Implementing a Big-data Based Strategy to Increase Students' Enrollment for Dalian Neusoft University of Information

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Abstract. Currently, education has become a business sector that provides service to students worldwide, which has shown similarity to consumer goods marketing. Higher education is becoming increasingly competitive among universities. Act as a private higher education organization, Dalian Neusoft University of Information (DNUI) aims to distinguish itself from national universities by topping education quality, students' innovation ability and startup across all departments in 2022. This needs the support of the most able and motivated students and sufficient funding. This project proposes a big-e based strategy to deal with the dilemma of this university. This strategy is a combination of big-data techniques, Customer-to-Business (C2B) initiative and Information Technology Outsourcing (ITO). Big-data and information technologies are introduced in business field for customer requirement analysis and preferences prediction. Big-data technique enables scale, scope and speed business. C2B enables consumers to name products or services such that the organization can generate the demand collection for a specific good or service. ITO contributes to cost-saving, skilled labor market and short marketing development time scale. Case based reasoning (CBR) is introduced in this project for logic predicate and propositional logic, which contributes to the likelihood and preferences calculation so as to support strategy innovation and current strategies update. The evaluation data of this project is collected from the random sampling technique and self-administered questionnaires were distributed by mail and online to middle school students in Dalian City. Analytic hierarchy process (AHP) algorithm is introduced for evaluating the reputation achieving of this strategy. The curriculum design is assessed by chi-square test. The location and distance analysis are evaluated by correlations.

Introduction

Currently, education has become a business sector that provides service to students worldwide [1]. The development of this service has shown similarity to consumer goods marketing [2]. Higher education is becoming increasingly diverse and competitive among universities worldwide [3]. As the widely use of social networks and communication tools, students are exposed to extensive information in terms of the importance of education. This incurs students are tending to be increasingly critical and analytical when choosing the educational institutions. Act as a private higher education organization, Dalian Neusoft University of Information (DNUI) aims to distinguish itself from national universities and traditional research universities by topping education quality, students' innovation ability and startup across all departments in 2022, which needs the support of the most able and motivated students and sufficient funding. However, similar to national universities, DNUI recruits students by following college entrance examination system. This traditional approach puts DNUI into the inferior place. Although it admitted enough people, it not means that these students are qualified as the university expectation. Poor business performance and repeat patterns of existing behavior are symptoms of failure [4]. In competitive marketing analysis, the educational institutions will be interested to establish a productive recruitment strategy to attract students effectively to choose their institution over their competitors. Thus, DNUI should enhance its current strategies to exploit the most talent students. Real life experience of being a member of the university improves their confidence to

the university. In this information era, e-commerce is adopted by a majority of companies for advantaging competition. E-commerce initiatives like Customer-to- Business (B2C) initiative and IT outsourcing (ITO) are widely used in customer behavior analysis and customer relationship establishment. What's more, current business strategies are dramatically affected by information and big-data technology. Big-data technique enables scale, scope and speed business. How to analyze big data timely and cost-effectively is a key ingredient for success in a wide range of areas, such as businesses, scientific and engineering disciplines, and government endeavors. Big-data analysis break the limitation of traditional market analysis methods, which is cost-saving, easy to use, accuracy, low dependency on equipment and advance organizations' strategic positon. The purpose of this project is to optimize previous mentioned issue of DNUI by conducting a big-data based strategy to ascend the enrollment number and quality of students. This strategy is a combination of big-data techniques, C2B initiative and ITO. Furthermore, the analyzed finding enables DNUI to design appropriate marketing plan accordingly to save cost, gain customer satisfaction, overcome their competitors, gain expected new students, and achieve the sustainable progress in the coming future.

The following of this research paper is arranged as follows. Section 2 discusses related work and theoretical background of this project. Model design is depicted in section 3 which clarifies the theoretical working mechanism of this model and shows how it distinguishes itself from traditional students' recruitment. Evaluation and findings are given in section 4. Section 5 concludes this project and proposes future work.

Related Work

Higher education industry has become increasingly diverse and competitive worldwide. Basheer stated in 2008 that appropriate marketing activities conducted by higher education organizations create added value for students, which contributes to student satisfaction, trust, relationship continuity and reputation [5]. Private higher education institutions can achieve sustainability through implementing a good marketing strategy. Current research demonstrates that there are generally two recruitment methods that can be applied in higher education students' recruitment, which are traditional and modern recruitment. Salehi (2012) stated that traditional method communicates with customers so as to sale goods or services, while modern method attracts customers by using facilities and technologies [6]. Traditional method does not contain Internet contents like e-mail and flyers [7]. Modern method includes social media marketing channels such as Facebook, Twitter, WeChat, Whatsapp and YouTube. Bruhn proved that traditional media contributes to brand awareness, while social media plays productively in terms of improving brand image [8]. A theoretical research of UK universities shows that using websites is one of the most significant ways to enhance brand communication [9]. Kara in 2007 found that Hong Kong respondents preferred to search future education information by Internet, instead of magazines, newspapers, radio and television. Previous researches demonstrate that in education filed modern ways are replacing traditional alternatives.

Diverse types of e-business initiative are applied by companies to improve customer related issues. One of the most productive e-strategies is C2B. C2B is a reverse pattern of Business-to-Customer (B2C). Dai defines C2B as an evolution path to business model, which ranks customer requirements first and enterprise production second. C2B model enables customers to participate in business process and customize individualized product to meet customers' needs. C2B also applied in education field, which enables students share ideas with professors and peers freely and access trustworthy information. ITO means handing over the management of part or all of an organization's information technology, systems and related services to a third party [10]. ITO contributes to cost-saving, skilled labor market and short marketing development time scale [11]. Motivations for adopting ITO include effective data collection, productive customer behavior analysis, cost reduction and business performance improvement. The highly development of big-data technology supports more accurate data analysis in business related activities and significantly boosts business performance. This incurs the progress of big-data tools, such as Hadoop [12], Starfish [13] and MetaMaker [14]. Hadoop is one of the most advanced big-data warehouses. Hadoop is consisted by two parts. One is distributed file system which is for structured, semi-structured and un-structured

data storage, while the other part is mapReduce which is responsible for data computations. Additionally, mapReduce computations can be expressed directly in general-purpose programming languages like Java or Python, domain-specific languages like R, or generated automatically from SQL-like declarative languages like HiveQL and Pig Latin [12]. Besides, metaMaker is a data mining and text mining tool and it can generate XML based files automatically. MetaMaker is introduced for customer preferences calculation matching to business-to-customer model [15]. Starfish is a self-turning big-data analytic system, which builds on Hadoop when adapting to user needs and system workloads to provide good performance automatically [13]. What's more, web search engines and social networks are mature enough to support individual user action capture and analysis. Networks and intelligence tools, such as Case based reasoning (CBR) algorithm, can support logic predicate and propositional logic so as to obtain customer preference, improve site design, and detect spam and fraud. Furthermore, mathematical tools are introduced for big-data based model and strategy evaluation. Intuitionistic fuzzy network is proposed in [16] for big data based C2B model assessment. [17] proposes a strategic evaluation methodology for customer relationship management system matching to e-business. Percentage calculation, Chi-square testing and correlation calculation algorithms are widely introduced for evaluating business model performance.

Strategy Design

This project design a big-data based approach as one of the recruitment strategies for DNUI to increase students' enrolment. This strategy is a combination of big-data techniques, C2B and ITO. Research instruments were redesigned, modified and constructed based on previous research findings of these three areas. The development process of strategy follows the flow of Fig.1 as a whole.

Figure1. Marketing Strategy Development Process

As shown in Fig.1, the big-data techniques are applied in "Recruitment strategy" and "Recruitment tactics" components. The outputs of big-data techniques support the university's recruitment strategy innovation. The primary data sets are extracted from customer requirements collaboration of C2B model and ITO cooperator, respectively. This big-data based strategy design is shown in Fig.2. Specifically, C2B model focuses on synthesizing students' needs and then conducing innovation to provide related services and products to satisfy customers. In this model, the logistic and operational related information, customer knowledge features and sales and marketing information of C2B model are taken into big-data consideration. Current study shows that ITO performance is significantly related to organization's financial situation, types of outsourced function and percentage of outsource. In order to gain enough knowledge of competitors, this model also takes listed ITO features which are shown in Fig.2 into big-data analysis. This project adopts big-data based tools MetaMaker, Starfish and Hadoop to support data analysis. MetaMaker is an automatic XML based data generation tool, which is for data extraction in this project. Hadoop is one of the most popular databases in dealing with big-data based project. In this project, its distributed file system is for data storage. MapReduce is for data analysis. Without any need for users to understand and manipulate turning knobs in Hadoop, Starfish provides automatic and high quality Hadoop's performance in terms of calculation. Finally, one function of big-data based outputs is directly to support the strategy innovation. The other function of these outcomes is to match with the current recruitment strategy through CBR system. In this

scenario, CBR system can predict whether these proposed plans can meet customer needs. The cooperation of big-data analysis and CBR algorithm enables DNUI to predict students' preferences and competitive recruitment criteria, so as to support the current strategy updated and achieve strategy innovation.
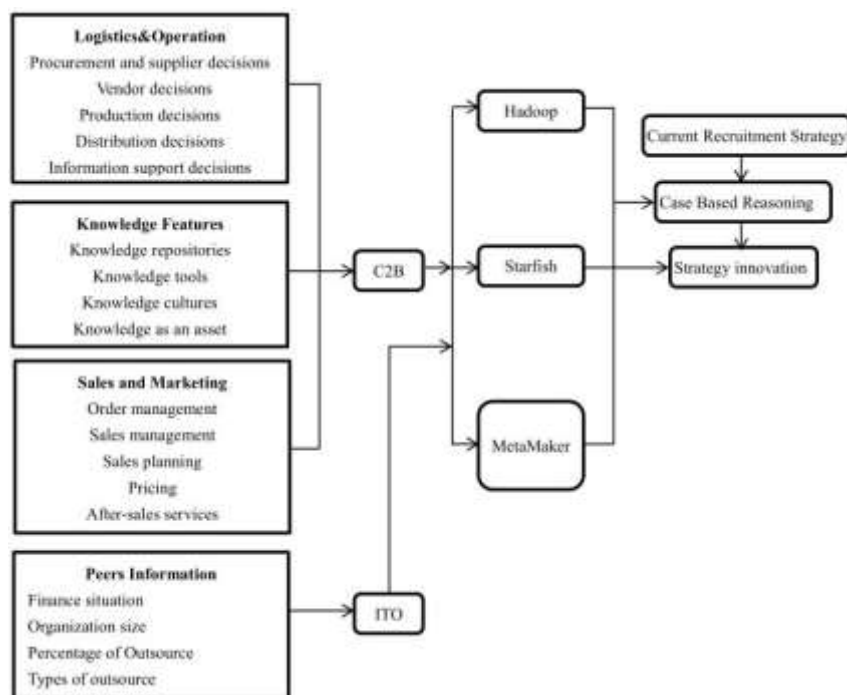

Figure2. Recruitment Strategy Design

Strategy Evaluation

The evaluation data of this project is collected from the random sampling technique and self-administered questionnaires were distributed by mail and online to middle school students in Dalian City. The result shows that compared with boys, girls account for larger population in respondents. The analyzed data shows that up-to-date curriculum design, higher reputation and school location are significant requirements from customers. Reputation achieving is compared based on current two reputation gaining strategies of DNUI and this proposed strategy by using Analytic hierarchy process (AHP) algorithm. The curriculum design is assessed by chi-square test. The location and distance analysis are evaluated by correlations. Firstly, AHP evaluates this model by checking whether this model can seek for the best reputation strategy for DNUI by establishing the reputation priority weights. The priorities of each proposed strategy with respecting to every criterion in a matrix. Then, each column of vectors is multiplied by the priority of the corresponding criterion. The results of each row in strategies' reputation priorities are shown in Table.1. Two traditional strategies are named as A and B, respectively. The strategy proposed by this project is C. The reputation priority calculation shows that C performs best.

Secondly, the calculation for curriculum design approvability is shown in Table.2. The calculated result is 0.628 which is greater than 0.05. This means the performance of curriculum design strategy can be accepted.

Table 1 Reputation priorities to identify the best strategy

	Reputation of employers	Transport convenience	Neighbor Universities	Employment rate	Global communication opportunities	Student Union	Facilities condition	Innovation and Startup	Reputation priority
	0.173	0.053	0.187	0.018	0.031	0.036	0.167	0.333	
A	0.753	0.233	0.754	0.335	0.675	0.747	0.200	0.072	0.395
B	0.182	0.055	0.064	0.333	0.101	0.061	0.403	0.650	0.342
C	0.065	0.714	0.181	0.333	0.226	0.194	0.405	0.278	0.264

Table 2 Chi-square test results

Particulars	Value	Freedom Degree	Significance
Pearson Chi-Square	7.119	8	0.628
Likelihood Ratio	7.167	9	0.623
Linear-by-Linear Association	0.861	1	0.365
Number of Valid Cases	400		

The correlations between the Predicted students' family location and the location information provided by DNUI are calculated in Table.3. The correlation coefficient value R is 0.134, which demonstrates the numbers are reasonable. The results also show the relationship between gender and school location. Correlation analysis means that the performance of this strategy is accepted.

Table 3 Correlation between students and Location

Variables	Particulars	Gender	Location
Gender	Family Location	1	0.067
	Importance		0.134
	Students No.		400
Location	Person Correlation	-0.067	1
	Importance	0.133	
	Students No.	400	

E-business is widely integrated into education market, which enables universities to recruit the most able and motivated students worldwide. This improves the education and research level and boost universities' financial budget. This project proposes a big-data based recruitment strategy for DNUI, which combines big-data techniques, C2B e-commerce and ITO e-strategy. This model analyzes customer knowledge, supply chain information and market making information with techniques like MetaMaker, Starfish and Hadoop. After collecting and synthesizing related information, the innovated strategy is proposed. At the same time, the big-data analysis also supports the availability test of recent strategy by CBR algorithm. The findings of this project show that this strategy performs effectively in recruiting desired students. Additionally, this project suggests that productive recruitment strategies consist of both traditional and modern methods. The evaluation result shows that DNUI lakes in maximizing the usage of effective methods and process to attract students. Advertising, attractive messages and brand building in social media are useful in attracting students. This big-data based strategy enables DNUI to recruit more talented, able students with cost-saving, larger market share and sustainability in future business.

Conclusion

E-business is widely integrated into education market, which enables universities to recruit the most able and motivated students worldwide. This improves the education and research level and boost universities' financial budget. This project proposes a big-data based recruitment strategy for DNUI, which combines big-data techniques, C2B e-commerce and ITO e-strategy. This model analyzes customer knowledge, supply chain information and market making information with techniques like MetaMaker, Starfish and Hadoop. After collecting and synthesizing related information, the innovated strategy is proposed. At the same time, the big-data analysis also supports the availability test of recent

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