

Selection of Specialization in Management Program- A Decision Tree Approach

Dr. Manohar Kapse, Assistant Professor, Institute of Management, Christ (Deemed to be University), Bangalore, Karnataka, India. mk10oct@gmail.com

Dr. Anuradha Pathak, Associate Professor, Indore Institute of Management & Research, Indore, Madhya Pradesh, India. gokhale.anu@gmail.com

Dr. Vinod Sharma, Associate Professor, Christ Institute of Management, Delhi-NCR, India. sharmavins@gmail.com

Chandan Maheshkar, Research Scholar, Devi Ahilya University, Indore, MP, India ch.maheshkar@gmail.com

Abstract

Purpose: This paper aims to provide insights into the factors which influence the selection of Specialization/Major in MBA program by second year MBA students of Indian Universities. **Design/Methodology/Approach:** Exploratory research design has been used in this study. The data was collected through online survey method from the top 30 universities of the country. 783 responses were received out of which only 473 valid responses were finalised for the analysis. The decision tree model for selection of specialization has been used to understand the criteria of selecting specializations. A predictive model is also developed using random forest with an accuracy of 88%.

Findings: The study found that Graduation score, Work Experience, Overall Percentage in MBA I Year, Percentage in Class 12th, Percentage in Class 10th and Previous Degree are coming out to be very important factors in selecting a specialization.

Originality/Value: The study provides insights into the factors which influence the selection of Specialization/Major in MBA program by second year MBA students of Indian Universities. The results of the study will be very useful for the decision makers of management institutes of the country to plan their resources to gain competitive edge.

Keywords - Management Education, Specialization, Management Program, MBA, Decision Tree, and Random Forest

I. INTRODUCTION

The present era offers students with varied career choices. The scope for building career in has tremendously increased. Studies have shown that career choices are influenced by number of factors such as their personality, interest, social contacts, available resources, advice from family and friends, educational choices, remuneration and the passion (Kochung and Migunde, 2011; Bandura et al 2001; Gesinde 1986). Interest in any particular field comes out to be an important factor for making career choices as well as educational choices. Now-a-days, students are exposed to huge information regarding the subject choices and the career choices.

Many students are well informed and are very sure and know exactly what course or major to pursue and there are also many students who are not sure about their educational choices. Thus choosing the best course and thinking about

the future career prospects can be a tough decision, and students do face problem while selecting their majors or specialization as there are many factors that influence the selection of specialization. This selection is important for one's academic performance as well as for employment opportunities, salary package and their position in the society. Thus there is a need to identify what are all the factors that influence the selection of specialization. Identifying these factors will also help to determine the market trends of the running programmes.

II. LITERATURE REVIEW

The importance of Management education is increasing day by day. Businesses require good managers to manage effectively and efficiently. And therefore managerial skills become crucial for organizations to be competitive and successful in ever changing business environment. A managerial skill is acquired in due course of learning which

greatly depends on choices of subjects. As pointed by Essam et al (2017), *“the academic specialization chosen by students is of crucial importance for their future career and therefore they should have access to appropriate information and guidance that would help facilitate a more optimal decision”*.

Bantham Beggs (2008) has defined selection of specialization as *“the specialization which is provides the best ability to the student to achieve their educational and post-education goals, and the one which provides a match between the students’ abilities and interest”*. There are several factors that influence the selection of specialization. They are categorized in to four factors viz. Social, Personal, Cultural and Psychological factors.

Several studies have revealed that many things right from the occupation of parents to the teacher delivering the specialization course may influence the choice of student (Kapse et al, 2019; Malgwi et al., 2005; Kim et al., 2002; Pritchard et al., 2004; DeMarie & Aloise-Young 2003). Sarwar and Masood (2015) found that six factors related to academics, social capital, human capital, future prospects, market demand and job prospects contribute around 47 percent in the decision making process of students for selecting the specialization. Jane W. Wairimu (2013) found that Personal, Cultural, Social, Geographical and emerging industrial factors play a significant role in the learner’s Specialization selection in the MBA courses.

According to Malgwi, et al. (2005), one the most significant determinant which influence the selection of specialization are ‘interest in the subject’, ‘job opportunities’, ‘compensation’, ‘introductory course’, and ‘discussion with other students’. Essam et al (2017) found in his study that the most important factor which affect the students’ specialization selection criteria is ‘Liking and preference of specialization’ or interest in the field above monetary compensation and job opportunity (Kim et al. 2002; Edward and Quinter 2012, Zhang 2007; Kazi et al 2017). Shertzer and Stone (2003) identified in their research that performance in the examination is one of the major criteria of specializations selection.

The choice of specialization is not only based on students’ personal factors but it is also influenced by their aptitude level and academics, content quality, level of difficulty of the subject and workload. Career development and employment opportunities, Parents’ advice, friends and relatives and teachers also affect the selection of majors.

DeMarie and Aloise- Young (2003) identified career as the most influencing factor for making specialization choice followed by interest in the subject and fun/enjoyment or say satisfaction of learning. Lowe and Simons (1997) stated that specialization selection is determined by remunerations, career opportunities, initial earnings, and

aptitude. They also found that parents & teachers had only moderate influence on the decision.

Parents significantly affect the choice of specialization (Pearson and Dellman-Jenkins 1997) followed by teachers. Siblings, friends, and the media also influence the choice but to a smaller extent. Ahmed (2013) has found that selection of specialization is determined by future earnings, career option, occupational prestige and type of work. LE MARINAS et al (2016) found that “extrinsic” and “interpersonal factors” are significantly influencing the choice of business and administration students. These include “career development” and “personal abilities” of the business graduates, “competition in the field” and “parents” are identified as the least influencing factors. Ahmed Aftab (2014) found that “Interpersonal Influences” & “Financial Outcomes” are the most influencing factors for students’ career choice. Ibrahim Umar (2014) found that “Parental influence, self – desire, better pay, prestige and future prospects” were found to be the major influential factors. Claudia et al (2014) found that “familiarity with the specialization”, “chances to obtain a safe job after graduation”, “diversity of jobs”, “pleasure to study a specific program”, “curiosity” and “parents’ advice” are the attributes considered to be important by students. Vickneswaran and Balasundaram (2013) found that the most important variable for selecting the subject is ‘personal factors’.

Hossain and Siddique (2012) conducted a study on undergraduate students and they found that specialization selection is based on two factors named as “Financial benefit” and “Social Status”. Singh et al (2011) found that factors such as Ease and external influences followed by the Institute and lastly the Individual’s benefit are the factors which the females consider while choosing the subject. Siegall et al (2007) indicated that specialization is evaluated on the basis of “more interesting”, “useful”, and “satisfying”. Nazim (2015) studied the factors that influence student’s choosing a marketing course and found that selection of specialization is attributed by the factors which are closely related to that.

Research Objectives:

1. To determine the factors influencing Specialization Selection of Second Year Students of MBA Program in Indian Universities using a Decision Tree Model.
2. To develop a prediction model for the prediction of specialization of Second Year Students of MBA Program in Indian Universities.

III. RESEARCH METHODOLOGY

In order to understand the students approach towards selection of specialization/major, an exploratory design approach was used. The researchers adopted a random sampling method for the collection of data from the

students pursuing MBA second year. For the study a structured and self-administered questionnaire was developed. The questionnaire was circulated through email to the selected top 30 ranked universities of the country. A total of 783 responses were received out of which 473 responses were considered for final data analysis after removing out-liars from the list.

The demographic profiles of the respondents are tabulated in Table 1. The data indicated that there were 43.3 percent female respondents and 56.7 percent male. Interestingly, we could capture the data from nearly all the states of country therefore, we categorized them into six zones. It can be seen from the table that south zone had 54.4 per cent participation, north zone had 18.2 per cent, central zone was 11.8 per cent, east zone was 11 per cent, west zone was 3.4 per cent and north-east zone was 1.1 per cent. The majority of the respondents were from engineering background that was 49.7 per cent and others were 51.3 (Table 1 represents the detail description). We also wanted to check whether marital status has any relationship with specialization therefore, we asked about the marital status of the students where we found that only 2.3 per cent of the respondents were married. It was also found that 66.2 per cent of the respondents belong to urban area, 24.5 per cent belongs to semi urban and 9.3 per cent were from rural areas. As far as the financial condition is considered, 38.3 per cent of the respondent's family income (per annum) was less than 5 Lakh, 39.3 per cent lies between 5 to 10 Lakh, 11.6 per cent were from above 10-15 Lakhs and 10.8 per cent respondents' family income was more than 15 lakhs per annum. The literature has identified a very strong relationship between work experience and selection of specialization so we collected this information also and we had 41.1 per cent of the respondents with work experience ranging from 1 year to 4 years and rest 57.9 per cent were fresher. As far as specialization is considered, 36.6 per cent of the respondents were from marketing, 31.1 from finance, 22.4 per cent from lean operations and systems, and 9.9 per cent were from HR.

Table 1: Frequency Distribution Table

Categorical Variable	Categories	Frequency	Percent
Gender	Female	205	43.3
	Male	268	56.7
State Zone	North Zone	86	18.2
	East Zone	52	11.0
	West Zone	16	3.4
	South Zone	258	54.5
	North East	5	1.1
	Central Zone	56	11.8
Previous Degree	Commerce	148	31.3
	Engineering	235	49.7
	Management	44	9.3

	Science	43	9.1
	Arts	3	.6
Marital Status	Single	462	97.7
	Married	11	2.3
Place you belong to	Rural	44	9.3
	Semi Urban	116	24.5
	Urban	313	66.2
Family Income per annum	0-5 Lakh	181	38.3
	10-15 lakhs	55	11.6
	15 lakhs and above	51	10.8
	5-10 Lakhs	186	39.3
Work Experience	no experience	274	57.9
	less than 1 year	50	10.6
	1-2 year	80	16.9
	2-3 year	60	12.7
	More than 3 years	9	1.9
Specialization	HR	47	9.9
	Finance	147	31.1
	Lean operations and Systems	106	22.4
	Marketing	173	36.6

Source: As per data collected

The data was collected consisting of five scale variables, which are academic performance of the students in Age, HSC, SSC, and Graduation and over all MBA percentage in first year. As per Table 2, the average age of respondents was 22.5 years, the average performance of the respondents in 10th and 12th class are 84 and 81.5 per cent, similarly the average performance in under graduate was 73.4, which was low as compared to 10 and 12 class. And the performance in MBA is 67.8 per cent.

Table 2: Descriptive Statistics

Scale variable	n	Minimum	Maximum	Mean	Std. Deviation
Age (in years)	473	19.00	26.00	22.5603	1.70774
Percentage in 10 th Class	473	58.90	97.20	84.0185	8.22575
Percentage in 12 th Class	473	60.29	97.17	81.5561	9.77328
Percentage in Graduation	473	58.00	94.00	73.4051	7.65052
Over all percentage in MBA	473	57.00	77.41	67.8742	3.76074
Valid N (listwise)	473				

IV. DATA ANALYSIS

Data mining, as mentioned by Christopher Clifton in Britannica, is the “*process of discovering interesting and useful patterns and relationships in large volumes of data*”. This field of study also uses various techniques of statistics and AI for example Neural Networks and Machine Learning along with DBMS to explore the pattern from the big data.

There are different ways of extracting the information and pattern, one of them is decision tree. In this research, we focused on using the decision tree method to find students' approach while deciding on their specialization during second year of MBA program. The paper also emphasizes on predicting the specialization of the new students. In this paper, the approach is to understand the factors responsible for selection of specialization and to suggest strategies for decision making for the students and for the management.

The decision tree is a supervised learning algorithm. There are many decision tree algorithms given by different authors such as Iterative Dicotomiser 3 (ID3), Classification and Regression Tree (CART) (Breiman, 1984), C4.5, C5.0, SLIQ, and SPRINT. As per Hunt's algorithm (Hunt, E.B. 1962) “a decision tree grows in a recursive fashion by partitioning the training records into successively purer subsets”. As per Quinlan (1986), “*the basic idea of ID3 algorithm is to construct the decision tree by employing a top-down, greedy search through the given sets to test each attribute at every tree node*”.

According to Pradhan (2013), decision tree can be used to study the mountain landslide factors. Babu., P. R. (2014); used decision tree algorithm in power sector, Zhang, Y. (2013) used in classifying junk and spam emails. Gu, Y. X. et.al.(1983) used Multilayer Decision Tree to for recognition Chinese Characters. Haiying Ma (2015) used decision tree in marketing for customer segmentation.

There is wide application of decision tree in Medical Science, Marketing, Computer Science and so on. The use of decision tree is frequent since it does not demand any assumption about the relation between the variables or the distribution of the variables or Models, as in multiple regression or logistic regression. The other reason for its wide usage is its simplicity in interpreting the results. It can be used for prediction as well as classification. The decision tree-based methodology is powerful for analysing the relationship between the dependent variable and independent variable. It also identifies the most significant independent variables for predicting the dependent variable. It can be applied to both the scale and categorical, or both type of variables.

In this study the dependent variable is the specialization selected and the independent variables are gender, State, Place belongs to, Marital status, family income, Experience and academic performance (10, 12, graduation and PG performance).

The students' search for the best specialization can be theoretically perceived as a search for the best choice among the four alternatives such as marketing, finance, HR or operations & systems. This specialization choice can be visualized using a decision tree. A decision tree is essentially a hierarchical structure which comprises of nodes and edges. This structure begins from a root node. The nodes which emerges from the root nodes is referred as other node or children nodes. These nodes are connected with each other via edges. The node signify the state and edge signify action. The sequence of the tree is read through the path of connected nodes with each other. Each of these paths gives a specific specialization as a leaf.

The accuracy of the decision tree model is determined by the two part, training 70 per cent and test data set 30 per cent. The model has been developed on the training data set. For the model development R packages rpart and caret were used. The model developed is given in Figure 1 which gives the fourteen rules developed by CART. In the training data set, the number of respondents of finance specialization are 103 (30.9 %), marketing 122 (36.6 %), Lean operations and systems 75 (22.5 %), and human resource 33 (9.9 %).

Following rules were identified from decision tree:

- There is a probability of 0.88 with support of 10 per cent (n=30), that a non-engineering student with under graduation percentage of more than 79, will opt for finance specialization.
- There is a probability of 0.83 with support of 9 per cent (n=25) that a non-engineering student with under graduate percentage less than 79 to 72, and over all MBA percentage of more than 68 percent will opt for finance specialization.
- There is a probability of 0.63 with the 6 percent (n=12) support that a non-engineering student with under graduate percentage less than 79, over all MBA percentage less than 68, work experience 1 to 3 years will opt for Finance specialization.
- There is a probability of 1 with 1 percent (n=3) support that an engineering graduate, with work experience of more than 2 Years, and 12th class percentage less than 79, will opt for finance specialization.

- There is a probability of 0.73 with 9 percent (n=22) support that an engineering graduate, and 12th class percentage more than 79, and under graduate percentage more than 77, and no work experience or 1 to 2-year work experience, will opt for finance specialization.
- There is a probability of 0.59 with 9 percent (n=17) support that a non-engineering student with under graduate percentage less than 79, over all MBA percentage more than 68, under graduate percentage more than 72 will opt for human resource specialization.
- A non-engineering student with under graduate percentage less than 79, and over all MBA percentage less than 68, and no work experience or less than 1-year work experience, and 10th class percentage more than 92, will opt for human resource specialization has a probability of 0.57 and support 2 percentage (n=4).
- A non-engineering student with under graduate percentage less than 79, and over all MBA percentage less than 68, and no work experience or less than 1years work experience, and 10th class percentage less than 92, will opt for marketing specialization has a probability of 0.85 and support 16 per cent (n=45).
- An Engineering graduate, with work experience less than 2 Years, and over all percentage in MBA less than 67, will opt for marketing specialization, has a probability of 1.00 and support 1 per cent(n=3).
- An Engineering graduate, with work experience more than 2 Years, and 12th class percentage between 79 and 74, will opt for marketing specialization, has a probability 0.82 and support 14 per cent (n= 37).
- An Engineering graduate, with work experience less than 2 Years, 12th class percentage more than 79, and under graduate percentage between 77 and 74, will opt for marketing specialization, has a probability 0.67 and support 5 per cent.
- An Engineering graduate, with work experience less than 2 Years, 12th class percentage more than 79, under graduate percentage more than 77, and work experience more than 2 years, will opt for marketing specialization, has a probability 0.56 and support 3 per cent (n=5).
- An Engineering graduate, with work experience less than 2 Years, 12th class percentage more than 79, under graduate percentage less than 74, will opt for Lean operations and systems specialization, has a probability 0.83 and support 7 per cent (n=19).
- An Engineering graduate, with work experience less than 2 Years, and over all percentage in MBA more than 67, will opt for Lean operations and systems specialization, has a probability 0.93 and support 9 per cent (n=28).

As per the decision tree model, using the test data, the variables which are important in the decision tree are Percentage in Graduation (57.39), Work experience (33.34), Overall percentage in MBA in first year (32.87), Percentage in Class 12th (29.47), Percentage in Class 10th (27.53), Previous degree (26.43), Family Income (10.25), State Zones (10.12), Gender (8.92), Place you belong to (4.42) and marital status (1.80). The scores show the influence of each variable in classifying or predicting the target variable.

To find the accuracy of the model, a confusion matrix was calculated. The confusion matrix for the decision tree model gives an accuracy of 0.7071, with kappa value 0.571, and McNamara's Test P-Value 0.000. In-order to increase the accuracy of prediction, random forest was used. From the random forest the accuracy of the model with mtry =10, that is considering 10 independent variables in the model, increased to 0.88, with kappa value 0.83, this gives a better result as compared to decision tree model.

The important variables as per random forest model are percentage in Under Graduate, Percentage in MBA first year, Percentage in Class 12th, Percentage in Class 10th, Previous Degree-Engineering, Work Experience- No experience, Gender-Male, Previous Degree-Commerce, Total Family Income per annum- 5 to 10 Lakh, and Place you belong to-Urban. The accuracy of the random forest model using the test data set is 0.9347, with kappa value 0.9096. The random forest model gives a better prediction.

V. DISCUSSION & CONCLUSION:

This research has revealed that there is high probability of students with high percentage in under graduate to select finance specialization. Even those students with 70 to 80 percentage in Engineering and performs well in MBA also considers finance. The probability of these students considering finance starts decreasing with increasing in experience. Those engineering graduates with good performance in their studies also select finance. This could be because of two major reasons. First, the perceived value for finance specialization is quite high among the fresh graduates as in India, students has craze for banking jobs. Second, most of the marketing jobs are misunderstood as only sales jobs. Students with low performance in studies from non-engineering back ground selects Human resource as specialization. Non engineering students with good performance in their studies and engineering students with low performance in their studies selects marketing. Engineering students with work experience and good to moderate performance in studies selects Lean operations and management. From the decision rule it is evident that most of the engineering students prefer LOS as specialization and non-engineering students finance specialization.

In conclusion, we can say that this study is very useful for the decision makers to face the upcoming challenges. This study revealed that the finance is the first choice among the

MBA in present times and marketing as the second choice. Considering the fact that there are many opening in finance and marketing in present times but at the same time declining the employability rate is a big concern. The universities offering MBA program shall develop the infrastructure in such a way that will not only help students to be industry ready and at the same time there shall be self-learning environment.

REFERENCES

- [1] Ahmad Nahar Al-Rfou (2013). Factors that Influence the Choice of Business Major Evidence from Jordan, *IOSR Journal of Business and Management*, 8(2), 104-108.
- [2] Babu P R, Dash P K, Swain S K, (2014). A new fast discrete S transform and decision tree for the classification and monitoring of power quality disturbance waveforms. *International Transactions on Electrical Energy Systems*, 24(9), 1279-1300.
- [3] Bandura, A., Barbaranelli, C., Caprara, G. V., & Pastorelli, C (2001). Self – efficacy beliefs as shapers of children’s aspirations and career trajectories, *Child Development*, 72,187-201
- [4] Beggs, J.M., J.H. Bantham, and S. Taylor (2008). Distinguishing the factor's influencing college student's choice of major. *College Student Journal*, 381-394.
- [5] Breiman et. al (1984). *Classification and Regression Trees*. Wadsworth & Brooks/Cole advanced books & software, California.
- [6] Claudia Bobâlcă, Oana ġugulea, Cosmina Bradu (2014). How are the students selecting their bachelor specialization? A Qualitative Approach. *Procedia Economics and Finance*, 15, 894 – 902.
- [7] DeMarie, D., & Aloise-Young, P. (2003). College students’ interest in their major. *College Student Journal*, 37, 462-470.
- [8] Edwards, K., & Quinter, M. (2012). Factors Influencing Students Career Choices among Secondary School students in Kisumu Municipality, Kenya. *Journal of Emerging Trends in Educational Research and Policy Studies*, 2(2), 81-87
- [9] Essam Hussain Al-Lawati , Renjith Kumar.R, Radhakrishnan Subramaniam (2017). An Empirical Study on Factors Influencing Business Students’ Choice of Specialization with Reference to Nizwa College of Technology, Oman, *International Business Research*, 10(9), 177-187.
- [10] Gensinde, S.A. (1986) *Vocational Theories Applied to the Nigerian Cultural Background in T. Ipaye (ed.) Educational and Vocational Guidance: Concepts and Approaches*, 207-221, University of Ife Press.
- [11] Haiying Ma (2015) A Study on Customer Segmentation for E-Commerce Using the Generalized Association Rules and Decision Tree. *American Journal of Industrial and usiness Management*, 05,813-818. doi: 10.4236/ajibm.2015.512078
- [12] Haiying Ma (2015). A Study on Customer Segmentation for E-Commerce Using the Generalized Association Rules and Decision Tree. *American Journal of Industrial and Business Management*, 5 ,813-818. doi: 10.4236/ajibm.2015.512078
- [13] Hunt, E.B. (1962). *Concept learning: An information processing problem*. New York: Wiley.
- [14] Ibrahim Umar (2014). Factors Influencing Students’ Career Choice in Accounting: The Case of Yobe State University, *Research Journal of Finance and Accounting*, 5(17), 59-62.
- [15] Jane W. Wairimu (2013). Factors Influencing the choice of Specialization of MBA Courses by Students at Institutions of Higher Learning in Kenya. A Survey of Nyeri County, Dissertation.
- [16] Kapse, M., Sharma, V., Maheshkar, C. & Poulouse, J. (2019). Are Management Graduates Market Ready? Exploring the Relationship between the Demographic Factors and the Perceived Level Job Preparedness. *UNNAYAN: International Bulletin of Management and Economics*. Volume – X, 165-175.
- [17] Kazi Afaq Ahmed, Nimra Sharif and Nawaz Ahmad (2017). Factors Influencing Students’ Career Choices: Empirical Evidence from Business Students, *Journal of Southeast Asian Research*, 2017, 1-15.
- [18] Kim, D., F. Markham, and J. Cangelosi (2002). Why students pursue the business degree: A comparison of business majors across universities. *Journal of Education for Business*, 78, 28-32.
- [19] Kochung, E., & Migunde, Q. (2011). Factors Influencing Students Career Choices among Secondary School students in Kisumu Municipality Kenya. *Emerging Trends in Educational Research and Policy Studies (Jeteraps)*, 2(2), 81-87.
- [20] Le Marinas, RS Icret, CV Marinas, E Prioteasa (2016). Factors influencing career choice: the Romanian business and administration students’ experience, *European Journal of Sustainable Development*, 5(3), 267-278.
- [21] Lowe, D. R., Simons, K. (1997). Factors influencing choice of business majors – some additional evidence: A research note. *Accounting Education: An International Journal*, 6, 39-45.
- [22] Malgawi, C.A., M.A. Howe, and P.A. Burnaby (2005). Influences on student's choice of college major. *Journal of Education for Business*, 80, 275-282.
- [23] Mohammad Emdad Hossain and Tabassum Siddique (2012). Career Preference of Business Graduate in Bangladesh: A Case Study of Some Selected Private Universities, *Asian Business Review*, 1(1), 106- 113.
- [24] Nazim Z. Hosein (2015). Factors that influence students choosing a Marketing course, *Research in Higher Education Journal*, 29, 1-26.
- [25] Pearson, C., & Dellman-Jenkins, M. (1997). Parental influence on a student’s selection of a college major. *College Student Journal*, 31, 301-314.

- [26] Pradhan B (2013). A comparative study on the predictive ability of the decision tree, support vector machine and neuro-fuzzy models in landslide susceptibility mapping using GIS. *Computers & Geosciences*, 51, 350-365.
- [27] Pradhan B. A comparative study on the predictive ability of the decision tree, support vector machine and neuro-fuzzy models in landslide susceptibility mapping using GIS. *Computers & Geosciences*, 2013, 51, pp.350-365.
- [28] Pritchard, R., Potter, G., & Saccucci, M. (2004). The selection of a business major. *Journal of Education for Business*, 79, 152-157.
- [29] Quinlan JR (1979) Discovering rules by induction from large collections of examples. In: Michie D (ed), *Expert systems in the micro electronic age*. Edinburgh University Press, Edinburgh
- [30] Quinlan JR (1993) C4.5: Programs for machine learning. Morgan Kaufmann Publishers, San Mateo
- [31] Quinlan, J.R. (1986) Induction of Decision Trees. *Machine Learning*, 1, 81-106. <http://dx.doi.org/10.1007/BF00116251>
- [32] Sarwar Aamir and Masood Rizwana (2015). Factors affecting selection of specialization by business graduates, *Science International (Lahore)*, 27(1), 489-495.
- [33] Shertzer, B, Stone, Shelly (2003). *C Fundamentals of Counseling: 2nd Edition*.
- [34] Siegall Marc, Kenneth J. Chapman, and Boykin Raymond (2007). Assessment of Core Courses and Factors that Influence the Choice of a Major: A "Major" Bias? Available at https://www.researchgate.net/publication/255664488_Assessment_of_Core_Courses_and_Factors_that_Influence_the_Choice_of_a_Major_A_Major_Bias
- [35] Singh Swapnika, Kapse Manohar and Sonwalkar Jayant (2011). Factors Which Affect the Career and Subject Preference of the Female Students of Business Schools, *Journal of Women's Entrepreneurship and Education*, 1-2, 89-107.
- [36] Vickneswaran, Anojan and Balasundaram, Nimalathan (2013). Factors Influencing in Career Choice of Second Year Undergraduate Students: A Case Study of Faculty of Management Studies & Commerce, University of Jaffna, Sri Lanka, *International Journal of Social Science & Interdisciplinary Research*, 2, 16-25.
- [37] Y. X. Gu, Q. R. Wang and C. Y. Suen (1983). Application of a Multilayer Decision Tree in Computer Recognition of Chinese Characters, in *IEEE Transactions on Pattern Analysis and Machine Intelligence*, PAMI-5, 1, 83-89.
- [38] Zhang Y, Wang S, Phillips P, (2013). Binary PSO with mutation operator for feature selection using decision tree applied to spam detection. *Knowledge-Based Systems*, 64, 22-31.
- [39] Zhang, W. (2007). Why IS: Understanding undergraduate students' intentions to choose an Information Systems major, *Journal of Information Systems Education*, 18(4), 447-458.