Impact of Application of Data Mining in the Lebanese Banking Sector

Kamel Hassan Kalakech[1] & HasanYousef El-Mousawi[1]

[1] Associate Professor, Lebanese University, Beirut, Lebanon

Correspondence: HasanYousef El-Mousawi, Faculty of Economical Sciences and Business Administration, Lebanese University, Beirut, Lebanon. Tel: 961-328-1831 or 961-7008-8037. E-mail: h_mousawi@hotmail.com

Abstract

This study aims at showing the level of implementing concepts and tools of data mining in the banking sector in Lebanon in addition to its constituent domains. The researchers adopt the descriptive-analytical method which is based on a questionnaire distributed on the society of the study. The researchers found that there is an interest in applying concepts of data mining in managing operations in the Lebanese banking sector. The researchers concluded that there is difference among the respondents' opinions regarding applying concepts of data mining in managing operations in Lebanese banks as related to difference in experience, in job levels and in qualifications.

Keywords: data mining, banking, classification, clustering, data warehouse

1. Introduction

There is an overwhelming amount of data: scientific, medical, demographic, financial and marketing data. People have no time to examine this data. Human attention has become the precious resource. So, we had to find ways to automatically analyze the data, classify it, discover and characterize trends in it, and spot anomaly.

The conventional way of extracting information is time-consuming and costly at the same time. With all the new computer technology available, it can process data beyond human capacity and speed, and much more efficiently than ever before. A large number of researchers are becoming more and more interested in data mining after its techniques developed and succeeded in such domains as finance, investing, marketing, accounting and banking.

In fact analyzing large mounds of data is a must. Every enterprise benefits from collecting and analyzing its data: banks can detect trends and anomalies in their customer accounts records, search engines can do better ranking and placement of ads, and environmental and public health agencies can spot patterns and abnormalities in their data. The list continues, with cyber security and detection of computer network intrusion; monitoring the energy consumption of household appliances; business and financial intelligence data; sporting trends in blogs, and many more. Storage is inexpensive and getting even less, so are data sensors. Thus, collecting and storing data is much easier than before. So, the problem becomes how data should be analyzed.

After going through previous studies about data mining, it becomes evident that there is not enough attention given to the philosophical foundations of data mining. As a result, there are many basic controversial questions which remain incomprehensible regarding the definition, foundation and scope of data mining. Introducing technology, mainly data mining, into the business world is a great innovation which helped organizations develop their perspective into business.

Computerizing our society has considerably improved our abilities to generate and collect data from various sources. A huge amount of data has flooded into almost every aspect of our lives. This unstable growth in stored or transitory data has created an urgent need for new techniques and automated tools that can intelligently assist us in transforming these vast mounds of data into useful information. This has led to the generation of a promising, flourishing frontier in computer science called data mining and its various applications.

2. Literature Review

Data mining emerged during the late 1980s, made great strides during the 1990s, and continues to prosper into the new millennium. This review of literature focuses on how data mining techniques are used for different application areas, especially in the banking sector to automatically, analyze the data, classify it, discover and characterize trends in it, and spot anomalies.

Tae et al. (1999) aimed at how data mining approach develops a bankruptcy prediction model suitable for normal & economic crisis conditions. It examines the dynamics of model change from ordinary to crisis condition and provides an interpretation of bankruptcy classification. The bankruptcy projection model showed that the major variables in predicting bankruptcy were "cash flow to total assets" and "production of capital" under usual circumstances and "cash flow to liabilities", "Fixed assets to long term liabilities and stockholders' equity" under emergency conditions. The accuracy rate of final prediction models in normal conditions and in emergency conditions was found to be 83.3 percent and 81.0 percent respectively. When the normal model was applied in emergency situations, projection accuracy dropped considerably in the case of bankruptcy classification (from 66.7 percent to 36.7 percent).

Özekes and Çamurcu (2002) prepared a function in data mining regarding classification and prediction. In this function, by examining the credits granted to customers in the past by a bank and the credits contracts that are ended, the decision tree and classification rules were formed. Following this, by using these classification rules, the status of repayment of customers' credits with credit contracts continuing was estimated.

Aşan (2007), aimed at classifying the socio-economic characteristics of clients, utilizing credit cards. With priority as a functional conclusion, the individual banking and credit cards are defined; the place and importance of this concept in this country are explained and bank customers who are using credit cards are put into groups employing clustering analysis. Bank clients which are placed into relation with this method, are classified into three groups, according to their socio-economic characteristics and into three sets. According to the three sets, it is observed that the customers differ, according to ten socio-economic indicators.

Linoff and Berry (2011) have given the Data mining techniques for marketing, Sales and customer relationship management (CRM), also Han and et al. (2011) have given the same approach.

Devale and Kulkarni (2012) investigate the use of various data mining techniques for knowledge discovery in the life insurance business. They introduced different ways for discovering knowledge in the form of association rules, clustering, classification and correlation suitable for data characteristics. They concluded that the decision maker must be a practicing statistician to gain a greater understanding of their business to help reduce fraud, improve underwriting and enhance risk management.

Kalyani (2012) exposed in his study several major data techniques that can be used in data mining such as clustering, association, classification, sequential patterns and prediction, etc. These techniques can help in finding the patterns to predict future trends in businesses to get bigger.

Moin and Ahmed (2012), in their paper, give an overview of the concept of data mining and highlights the applications of data mining to improve the performance in the banking sector.

Petre (2013) focuses in her study on presenting the applications of data mining in the business environment. Also, her paper presents the main business areas which can benefit from the use of data mining tools: retail, banking and insurance. Peter concluded, that the architecture proposed for the data mining solution for the business environment would improve the efficiency of the company, by providing valuable decision making knowledge to minimize operating costs and gain competitive advantage.

Ramageri and Desai (2013) explain in their study, how data mining can be applied, and be useful, in the retail industry to make better business decisions. They proved that in retail industry data mining techniques can be deployed for market campaigns, to target profitable customers using reward based points. By doing so, the retail industry will make a better profit, resist and will be more successful in this competitive market if adopted data mining technology for market campaigns. Pulakkazy and Balan (2013) study reveals about data mining techniques used in the banking sector. Using this technique the decision making will become easier and faster. Banks are using data mining in marketing, credit risk management, detection of money laundering, liquidity management, investment banking, and fraud detection. The identified patterns help the bank predict future proceedings.

Jayarsee and Balan (2013) show the significance of data mining technologies and its advantages in the banking and financial sectors.

Chitra and Subashini (2013) in their study analyze the data mining techniques and its applications in banking sector like customer retention, automatic credit approval, fraud prevention and detection, acquiring new customer, provide segment based products, marketing and risk management. At last concludes that data mining techniques are very useful to the banking sector, so the decision-making process becomes very fast.

Raju et al. (2014) provide a critique of the concept of data mining and customer relationship management in organized banking and retail industries. Their study discusses various tasks and applications of data mining in

different sectors. They concluded that its applications in different areas as analyzing medical outcomes, detecting credit card fraud, predicting customer purchase behavior, predicting the personal interests of Web users, etc. have been very successful. Also, the retail industry is becoming aware that data mining techniques could give them a competitive advantage. Also, they confirmed that the actors of this industry have realized the utility of data mining and its significant importance in their decision-making process and derive considerable competitive advantage to withstand competition in future in addition to immense benefit.

Islam and Habib (2015) attempt to build up a model to predict prospective business sectors in retail banking. To achieve this, data mining techniques are adopted to analyze the challenging issues, where pruned decision tree classification technique has been used to develop the model.

Hamid and Ahmed (2016) use data mining to develop a predictive model for classifying loan risk in the banking sector. This model can be used to predict and classify the applications of loans that are introduced by the customers to good or bad loan by investigating customer behaviors and previous pay back credit.

Sudhakar and Reddy (2016) give an effective prediction model for the bankers that help them predict credible customers who have applied for a loan. Decision Tree Induction Data Mining Algorithm is applied to predict the attributes relevant to credibility.

Soumya and Deepika (2016) present data mining with predictive analytics for financial applications and explores methodologies and techniques in data mining area combined with predictive analytics for application-driven results for financial data. They concluded that financial services institutions use predictive analytics to segment customers and predict which ones will react well to cross-selling promotions. Predictive analytics is ideal for classifying which customers are likely to respond to offers for additional products and services, allowing banks to achieve profitability in the near term.

Preethi and Vijayalakshmi (2017) analyze the various data mining techniques and concepts that can be applied to the banking sector to enhance its performance. At last, concludes that bank will obtain a massive profit if they implement data mining in their process of data and decisions.

3. Research Problem and Hypotheses:

Drawing from the previous studies, the researchers have the following questions in mind:

- To what extent do banks in Lebanon have interest to work using data mining systems to have positive effects on the bank operations?

- Are there differences of statistical significance among the sample in implementing IT in running the banking operations which refer to the difference in years of experience, job level, and academic qualification?

Based on the questions, the researchers have the following hypotheses to discuss and to be accepted or rejected:

H_1: There is interest in implementing concepts of data mining technology in managing operations at Lebanese banks.

H_{02}: There is no difference of statistical significance among the respondents' opinions about implementing concepts of data mining technology in managing operations at Lebanese banks, as relative to difference in experience, job level or academic qualification.

4. Theoretical Framework

4.1 Data Mining

Data mining has become a modern concept in support of successful decision-making systems in modern-day business organizations (Michael et al., 2000). There emerged the need for a practical phase to conclude specifications and relations between given information, in addition to presenting information which was not popular previously in the domain of traditional information systems. This is called data mining which provides new roles to previous one where it supplies information and wide knowledge which help in making better decisions. This includes the following (Turban & Leinder, 2008):

- Creating Knowledge: Knowledge systems supply employees in the cognitive domain with graphs, analysis, means to manage documents, in addition to access to internal and external sources of information and knowledge.

- Discovering and Codifying Knowledge: Artificial Intelligence Systems have provided the possibility of integrating experience in order to indentify relations and patterns within large amount of information. Decision Support Systems can analyze a large data-base and discover new information.

- Sharing Knowledge: Collaborative systems can help employees access simultaneously and work on the same document from distinct locations to coordinate their various activities.

- Distributing Knowledge: Information and communication systems can supply documents and other means of information and distribute them among employees in the information sector to link offices to other business units inside and outside the organization.

Consequently, features which data mining support with – such as providing accurate information quickly– show the importance of this technique in decision-making. Most important features of data mining include (Hussein, 2004):

a) Helping the decision-maker enhance association among different divisions of an organization.

b) It facilitates tackling modern information technology and helps valuate the efficiency and productivity of subsidiary information systems through providing accurate information.

c) It helps the efficient use of available data sources and plan to improve available accounting and banking systems.

d) It helps disclose the organization's ability and capacity to evolve and be in accord with development and its needs to improve information systems of technical and human resources.

e) It enables decision-makers to plan for continual testing and problem-finding, in addition to control over data information files necessary for decisions.

f) It assists the decision-makers in whatever they need to make decisions which enhance work, accomplish tasks and facilitate procedures.

Consequently, the information technology environment has created a novel concept which was rarely recognized before because of the great current need for information and for all forms of communication and relation between financial and economic activities. Great need for search engines emerged to seek a lot of information as a result of progress in knowledge concepts; thus, the following needs were urgent:

I. Administrative Level Needs

Accounting and banking information systems help all administrative levels by providing information necessary to manage their work. Following are the administrative levels (Kassem, 2004):

1) The Strategic Level Administration: The higher level needs information for long-term planning and specifying goals to be achieved.

2) Management Level Administration: These are middle level management which use the information for medium-term planning and for changing the goals to working programs and specifying the financial and human costs for each of the goals.

3) Knowledge Level Administration: This class of administration uses the information for short term planning and in changing plans and programs to detailed agendas which involve employees who work in data, knowledge and information.

4) Operational Level: This is the main basis for an organization's actions which include managing operations (Dahrawi, 2007).

II. Systems Relations

Accounting and banking information systems interact with a large sum of individuals who are sharing in managing the systems' affairs. Most important domains of this interaction is as follows (Helms & Mancino, 1998):

A. Category of employees involved in the communication: These vary according to the quality of information that they need to manage and accomplish their jobs.

B. Communication through the systems: Banking and accounting systems rely on a number of procedures and activities which are influenced by the information technology environment.

C. Communication with other systems: Most operating systems receive input from other systems. Thus, it is vitally important to specify the procedures and conditions under which the connection is made.

D. Finding search engines among a number of systems: Information systems interact within a greater system and there should be a clear relation whose results should be in the data basis which can satisfy the requirements of all information services which are designed for different purposes and intended for

different users.

4.2 Information Production

Accounting can be considered as an information system which is specific to identifying, measuring and producing enough information about the economic organization which can be used in valuation and decision-making by users of this information (Romney & Steinbart, 2003). Consequently, the financial events in the life of any individual or organization can be followed up in a way that enables the individual or organization to disclose the financial position and the activities done for everyone who is interested in that individual or organization.

Producing information through accounting systems is considered necessarily important which should comply with a group of standards which guarantees its quality as the outputs of accounting information systems are important to get the greatest value from them within the least time and effort. Tackling these outputs should be in accord with the following standards (Kashef, 2000):

A.   Standards of using information: Using outputs of banking and accounting information system is a requirement within and outside the organization; therefore, the process of producing information is two types as follows:

-    Information necessary for use in the bank: It is included in the reports presented to the decision-makers and managers.

-    Information for use outside the bank: It includes reports presented to parties of interest in the activities of the bank.

B.   Standards of size of the produced information: The size of the required information affects the method used to obtain it. Thus, if the required information is much, factors of producing it typed is affected by speed of getting it accessible and speed of the means used in producing it such as monitors, printers, network, etc.

C.   Standards of quality of produced information: Knowledge of how to use information helps in determining the level of quality required, such as the case when the managers require certain information to make a decision, the level of quality of presented information should reach the point of zero error (Marakas, 2003).

D.   Standards of costs of produced information: Cost of produced information in accounting information systems is affected with the time required to produce it or the level of quality required since it requires some high cost technology (Ener, 1992).

4.3 Data Warehousing

Information technology has created new roles for accounting information systems which enable them to tackle the information in ways that are different from traditional ways. Following are some:

a.   Data Storage: Data passes through all stages of gathering and producing information which leads to the final result since one system's input is another system's output (Marakas, 2003). Thus, gathering information from different sources within the bank and changing it to homogeneous data which helps in decision-making enables everyone of interest to access the information which is in a data-base waiting to be processed then stored in the data-base to be used later.

b.   Storing data to meet quality standards: Inputs of accounting and banking information technology is important for producing proper information that meets its required characteristics since tackling information systems inputs starts with gathering tasks and activities necessary to obtain data and getting it to the first step in the systems (Kassem, 2004).

c.   Storing data to meet the needs of users: The need for information requires storing data to guarantee coordination among activities and distribution among employees and other people of interest to reduce time and present it properly, correctly and inexpensively (Enderson & William, 2002).

5. Methodology

The researchers adopted the qualitative and descriptive approach, utilizing an empirical study. The researchers developed a questionnaire to collect necessary data for the study to be analyzed using SPSS method. The questionnaire is of about 30 items to be distributed to a population of commercial banks in Lebanon. As for the sample surveyed, it includes personnel who work in Information Technology (IT), people concerned in creating accounting and banking systems, and people who work in key banking operations. The researchers distributed 160 copies of the questionnaire in 50 banks and their branches operating in Lebanon.

6. Procedures and Methods

6.1 Population and Sample

Since the topic of the research is **"**Impact of Application of Data Mining in the Lebanese Banking Sector", the society of the study was employees of nine banks operating in Lebanon, by varying the banks and their regions of operation and varying employees as to their different positions and tasks required from them in addition to their authorities and responsibilities. In the empirical part of the study, the researchers utilized a questionnaire which is an important source of information necessary for the study.

The total number of questionnaires distributed on the sample was 160. The researchers retrieved 155, 150 of which were valid for the study. This sample represents the society of the study and its general inclination.

Table 1. Sample distribution

Career level	Frequency	Percent %
Manager	9	6
Head of department	44	29.3
Employee	97	64.7
Total : N	150	100.0

6.2 Instrumentation

Based on the literature review, an informal discussion with high leveled banking experts was conducted, after which the researchers constructed a three-point scale questionnaire and asked managers of banks, heads of departments and employees to respond to the items as shown in the table below:

Table 2. Mean

Weighted average	Mean
1 - 1.66	High
1.67 - 2.33	Medium
2.34 - 3	Low

Findings of the current study show the reliability of the scale used, Cronbach's Alfa was calculated using SPSS to check the accuracy of the sample's responses.

It is clear from the above **table** that Cronbach's Alfa is 0.969 (96.9%) in general for the questions, which is a strong sign of reliability.

Table 3.Cronbach's Alpha

Domain	Variables	Cronbach's Alpha Based on Standardized Items	Cronbach's Alfa
First	8	0.983	0.971
Second	8	0.967	0.968
Third	7	0.954	0.958
Fourth	7	0.977	0.979
Fifth	7	0.988	0.987
Sixth	7	0.957	0.959
All Domains	44	0.965	0.969

7. Testing and Analyzing the Hypotheses

7.1 First Domain: The Extent of Attention for Knowledge Work Environment Using Information Technology (IT)

Table 4.The extent of attention for knowledge work environment using information technology (IT).

	Items	High	Medium	Low	Sig.(2-tailed)	Std.deviation
Q1	Using IT systems has changed the direct work environment toward increasing its efficiency.	30.7	45.3	24.0	0.001	1.145
Q2	Using IT has changed the culture of the bank toward internal and external clients.	34.7	26.7	38.6	0.000	1.123
Q3	Using advanced algorithms has made positive changes in the service domains which respond to a client's needs.	42	22.7	35.3	0.000	1.135

Q4	Using IT has helped in transferring data from the bank and to it and among its departments and branches.	37.4	35.3	27.3	0.002	1.015
Q5	The used algorithms help in processing data fast enough to meet the requirement of clients getting service as they hope.	29.3	30.7	40	0.000	1.174
Q6	The technological advancement the bank reached achieves the principle of technological innovation based on a huge stock of knowledge and applications.	29.3	50.7	20	0.000	1.189
Q7	Data transfer systems achieve the principle of technological innovation based on human effort.	38	25.3	36.7	0.002	1.041
Q8	Technological innovation leads to devising new ideas in an organized and convenient framework.	36.7	38	25.3	0.000	1.324
	Total	**34.75%**	**34.33%**	**30.91%**	**0.0006**	**1.120**

The above table 4 shows that the answers of 76% of the sample were high and medium that "using IT systems has changed the direct work environment toward increasing its efficiency", while 34% responded as low. The table also shows that 61.4% of the sample responded high and medium that "using IT has changed the culture of the bank toward internal and external clients", while 38.6% were low. The table also shows that answers of 64.7% of the sample were high and medium that "using advanced algorithms has made positive changes in the service domains which respond to a client's needs", while 35.3% were low. The table also shows that answers of 72.6% of the sample were high and medium that "using IT has helped in transferring data from the bank and to it and among its departments and branches", while 27.2% were low. It is also evident from the above table that the answers of 60% of the sample were high and medium that "the used algorithms help in processing data fast enough to meet the requirement of clients getting service as they hope", while 20% were low. The table also shows that 80% of the sample responded high and medium that "the technological advancement the bank reached achieves the principle of technological innovation based on a huge stock of knowledge and applications", while 20% were low. It is also evident from the above table that the answers of 63.3% of the sample were high and medium that "the used algorithms help in processing data fast enough to meet the requirement of clients getting service as they hope", while 36.7% were low. The table also shows that answers of 74.7% of the sample were high and medium that "technological innovation leads to devising new ideas in an organized and convenient framework", while 25.3% were low.

7.2 Second Domain: The Extent of Attention for Enhancing Knowledge Systems Using Evolvement of Search Systems

Table 5. The extent of attention for enhancing knowledge systems using evolvement of search systems

	Items	High	Medium	Low	Sig. (2-tailed)	Std. deviation
Q1	The bank realizes knowledge of the field to be worked on by attaining necessary, scientific and technical data depending on internal and external sources of data.	45.3	31.4	23.3	0.001	1.165
Q2	The bank gets the verbal and written data which is available in data banks using proper techniques.	48	27.4	24.6	0.000	1.087
Q3	The bank is capable of valuation based on the ability to discover risks and threats.	50.7	26	23.3	0.003	1.062
Q4	The bank has the ability to know the modern technological potentials which enables it to get verbal and written data which is available in data banks.	40.1	38.6	21.3	0.000	1.115
Q5	The bank has the ability to evaluate the available potentials and the possibility of using them externally.	34.1	39.3	26.6	0.005	1.274
Q6	The bank has the ability to integrate all theoretical and practical knowledge elements to find something new, the ability to integrate various technological resources.	32.7	38	29.3	0.000	1.221
Q7	The bank realizes that work or research requires innovation, hard work and focus to go beyond what is available relying on present knowledge.	44	36.7	19.3	0.001	1.096
Q8	The bank realizes that developing communication technology is a must and requires innovating the used technology on the part of economic business organizations to adapt with society requirements.	30.1	28.6	41.3	0.001	1.371
	Total	**40.56%**	**33.21%**	**26.12%**	**0.0013**	**1.143**

The above table 5 shows that the answers of 76.7% of the sample were high and medium that "the bank realizes knowledge of the field to be worked on by attaining necessary, scientific and technical data depending on internal and external sources of data", while 23.3% responded as low. It is evident from the table that 75.4% that "the bank gets the verbal and written data which is available in data banks using proper techniques", while 24.6% were low.

The table also shows that the answers of 76.7% of the sample were high and medium that "the bank is capable of valuation based on the ability to discover risks and threats", while 23.3% responded as low. It is evident from the table that 78.7% that "the bank has the ability to know the modern technological potentials which enables it to get verbal and written data which is available in data banks", while 21.3% were low. The above table also shows that the answers of 73.4% of the sample were high and medium that "the bank has the ability to evaluate the available potentials and the possibility of using them externally", while 26.6% responded as low. The above table shows that the answers of 70.7% of the sample were high and medium that "the bank has the ability to integrate all theoretical and practical knowledge elements to find something new, the ability to integrate various technological resources", while 29.3% responded as low. It is evident from the table that 80.7% that "the bank realizes that work or research requires innovation, hard work and focus to go beyond what is available relying on present knowledge", while 19.3% were low. The above table also shows that the answers of 73.4% of the sample were high and medium that "the bank has the ability to evaluate the available potentials and the possibility of using them externally", while 26.6% responded as low. The above table also shows that the answers of 58.6% of the sample were high and medium that "the bank realizes that developing communication technology is a must and requires innovating the used technology on the part of economic business organizations to adapt with society requirements", while 41.3% responded as low.

7.3 Third Domain: The Extent of Attention Given to Search Systems as a Tool to Exchange Knowledge with External Environment

Table 6. The extent of attention given to search systems as a tool to exchange knowledge with external environment

	Items	High	Medium	Low	Sig. (2-tailed)	Std. deviation
Q1	The bank works as an open system where it relies on the elements available in the external environment, with its various frames, in its inputs.	49.3	22.1	28.6	0.000	1.174
Q2	The bank is concerned with monitoring and following up the external surrounding to adapt with it, and does its best to incorporate with it to lessen its negative consequences.	45.3	27.7	27.3	0.001	1.417
Q3	The bank perceives the importance of adopting modern concepts in success of decision support systems in modern business organizations and in providing data which helps making decisions.	44.1	34.6	21.3	0.000	1.145
Q4	The bank recognizes the need for a procedural stage to extract relations and specifications from data and present new data strange to traditional work systems.	39.3	38.7	22	0.002	1.114
Q5	The bank realizes that the requirements of the external environment in the form of used systems have impelled a new environment toward practicing the knowledge role as integrated systems to whom new roles additional to their traditional roles are added, which supply new data and vast knowledge which helps in taking good decisions.	32.6	40.1	27.3	0.000	1.126
Q6	The bank realizes the importance of helping service recipients to understand services that are based on correct available data about them.	33.3	37.4	29.3	0.002	1.347
Q7	The bank realizes the importance of service recipients understanding services designed to fulfill their needs, being concerned with accounting and banking data systems because of the results reflected in the services they receive.	43.3	37.4	19.3	0.004	1.412
	Total	**41.01%**	**33.87%**	**25.01%**	**0.0012**	**1.152**

The above table 6 also shows that the answers of 71.4% of the sample were high and medium that "the bank works as an open system where it relies on the elements available in the external environment, with its various frames, in its inputs", while 28.6% responded as low. The table also shows that the answers of 72.7% of the

sample were high and medium that "the bank is concerned with monitoring and following up the external surrounding to adapt with it, and does its best to incorporate with it to lessen its negative consequences", while 27.3% responded as low. The table also shows that the answers of 78.7% of the sample were high and medium that "the bank perceives the importance of adopting modern concepts in success of decision support   systems in modern business organizations and in providing data which helps making decisions", while 21.3% responded as low. The table also shows that the answers of 78% of the sample were high and medium that "the bank recognizes the need for a procedural stage to extract relations and specifications from data and present new data strange to traditional work systems", while 22% responded as low. The table also shows that the answers of 72.7 % of the sample were high and medium that "the bank realizes that the requirements of the external environment in the form of used systems have impelled a new environment toward practicing the knowledge role as integrated systems to whom new roles additional to their traditional roles are added, which supply new data and vast knowledge which helps n taking good decisions", while 27.3% responded as low. The table also shows that the answers of 70.7% of the sample were high and medium that "the bank realizes the importance of helping service recipients to understand services that are based on correct available data about them", while 29.3% responded as low. The table also shows that the answers of 80.7% of the sample were high and medium that "the bank realizes the importance of service recipients understanding services designed to fulfill their needs, being concerned with accounting and banking data systems because of the results reflected in the services they receive", while 19.3% responded as low.

7.4 Fourth Domain: The Extent of Attention Given to Search Systems as Tools of Knowledge Exchange with the Internal Environment

Table 7. The extent of attention given to search systems as tools of knowledge exchange with the internal environment

	Items	High	Medium	Low	Sig. (2-tailed)	Std. Deviation
Q1	Upper-level managements use produced data for long-term planning, drawing general policies and goals, and specifying goals to be achieved.	45%	33.5%	21.5%	0.000	1.195
Q2	Mid-level managements use produced data for mid-term planning, interpreting goals to work schedules, and specifying material and human resources necessary for specific goals.	44%	41%	15%	0.000	1.241
Q3	Supervisory managements use produced data for short-term planning and changing plans into detailed programs incorporating those who work with data, information and knowledge.	39%	37%	24%	0.000	1.147
Q4	4- Data mining helps system users find solutions for their problems, understand using systems, their inputs processes and outputs; and consequently, the form of reports they will sign and adopt.	34%	31%	35%	0.000	1.174
Q5	Data mining helps programmers and system analysts know how their bank works and supplies them with what they need to understand its goals, function of actions in it and to solve problems they are responsible for.	40%	22.4%	37.6%	0.001	1.185
Q6	Data mining helps find ability of communication among employees concerned with performing services clearly, whose result is the well-being of system operations planned for use at the bank and for fast, efficient processing.	37.5%	26.4%	36.1%	0.000	1.365
Q7	The management helps in reaching the results required from accounting, banking and search systems to solve management and bank problems and in noting the importance of the goals to be achieved at the bank.	33.8%	30.4%	35.8%	0.001	1.741
	Total	**39.04%**	**31.67%**	**29.28%**	**0.000**	**1.204**

The above table 7 shows that the answers of 78.5% of the sample were high and medium that "upper-level managements use produced data for long-term planning, drawing general policies and goals, and specifying goals to be achieved", while 21.5% responded as low. It is evident from the above table that 85% that "mid-level managements use produced data for mid-term planning, interpreting goals to work schedules, and specifying material and human resources necessary for specific goals", while 15% were low. It is also evident from the above table that 76% that "supervisory managements use produced data for short-term planning and changing plans into detailed programs incorporating those who work with data, information and knowledge", while 24%

were low. The table also shows that the answers of 65% of the sample were high and medium that "data mining helps system users find solutions for their problems, understand using systems, their inputs processes and outputs; and consequently, the form of reports they will sign and adopt", while 35% responded as low. The table also shows that the answers of 62.4% of the sample were high and medium that "data mining helps programmers and system analysts know how their bank works and supplies them with what they need to understand its goals, function of actions in it and to solve problems they are responsible for", while 37.6% responded as low. The table also shows that the answers of 63.9% of the sample were high and medium that "data mining helps find ability of communication among employees concerned with performing services clearly, whose result is the well-being of system operations planned for use at the bank and for fast, efficient processing", while 36.1% responded as low. It is also evident from the above table that 64.2% that "the management helps in reaching the results required from accounting, banking and search systems to solve management and bank problems and in noting the importance of the goals to be achieved at the bank", while 35.8% were low.

7.5 Fifth Domain: The Extent of Attention in Search Systems and Mining as a Supportive Tool to Manage Knowledge

Table 8. The Extent of attention in search systems and mining as a supportive tool to manage knowledge

	Items	High	Medium	Low	Sig. (2-tailed)	Std. deviation
Q1	Data mining is an impelling need to find knowledge among knowledge information systems, necessary to supply knowledge workers with graphs, analysis, communications and means of managing documents.	32.5%	33.8%	33.7%	0.000	1.165
Q2	Data mining is an impelling need to supply knowledge through knowledge information systems which help in reaching internal and external sources of information and knowledge.	29.6%	33.9%	36.5%	0.001	1.112
Q3	Data mining was a result of discovering knowledge supplied by artificial intelligence systems in the possibility of devising and fusing alternatives to find patterns and relationships in mounds of data.	45.9%	25.5%	28.6%	0.000	1.274
Q4	The bank applies the required decision support systems related to analyzing large data bases and discover new knowledge.	39.9%	22.4%	37.7%	0.001	1.415
Q5	Data mining requires classifying knowledge to find new patterns and relationships resulting from analysis of large data bases which can also discover new knowledge.	35.1%	41.3%	23.6%	0.000	1.195
Q6	Data mining is performed through sharing knowledge, based on collaborative cooperation can help workers reach and work on the same document from various positions and coordinate their various activities.	29.4%	26.8%	43.8%	0.000	1.108
Q7	Data mining is concerned with distribution of knowledge through office systems and communication tools which can supply documents and other forms of information, then circulate them among knowledge and information workers to link offices with other work units inside and outside the bank.	50.7%	21.4%	27.9%	0.000	1.117
	Total	37.42 %	29.35%	33.42 %	0.000	1.129

It is evident from the above table 8 that 66.3% that "data mining is an impelling need to find knowledge among knowledge information systems, necessary to supply knowledge workers with graphs, analysis, communications and means of managing documents", while 33.7% were low. It is also evident from the above table that 63.5% that "data mining is an impelling need to supply knowledge through knowledge information systems which help in reaching internal and external sources of information and knowledge", while 36.5% were low. The table also shows that the answers of 71.4% of the sample were high and medium that "data mining was a result of is covering knowledge supplied by artificial intelligence systems in the possibility of devising and fusing alternatives to find patterns and relationships in mounds of data", while 28.6% responded as low. The table also shows that the answers of 62.3% of the sample were high and medium that "the bank applies the required decision support systems related to analyzing large data bases and discover new knowledge", while 37.7% responded as low. It is also evident from the above table that 63.5% of the sample were high and medium that "data mining is an impelling need to supply knowledge through knowledge information systems which help in reaching internal and external sources of information and knowledge", while 36.5% were low. It is also evident

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International Journal of Economics and Finance
Vol. 11, No. 8; 2019

from the above table that 76.4% of the sample were high and medium that "data mining requires classifying knowledge to find new patterns and relationships resulting from analysis of large data bases which can also discover new knowledge", while 23.6% were low. The table also shows that the answers of 56.2% of the sample were high and medium that "data mining is performed through sharing knowledge, based on collaborative cooperation can help workers reach and work on the same document from various positions and coordinate their various activities", while 43.8% responded as low. The table also shows that the answers of 72.1% of the sample were high and medium that "data mining is concerned with distribution of knowledge through office systems and communication tools which can supply documents and other forms of information, then circulate them among knowledge and information workers to link offices with other work units inside and outside the bank", while 27.9% responded as low.

7.6 Sixth Domain: The Extent of Attention in Search Systems and Mining as a Decision Support Tool

Table 9. The extent of attention in search systems and mining as a decision support tool

	Items	High	Medium	Low	Sig. (2-tailed)	Std. deviation
Q1	The search systems used requires speed since required documentary procedures for information and servers are much faster when using computers, especially in restoring data.	36.6%	32.8%	30.6%	0.000	1.108
Q2	The search systems used are accurate to ensure accuracy and avoid errors, whose possibilities are more in traditional, manual systems than in computerized systems.	37.8%	24.7%	37.5%	0.000	1.103
Q3	The search systems used help save effort in dealing with information and its sources, processing it, storing it and managing it; and in restoring data and sources to use them by researchers and others.	41.7%	33.8%	24.5%	0.000	1.584
Q4	The search systems used help in saving massive amounts of data since data bases and warehouses are increasingly large compared to the huge potentials of electronic means of storing.	42.3%	22.2%	35.5%	0.000	1.962
Q5	The search systems used incorporate available alternatives in restoring data and using it better and on a wider scale than traditional systems.	29.9%	27.8%	42.3%	0.000	1.107
Q6	Most operation systems receive inputs from other systems, sent as outputs of the latter, in which conditions and procedures of communication between them are established.	53.2%	31.1%	15.7%	0.000	1.147
Q7	The bank realizes that outputs of search systems may include critical information which depends on time and size of the information sent and gives attention to specify requirements of reaching this information in due time among these search systems.	44%	23%	33%	0.000	1.162
	Total	**40.71%**	**28%**	**31.28%**	**0.000**	**1.249**

It is evident from the above table 9 that 69.4% of the sample were high and medium that "the search systems used requires speed since required documentary procedures for information and servers are much faster when using computers, especially in restoring data", while 30.6% were low. The table shows that the answers of 62.5% of the sample were high and medium that "the search systems used are accurate to ensure accuracy and avoid errors, whose possibilities are more in traditional, manual systems than in computerized systems", while 37.5% responded as low. The table shows that the answers of 75.5% of the sample were high and medium that "the search systems used help save effort in dealing with information and its sources, processing it, storing it and managing it; and in restoring data and sources to use them by researchers and others", while 24.5% responded as low. The table shows that the answers of 57.7% of the sample were high and medium that "the search systems used incorporate available alternatives in restoring data and using it better and on a wider scale than traditional systems", while 42.3% responded as low. The table also shows that the answers of 84.8% of the sample were high and medium that "most operation systems receive inputs from other systems, sent as outputs of the latter, in which conditions and procedures of communication between them are established", while 15.7% responded as low. It is also evident from the above table that 67% of the sample were high and medium that "the bank realizes that outputs of search systems may include critical information which depends on time and size of the information sent and gives attention to specify requirements of reaching this information in due time among

these search systems", while 33% were low.

8. Testing the Hypotheses

The research hypotheses were tested using One-Sample T-Test and Analysis of Variance (Anova).

The hypotheses are as follows:

First Hypothesis: There is interest in implementing concepts of data mining technology in managing operations at Lebanese banks.

Second Hypothesis: There is no difference of statistical significance among the respondents' opinions about implementing concepts of data mining technology in managing operations at Lebanese banks, which refer to difference in experience, job level or qualifications.

8.1 Testing the First Hypothesis

H_1: There is interest in implementing concepts of data mining technology in managing operations at Lebanese banks.

After analyzing the 44 questions of the second section (6 domains) using One-Sample T-Test, the following results were available:

Table 10. Mean and standard deviation for all items

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
H1	150	1.6714	0.47289	0.3861

Table 11. Results of one-sample test

One-Sample Test					
Test Value = 1.5					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference
					Lower	Upper
H1	-37.344	149	0.000	-1.44190-	-1.5182-	1.3656

The above table regarding the first hypothesis shows that the value of the significance (sig) is 0.000, which is smaller than the significance 0.05. This means accepting the hypothesis. Consequently:

"There is interest in implementing concepts of data mining technology in managing operations at Lebanese banks."

8.2 Testing the Second Hypothesis

H_{02}: There is no difference of statistical significance among the respondents' opinions about implementing concepts of data mining technology in managing operations at Lebanese banks, which refer to difference in experience, job level or qualifications.

8.2.1 The Variable 'Experience'

After analyzing the 44 questions of the second section (6 domains) as related to the first hypothesis, the difference between these results and the variable 'experience' in the demographic information as follows:

Table 12. Mean and standard deviation

Confidence Interval for Mean 95%			
Experience (Years)	N	Mean	Std. Deviation
Less than 5 years	9	1.409	0.641
5 to Less than 10 years	44	1.606	0.610
10 to less than 15 years	49	1.861	0.531
15 to less than 20 years	35	2.444	0.466
More than 20 years	13	2.101	0.485
Total	150	1.916	0.634

8.2.2 One Way Anova

Table 13. Results of one way anova test

Source of Variance	Sum of squares (SS)	df	Mean squares	F Calculated	F Tabulated	Sig.
Between Groups	$SS_B =$ 16.894	$K - 1 =$ $5 - 1 =$ 4	$S_B^2 =$ 16.89/4= 4.223	S_B^2/S_W^2 4.22/0.297 =14.207		0.000
Within Groups	$SS_W =$ 43.107	$N - K =$ $150 - 5 =$ 145	$S_W^2 =$ 43.10/145= 0.297		$F_{\alpha (K-1),}$ $(N-K)$ 11.258	
Total	$SS_T=$ $SS_B + SS_W=$ 60.001	$N - 1 =$ $150 - 1 =$ 149				

From the above table, it is clear that the value of F Calculated is 14.207, which is greater than the value of F Tabulated, which is 11.258. As a result, the null hypothesis is rejected at α = 0.05. Consequently:**"There is difference of statistical significance among the respondents' opinions about implementing concepts of data mining technology in managing operations at Lebanese banks, which refer to difference in experience, job level or qualifications."**

8.2.3 The Variable 'Job Level'

After analyzing the 44 questions of the second section (6 domains) as related to the first hypothesis, the difference between these results and the variable 'job level' in the demographic information as follows:

Table 14. Mean and standard deviation

Confidence Interval for Mean 95%			
Job Level	N	Mean	Std. Deviation
Manager	9	1.409	0.641
Head of Department	44	1.584	0.608
Employee	97	2.11	0.557
Total	150	1.916	0.634

8.2.4 One Way Anova

Table 15. Results of one way anova test

Source of Variance	Sum of squares (SS)	df	Mean squares	F Calculated	F Tabulated	Sig.
Between Groups	$SS_B =$ 10.982	$K - 1 =$ $3 - 1 =$ 2	$S_B^2 =$ 10.98/2= 5.491	S_B^2/S_W^2 5.49/0.333 =16.466		0.000
Within Groups	$SS_W =$ 49.019	$N - K =$ $150 - 3 =$ 147	$S_W^2 =$ 49.01/147= 0.333		$F_{\alpha (K-1),}$ $(N-K)$ 12.354	
Total	$SS_T=$ $SS_B + SS_W=$ 60.001	$N - 1 =$ $150 - 1 =$ 149				

From the above table, it is clear that the value of F Calculated is 16.466, which is greater than the value of F Tabulated, which is 12.354. As a result, the null hypothesis is rejected at α = 0.05. Consequently:

"There is difference of statistical significance among the respondents' opinions about implementing concepts of data mining technology in managing operations at Lebanese banks, which refer to difference in experience, job level or qualifications."

8.2.5 The Variable 'Qualifications'

After analyzing the 44 questions of the second section (6 domains) as related to the first hypothesis, the difference between these results and the variable 'qualifications' in the demographic information as follows:

Table 16. Mean and standard deviation

Confidence Interval for Mean 95%			
Qualification	N	Mean	Std. Deviation
Lower than a B.A.	16	2.031	0.497
B.A	56	1.763	0.643
Masters	69	2.080	0.600
Ph.D	9	1.409	0.641
Total	150	1.916	0.634

Table 17. Results of one way anova test

Source of Variance	Sum of squares (SS)	df	Mean squares	F Calculated	F Tabulated	Sig.
Between Groups	$SS_B =$ 5.687	$K - 1 =$ $4 - 1 =$ 3	$S_B^2 =$ 5.68/3= 1.896	S_B^2/S_W^2 1.89/0.372 =5.095		0.000
Within Groups	$SS_W =$ 54.314	$N - K =$ 150 - 4= 146	$S_W^2 =$ 54.3/146= 0.372		$F_{\alpha(K-1),(N-K)}$ 3.857	
Total	$SS_T=$ $SS_B + SS_W=$ 60.001	$N - 1 =$ 150 - 1 = 149				

From the above table, it is clear that the value of F Calculated is 5.095, which is greater than the value of F Tabulated, which is 3.857. As a result, the null hypothesis is rejected at α = 0.05. Consequently:

"There is difference of statistical significance among the respondents' opinions about implementing concepts of data mining technology in managing operations at Lebanese banks, which refer to difference in experience, job level or qualifications."

9. Conclusions and Recommendations

Based on all the above, the following results were obtained:

☐ There is interest in applying concepts of data mining in managing operations in Lebanese banks.

☐ There is difference of statistical significance among the respondents' opinions regarding applying concepts of data mining in managing operations in Lebanese banks.

☐ There is difference of statistical significance among the respondents' opinions regarding applying concepts of data mining in managing operations in Lebanese banks related to difference in experience.

☐ There is difference of statistical significance among the respondents' opinions regarding applying concepts of data mining in managing operations in Lebanese banks related to difference in job levels.

☐ There is difference of statistical significance among the respondents' opinions regarding applying concepts of data mining in managing operations in Lebanese banks related to difference in qualifications.

Based on the results of the study, the researchers recommends the following:

☐ Enhancing the relation among all IT systems presently applied at the Lebanese banks and benefiting from the IT outputs to be inputs in other banking systems; in addition to training the appropriate human cadres in order to boost their performance.

☐ Selecting innovative IT systems and tools which can enhance the banking operations which may increase profits to shareholders.

☐ Adopting the most updated concepts and tools in order to increase the efficiency of decision-making system to provide the suitable type of information at the right time to help redirect the deviation if it exists.

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