about certain critical features of the system.

There are numerous insurance, legal and financial services obtainable that construct the behavior of business less risky and simpler. Establishing and maintaining confidence and trust at diverse stages of the interaction is the goal of web-based transaction framework [17]. The trust services solve various troubles such as ensuring the legitimacy of electronic communication, producing an electronic signature and also creating an electronic audit.

Data mining is an expertise that provides different procedures for planning, detection, diagnosis, problem solving, innovation, learning and integration. The data mining in the uses for finance can be utilized to generate the knowledge from the information systems of any organization [18]. The knowledge discovery algorithms, the classification of knowledge data discovery is drawn from models such as, rule-induction decision tree, Bayesian classifier, genetic programming for interfacing the knowledge discovery

algorithms [18]. A data management technique, known as the latent semantic indexing, is used to structure a CDM (Correlated distribution matrix for mining the consumer product data. On the other hand, the decision support is the main goal for applying the data management to extract the knowledge for certain issue of knowledge management from a data base [18]. These techniques can be utilized to fulfill the requirements of a secure and managed knowledge management system to perk up the confidentiality and privacy of the personal data and information of an organization.

### 2.3 Privacy Management

Privacy has always been identified as a major concern in the knowledge management system. It is a fact that the privacy of confidential data is highly sensitive issue for the organization, which is necessary to be considered in order to progress in the professional environment [19]. The concept of secure information or privacy management is the key to assure effective data mining and intelligent web systems. There are a significant number of technologies, which are mostly used within the organizational settings to develop secure knowledge management system. Decision making, systems thinking, team orientation, competent systems, and specialist expertise are always recognized as core aspects of successful and secure knowledge management system [19, 20]. The privacy of data in regards of any system is mainly dependent upon information technology, which is combined to develop synergic effectiveness. Sharing of knowledge along with the accomplishment of tasks is directly associated with heterogeneous enterprise boundaries. The protection of valuable knowledge is mainly assisted by the existing privacy management tools, which are employed in the corporate processes and infrastructure [21]. Semantic web has been identified as a major tool for the execution of strategies and processes along with metrics. Therefore, it is said that the semantic web and data mining have inference abilities to secure information through intensive confidentiality and sensitivity options [22, 23].

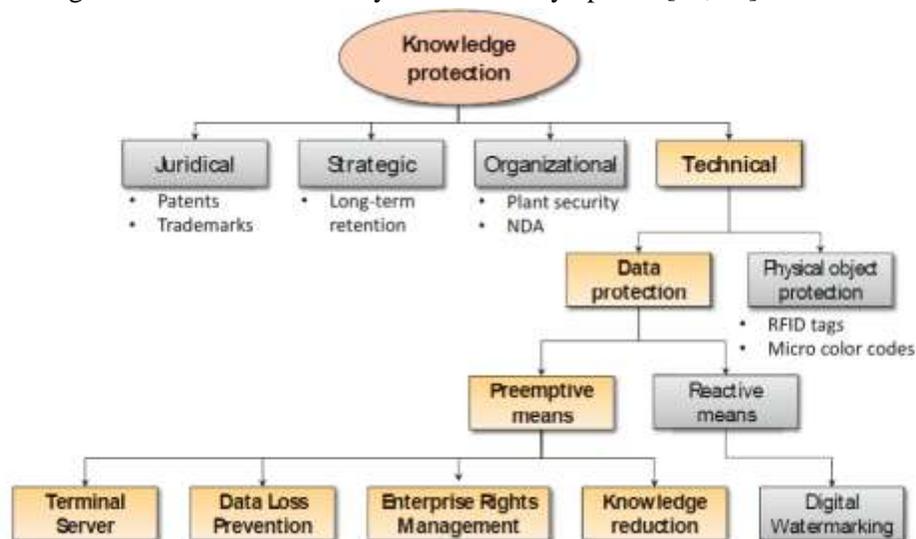
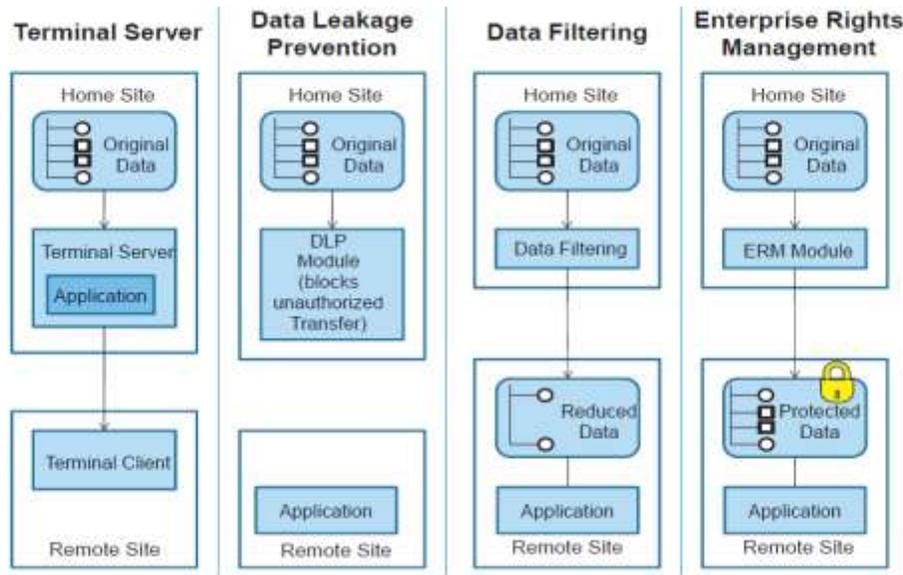


Figure 1 is representing diversified categories of privacy management approaches, which are mostly used for technical data protection through preemptive concepts. The juridical protection is completely related with the copyrights that can be used for data protection. A set of legal framework is developed to secure highly sensitive data from being misused or stolen. Along with juridical protection, strategic

protection approach is also significant for controlling knowledge bearer in regards of long term strategies. Organizational protection tool is an implicit protection means, which is directly associated with the privacy of stakeholder's information and knowledge.



Terminal Server is considered as preemptive application that receives input and transmits graphical user interface output through a network connection (Figure 2). 3D CAD along with the central manageability of system is certain valuable aspects related to server [24]. Data Leakage prevention monitors is another secure technique, which protects data to be theft from the organizational settings. DLP systems and modules are mainly responsible for controlling and restricting file transfers and email attachment of highly confidential data. Data filtering is also recognized as specified approach for reducing and minimizing the risk of knowledge loss [25]. Centralized permission management through policy enforcement is an electronic vault solution that can enhance end-user applications.

### 3. Research Methodology

#### 3.1 Data Design

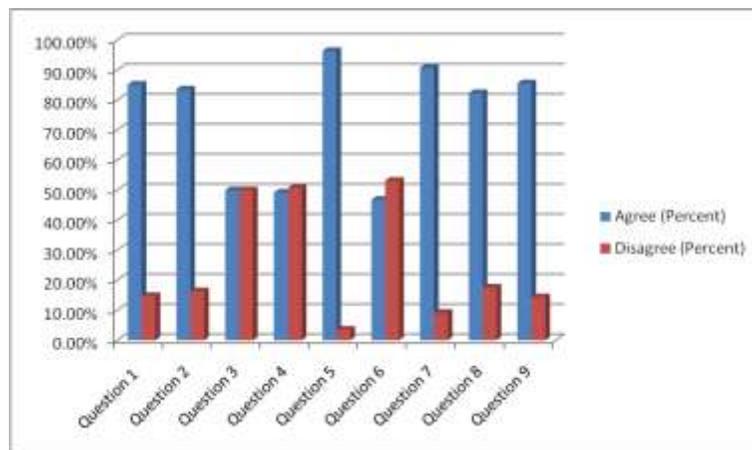
Mixed research design has been incorporated to evaluate the aspects and techniques that can aid the knowledge management systems regarding the trust, privacy and confidentiality. A sample of 250 participants was selected for the study. The data was collected from the IT managers, software managers, chief information officers, executive and general employees. A questionnaire has been constructed in order to collect the views of the respondents in evaluating the measures taken by the knowledge management in an organization. It was assured to the participants that the data would be collected with anonymity. Organizations selected for this study conducted these surveys to evaluate the annual progress and perception of the employees. Questionnaires for the inquiry were routed online through the official portal. Data was retrieved from the organization's database with the written consent. After the collection and analysis of the quantitative data, a qualitative review approach has been utilized for retrieving relevant outcomes. A pilot study has been conducted before performing the study with the samples of 25 participants. According to Connelly [26], it has been suggested that a pilot study sample should be 10% of

the sample projected for the larger parent study. The total participants recruited in the study are 250; therefore, 25 participants were selected for pilot study.

The main objective of the pilot test was to examine the employees' understanding the concept of the questionnaire as well as the clarity of questionnaire. The pilot test was also executed to measure the validity and reliability of the data. The statistical tool considered for this study was Statistical package for the social sciences (SPSS). All the employees have shown a significant contribution in the research performance. They were asked to fill inform consent. The data collected from these participants was ensured to be confidential.

#### 4. Results

Figure 3 has shown the frequencies in terms of percentages, indicating the responses of the participants. The findings have clearly indicated that most of the participants have shown their agreements towards the asked questions. It has also shown the descriptive statistics of the responses of every question included in the questionnaire regarding the aspects of the knowledge management systems and privacy concerns as well.



[Table 1 near here], [Table 2 near here], [Table 3 near here]

The table of model summary has the values of Coxx & Snell R square and Nagelkerke R square, which are the methods of calculating the explained variations. Therefore, the explained variations in the analysis based on the ranges of model from 47% to 84%. The value of chi-square is found to be statistically significant as the p-value is less than the level of significance ( $\alpha=0.05$ ). The binomial logistic regression has estimated the probability of independent variables. It has been found that the all the variables have positive impact on the knowledge management system. The p-values for the independent variables are less than the level of significance, concludes that all the techniques and aspects has positive and statistically significant impact on the knowledge management system (Table 1; Table 2; Table 3).

#### 4.1 Correlation Test

The correlation test between the variables, being identified in the questionnaire. It has been observed that there is a positive and very strong relationship between “RBAC is better than UCON” and “UCON is better than RBAC”. They both can emerge as an influential tool for the knowledge based management system. The Pearson correlation test has also been applied between the variables “RBAC is a better model to identify the tools and search engines relevant for information.” And “RBAC is better than UCON” (Table 4).

[Table 4 near here]

[Table 5 near here]

There is a positive and strong correlation found between these two variables. The analysis concludes that RBAC solely is able to perk up the structure of knowledge management system. The Pearson correlation test has been used to identify the association between the variables that “Privacy is fundamental for data sharing” and “Secure semantic web and preserving of data mining should be main technology” (Table 5). It has been identified that there is negative and weak association found between these two variables. It concludes that there is no association between these two variables in organizing the knowledge management system. The Pearson correlation test has been applied on the audit strategies and the data collection in organizing the knowledge management system. It has been observed that there is positive and weak correlation between the variables. They might be helpful together in the management of knowledge sharing programs, but according to the present analysis they have no significant association.

## **5. Discussion**

Interdependent processes of knowledge maintenance and creation have been implicated in the knowledge management, knowledge retrieval and knowledge distribution. The members of an organization can be involved in numerous chains of knowledge management processes. The knowledge management is a continuous and dynamic phenomenon of an organization [25].

The underlying approaches and tools, complexity and resource requirements of knowledge management systems change, is based on the scope, type and characteristics of the knowledge management procedures. The knowledge might be an explicit or tacit and it can rise to a cognitive state, an object or ability. It may exist in the social systems, physical settings, processes or policies. In order to deal effectively with the diversity of knowledge attributes and types, it is essential to employ a variety of knowledge management approaches and procedures [27].

The establishment and formation of knowledge management projects are very much dependent on the support of top management [25]. The status of organization and physiological conditions of staff should be considered for the implementation of knowledge management systems. The organization is vastly dependent on the contribution of each member to form a learning type organization and also to exchange his/ her experiences and knowledge [28]. Many firms have made a high-level business role dedicated to the knowledge management, to assist the knowledge management initiatives with the strategies of organization [20].

The main purpose of knowledge management is to efficiently develop the knowledge, and promote the knowledge sharing to gain the overall competitiveness of an organization. The learning type association is an important condition for the success of any organization. It has been proposed that the process in the implementation of knowledge management must comprise of training, information technology and human resources. The content of personal learning is much identified by the planning of human resources. Furthermore, the desire to share the knowledge with others, the formation can provide a worthy intelligence for an organization to create constant competitiveness [29]. It is essential to set up a foundation of learning type association such as experience and knowledge, before they can be communicated with each other. Through the knowledge management system the knowledge can be stored, classified and shared to achieve the cause of recycling [30]. The knowledge management strategy can be divided into two groups. The systematic strategy is the one, in which the knowledge is classified

carefully and encoded. Another one is the personalized strategy, in which exchanging and sharing information is done by personal contacts.

It has been suggested that the knowledge management affects the outcomes of an organization positively. There is a strong positive relationship between the knowledge management systems and organizational and operational performances [31]. Knowledge sharing can be both informal and formal. A research has suggested that the higher the efficiency of accumulation of knowledge in an organization, the greater will be the positive impact on the knowledge management [32].

There is a strong and positive relationship that exists between the organizational and operational performance. The knowledge management mediates the impact of culture of an organization and partially reconciles the structure of organizational effectiveness. Finally, it has been observed from many studies that knowledge management affects the performance of an organization in an optimistic manner, but the relationship is somehow difficult to demonstrate [32].

A detailed discussion of knowledge management and the systems used for the knowledge management have been incorporated in the study. It has been a popular topic in numerous studies including organizational theory and information system as well as strategic management. Both the quantitative and qualitative approaches have evaluated that the role of Information technology has an essential part in the knowledge management procedures of an organization. The role of IT will obtain substantial scholarly consideration and become a significant point of investigation. The quantitative analysis has shown the correlation between the variables. The results have indicated that the role of IT has influenced the managements systems and helped to enhance the abilities of the individuals as well as the employees working under the knowledge management system.

## **6. Conclusion**

It has been observed from the results that RBAC and UCON might build a proper knowledge management system in regards with the privacy and confidentiality of data. Both RBAC and UCON can be emerged as two prominent access control policies for the improvement of knowledge management system. The field of investigation to analyze such ideas is expanding over the time. However, the study executed and estimated the approach Knowledge Management Systems: Evaluating Confidentiality, Trust, and Privacy Concerns that might be enhanced in several aspects. The study could furnish as higher study when the sample size is not limited. The sample was restricted to the IT managers, general managers, executive employees and chief information officers and also who were aware of the knowledge management programs. It was highly expected that they all were familiar with high technology innovations and knowledge management systems. The exclusion of some irrelevant variables was the primary limitations of the study. Future researches can impose more control on the participants selected for the study. Interaction among people while visiting a site is itself a worthwhile activity to examine, but it must be either controlled or measured so as to understand the role it plays in shaping attitudes and behaviors.

### **Ethical approval and consent to participate**

Not applicable

### **Consent for publication**

Not applicable

**Competing Interest**

The author declares no competing interest.

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**Tables**

**Table 1:** Binary Logistic Regression Analysis

<b>Omnibus Tests of Model Coefficients</b>		
Chi-square	df	Sig.
162.501	8	.000
162.501	8	.000
162.501	8	.000

**Table 2:** Regression Classification table

Observed		<b>Classification Table<sup>a</sup></b>		
		Predicted		Percentage Correct
		Knowledge management requires the data collection after every six months		
		Agree	Disagree	
Knowledge management requires the data collection after every six months	Agree	213	0	100.0
	Disagree	14	23	62.2
Overall Percentage				94.4

**Table 3:** Regression variable in the equation

Variables in the Equation	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
Collection of data	20.093	3792.190	.000	1	.996	532557267.128	.000	.
Audit strategies	-.274	29822.411	.000	1	.023	.760	.000	.
RBAC	.814	29474.787	.000	1	.052	2.256	.000	.
UCON	-.686	12788.464	.000	1	.001	.503	.000	.
RBAC and UCON	.978	9060.411	.000	1	.003	2.659	.000	.
RBAC model	41.702	9198.844	.000	1	.050	129049930113520 2300.000	.000	.
Secure semantic web and preserving of data	-16.772	10757.833	.000	1	.051	.000	.000	.
Privacy	1.722	9967.756	.000	1	.021	5.594	.000	.
Protection measures	-22.017	7811.836	.000	1	.998	.000		

**Table 4:** Portals are communicated and facilitated way of communication and Portal is a need for the college student of higher education

<b>Correlations</b>			
		Portals are communicated and facilitated way of communicating with other students.	Portal is a need for the higher education students, who need a place to connect actively with other classmates.
Portals are communicated and facilitated way of communicating with other students.	Pearson Correlation	1	.496**
	Sig. (2-tailed)		.000
	N	400	400
Portal is a need for the higher education students, who need a place to connect actively with other classmates.	Pearson Correlation	.496**	1
	Sig. (2-tailed)	.000	
	N	400	400

\*\* . Correlation is significant at the 0.01 level (2-tailed).

**Table 5:** Pearson Correlation test

	RBAC is better than UCON	RBAC model better identify tools and search engines relevant information	Privacy is fundamental for data sharing	Knowledge management requires the data collection after every six months
UCON is better than RBAC	.984**	--	--	--
RBAC is better than UCON	--	.713**	--	--
Secure semantic web and preserving of data mining should be main technology	--	--	-.147*	--
Audit strategies must be conducted every year	--	--	--	.241**

**Figure Legends**

**Figure 1:** Knowledge protection model

**Figure 2:** Graphical representation of data privacy techniques

**Figure 3:** Summary of Results