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IT outsourcing intent in academic institutions in GCC countries

An empirical investigation and multi-criteria decision model for vendor selection

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Abstract

Purpose – The purpose of this paper is to understand the reasons behind the intent for information technology (IT) outsourcing in academic institutions in GCC countries. It also aims to develop a multi-criteria decision model (MCDM) to aid the critical decision of IT outsourcing vendor selection.

Design/methodology/approach – The research utilizes a questionnaire-based survey to investigate reasons of IT outsourcing intent and the factors considered important for IT outsourcing vendor selection in academic institutions. The results of questionnaire-based study were utilized to develop a grey theory-based MCDM for vendor selection.

Findings – The results show that facilitating access to new technology, focus on core-competence, saving staff costs, and improved customer service are the most important factors for IT outsourcing intent while reputation of vendor, access to the state of art technology, quality of service, and knowledge of industry were considered as the most important factors for IT outsourcing vendor selection. Grey theory-based decision model was applied to a real case to facilitate the decision of selection of an IT outsourcing vendor.

Practical implications – Academic institutions that plan to outsource IT in future would be the major beneficiaries of this study. They can utilize the multi-criteria model to select the best vendor. The model facilitates a more rational decision making as it incorporates several criteria considered important for IT outsourcing vendor selection.

Originality/value – This study contributes to the body of research on IT outsourcing. It is first of its kind with its focus on academic institutions in GCC countries where currently education is a priority and IT is a backbone for its delivery. Another novelty of this research is that it propose a MCDM for IT outsourcing vendor selection. The findings of this study would serve as a guide to those institutions that intend to outsource IT functions to meet the ever growing needs of managing IT effectively.

Keywords GCC, Multi-criteria decision making, Grey theory, IT outsourcing, Academic institutions

Paper type Research paper

Introduction

Information technology (IT) outsourcing has been described as the process of turning over part or all of an organization's technology/systems-related functions to an external services provider(s) (Loh and Venkatraman, 1992; Gottschalk and Solli-Saether, 2005; Kshetri, 2007). The "Kodak Outsourcing" experiment in 1989 has shown that IT outsourcing is a viable alternative to manage complex IT systems and thus it has emerged as an important agenda corporate information management parlance (Kern and Willcocks, 2000). By IT outsourcing it is generally understood that the physical and/or human resources related to an organization's IT are going to be provided and/or

managed by an external vendor who has developed specialized capabilities in managing IT systems at a lower cost (Gonzalez *et al.*, 2005). Research also indicate that those activities that have little impact on the competitive position of the business are good candidates for outsourcing. However, it is recommended to insource those activities which support the core activities of the organization (Foogooa, 2008). Today, IT outsourcing projects are also seen as a means of transferring and leveraging the vendors' superior technical and business knowledge and benefiting complementary skills and scarce expertise (Al-Salti and Hackney, 2011).

Rapid growth of IT has offered competitive advantages, efficiencies and effectiveness in operations and improved customer service but at the same time organizations' have to face increasing complexities in managing IT coupled with demand of increased investment to maintain suitable IT infrastructure (Gulla and Gupta, 2011). Thus the growth in the practice of outsourcing IT has emerged as a viable alternative in meeting organizations' IT needs (Dibbern *et al.*, 2004). Thus to improve organizations' IT capabilities and reduce the expenditure on implementing latest IT tools, companies are resorting to IT outsourcing (Kobelsky and Robinson, 2010). Organizations can pursue four forms of IT outsourcing strategies. These are, insourcing, selective sourcing, strategic alliance sourcing, and total outsourcing. In total outsourcing the entire IT function is outsourced, while in selective outsourcing strategy the focus is to outsource specific functions like data center operations, telecommunications, payroll, and organizations usually utilize the services of many vendors. In strategic alliance outsourcing the organization creates a joint venture with a vendor to manage IT while insourcing relies on in-house resources of the organization (Pati and Desai, 2005). Studies have found that selective IT outsourcing strategy tend to exhibit higher rates of success than either total outsourcing or total insourcing by reducing risks and requiring a less complex governance structure (Lacity and Willcocks, 1998; Koong *et al.*, 2007).

IT outsourcing has been growing at the rate of 14 percent annually, and the IT outsourcing market is estimated to be worth about \$320 billion in 2015 (Bahli and Rivard, 2013). In addition to the IT outsourcing trend in the industry, the research in this area has attracted the attention of a number of researchers, there have been 164 empirical studies conducted on IT outsourcing over the last 20 years (Gorla and Somers, 2014). Research in IT outsourcing indicate that IT outsourcing landscape is transforming, IT outsourcing contracts that were limited to maintaining systems has gone a major change. Today outsourcing agreements have transformed and have expanded to include multiple systems, processes, and include major transfer of assets, leases, functions, and people. The complexities of IT outsourcing agreements put the onus on the client organization to lay out the expectations from such agreements and understand the risks that are part of an outsourcing agreement (Mojsilović *et al.*, 2007). According to Alsudairi and Dwivedi (2010) outsourcing has evolved from a differentiation strategy for gaining competitive advantage to more as a basic strategy of IT management.

Reasons for IT outsourcing
Companies deciding to outsource an IT function considers reduction of cost and access to state of the art technology as the major reasons that impact their decision (Dibbern *et al.*, 2004). Firms' usually expect benefits like cost reduction, improved quality of service, availability of latest technology, and increased flexibility resulting from their decision to outsource IT activities to an outside vendor (McFarlan and Nolan, 1995; Bahli and

Rivard, 2005). Research also points that for firms, the intent to outsource IT is now moving into the domain of strategic decision making where cost reduction is just one of the criteria among many other criteria considered as important (Teng *et al.*, 1995). This is happening due to the recognition of the fact that adoption of IT tools help improve ways of serving customers and this expertise can be advantageously acquired with the help of an outside vendor (Yang and Huang, 2000).

Outsourcing is a result of a focus on firm's core competencies. Thus processes that do not contribute to a firm's sustainable competitive advantage are considered good candidates for outsourcing (Prahalad and Hamel, 1990). This was supported in a study on IT outsourcing by Gottschalk and Solli-Saether (2005) who found that core competency management and strategic management were the most important factors for an outsourcing decision. Further, it is found that technical IT skills or IT infrastructure cannot be a source of sustainable competitive advantage as computer-based information systems can be easily replicated (Weill and Broadbent, 1998). Thus IT outsourcing provides a better strategic alternative than acquiring IT infrastructures and developing technical skills within the organization (Pati and Desai, 2005). In making a case for outsourcing an IT function, Peslak (2012) suggests that "viewing IT as a competitive advantage, did significantly affect IT offshore outsourcing and outsourcing. This can be safely used as major criteria for these actions." In an IT outsourcing study in Australian companies by Costa (2001) it was found that there are two major considerations for a firm to outsource IT. First economic and technical considerations such as the lack of relevant resources and second the need of the organizations to focus on their core functions to develop core competencies.

In addition to the concept of core competency, cost reduction is also considered as a reason for IT outsourcing (King, 2007; Davis *et al.*, 2006). In a recent study, Patil and Wongsurawat (2015) found that the primary driver for organizations outsourcing their IT is cost. The study by Gilley and Rasheed (2000) found that there exit a relationship among IT outsourcing and financial and non-financial results for the company. The financial improvements that can accrue from of IT outsourcing include reduction of operational costs, improvement of measurability of costs, and transformation of fixed costs into variable costs, whereas improvement in non-financial benefits include focus on core competencies, improvement of quality, acquisition of external competencies, and control over internal departments (Quelin and Duhamel, 2003). IT outsourcing is also viewed as leading to a system that is adaptable to change as compared to internal IT departments (Can *et al.*, 2009). Keeping pace with ever changing technology is another reason to outsource IT (Mojsilović *et al.*, 2007). Outsourcing is an attractive alternative that provides capital market gains, cost savings, a larger pool of skilled vendors and quicker development cycle time (Godwin, 2000). In a study of IT outsourcing in Saudi Arabia, Sohail (2011) found that lack of internal resources, focus on core competencies and reduction in cost are the major reasons for IT outsourcing.

Factors for IT outsourcing vendor selection decision
Today the rate at which technology becomes obsolete is very fast and this affects the organizations capability to keep up with the developments in the area of IT. In this scenario, IT outsourcing model has attracted the attention of organizations in acquiring and managing costly and complex IT. One of the strategic issue that is an imperative for a successful IT outsourcing decision is the selection of a suitable outsourcing vendor. Because of the increased complexity in outsourcing projects and the bounded rationality of human beings, firms are changing their IT outsourcing management

toward a more trust-oriented vendor relationship building style (Shi, 2010). The success or failure of the outsourcing agreement depends largely on the right choice made in the selection phase (Barthélemy, 2001). Thus, organizations need to take a careful evaluation and an informed decision for the selection of the outsourcing vendor from wide range of IT vendors (Baldwin *et al.*, 2001). Due to the expansion of IT outsourcing markets competing vendors should be evaluated against the selection criteria. Studies also suggests that for a more productive relationship with a potential outsourcing vendor, it is advisable to collect information regarding current outsourcing partnerships in the same sector as well as in related industries (Martinsons, 1993). To understand the importance of vendor characteristics, Tullous and Munson (1991) in their study proposed various empirical methodologies. The choice of criteria for vendor evaluation is also impacted by culture as studied by Cusumano and Takeishi (1991). McFarlan and Nolan (1995) suggested that the vendor's long-term financial stability, its willingness to update technology, and its management culture compatible with the outsourcing firms should be addressed as the key selection criteria.

Fink and Shoeib (2003) suggest a decision-making framework consisting of five phases, namely intelligence, analysis/planning, strategy selection, action, and evaluation/monitoring. Their study also pointed that the action phase was statistically more significant than all other phases. In this phase two critical activities are vendor evaluation and vendor selection. Considering vendor evaluation as an important step that would have an impact on the overall outsourcing agreement a three step process was suggested by Halvey and Melby (1996). The three steps of this process to select the best outsourcing vendor are: identification through comprehensive research, understanding vendor capabilities, and screening process. Criteria considered for vendor selection range from track record, knowledge of industry, technical and industry experience, financial stability, willingness to negotiate, and ability to set up measurement systems (Halvey and Melby, 1996; Minoli, 1995). According to Gonzalez *et al.* (2005), analysis of the stability, quality and reputation of the potential vendor is also important for a fruitful relationship. The decision to select the right outsourcing provider is critical as it is found to be positively related to the performance improvement and can also affect the performance of the company as assessed by the market (Agrawal *et al.*, 2006). Studies indicate that organizations should carefully manage activities that lead to a potential vendor selection, keeping in mind the fact that choosing outsourcing companies with excellent service quality is a critical factor that results in a productive relationship with an outside vendor (Chang *et al.*, 2012). Cao *et al.* (2012) developed a ANP and grey relational approach for the selection of IT outsourcing vendor in banks. The criteria they used were market share, cost reduction, price of service, and financial stability.

Research objectives
Research in IT outsourcing can be categorized under two major themes (Alaghehband *et al.*, 2011). Studies under the first theme examines the potential determinants or antecedents that can be used to explain and predict the IT outsourcing decision and/or outcome. The second stream of researchers focusses on the post-outsourcing phase, where the emphasis is on the management of relationship between the firm and its outsourcing provider. Based on the above categorization the present study falls into the first category. It pertains to understanding factors for IT outsourcing intent and propose a multi-criteria decision model (MCDM) for IT outsourcing vendor selection in academic institutions. In the GCC region, education is a priority and the governments'

are investing heavily in supporting existing institutions and developing new institutions. These institutions are adopters of latest technology and would like to employ latest IT tools to facilitate student learning. Lately, due to the fast pace of technology development which makes IT tools become obsolete at an increasing fast pace, these institutions are finding hard to balance the need of new IT tools and the cost to implement them. Most of these institutions have in house IT support which is now under stress to meet the growing IT needs of the community. It is also observed that majority of the courses now demand extensive use of IT services, administration is faced with the option of either increase the head count in their IT centers or to outsource IT services. Usually, cost saving is the overriding criteria that would be considered as the basis of the vendor selection. But literature available on IT outsourcing clearly indicate that vendor selection should be based on a variety of factors. Thus, the model developed in this paper provides the opportunity to incorporate various criteria in IT outsourcing vendor selection and would result in a more rational decision with a long-term impact.

Research methodology

According to Dibbern *et al.* (2004) there are five types of methodologies applied in conducting IT outsourcing research. They are surveys, case studies, action research, conceptual frameworks, and mathematical models and analyses. Our study combines two methods which is survey and mathematical modeling. The basis for adopting this approach is the outcome of literature review which indicated that there is no study on IT outsourcing conducted in academic institutions particularly in Gulf region. Further, literature also mentions that vendor selection is an important determining factor for successful IT outsourcing. From the literature it was amply clear that cost cannot be the sole criteria for vendor selection and a multi-criteria decision making approach is required for a more informed decision and thus a grey-based model is proposed in this research for vendor selection.

Based on literature review and previous works, a survey questionnaire was developed. All constructs in the survey were measured using a five-point Likert rating system ranging from strongly disagree to strongly agree. To ensure validity and reliability, it was decided to adapt existing measures validated from previous studies on IT outsourcing like Lacity *et al.* (2011), Gonzalez *et al.* (2005), and Sohail (2011).

The questionnaire consisted of two parts: the first part included demographic characteristics, including gender, age, scientific degree, and work experience in managing IT systems. The second part of the questionnaire consisted of questions that elicited responses on managers' perception about the reasons of IT outsourcing and factors considered as important for IT outsourcing vendor selection. The questionnaire was pre-tested by contacting 11 IT managers who had previous experience in IT outsourcing in their organization. As these managers were associated with businesses, responses collected from them were not included in the final data set. Also the questionnaire was discussed with four academics working in the area of IT.

Based on the inputs received from the IT managers and academicians, questionnaire was modified. This improved the questionnaire by providing more clarity and deletion of some redundant questions (Dillman, 1978). After pre-testing stage and modification, the survey was sent via e-mail to potential respondents. The data were collected via electronic survey which was sent to managers' involved in decision making related to IT function in an academic institution. The selection of an academic institution for survey was done on the basis of student population in the institution. Majority of these

institutions are public universities but few institutions in the data set are private universities. Due to the growing number of student population and very fast changing technology landscape, the in-house IT function is not able to cope with the fast up-grades or adoption of new technology. The e-mail notified the respondents about the general content of the survey and provided an internet link that took them to the online survey. The total number of academic institutions contacted was 77 and a total of 53 completed responses were received spread across six GCC countries.

Lately, companies are increasingly opting to outsource which had made supplier selection a major strategic decision (Gunasekaran *et al.* (2015). Vendor selection is one of the major steps in information systems outsourcing process; selecting a good team to begin with is considered one of the main success factors for outsourcing (Al-Ahmad and Al-Oqaili, 2013). There are several studies that have utilized MCDM for supplier selection aiding an outsourcing decision (Tjader *et al.*, 2010; Liou *et al.*, 2011; Araz *et al.*, 2007; Yang *et al.*, 2007). Olson (2007) presented a multi-criteria approach for evaluating enterprise resource planning outsourcing decisions. Wang and Yang (2007) considered six factors, including economics, resource, strategy, risk, management, and quality for outsourcing decisions and proposed the AHP and PROMETHEE as aids in making IT outsourcing decisions. Kahraman *et al.* (2009) proposed interactive group decision-making methodology to select/rank IT providers under multiple criteria. The present study is also aimed at developing a MCDM model for the selection of IT outsourcing vendor for academic institution.

Grey theory is a decision-making approach under conditions of uncertainty, and has been found to be superior to comparable methods in the mathematical analysis of systems with incomplete information (Hashemi *et al.*, 2015). It is an effective method used to solve uncertainty problems with discrete data and incomplete information. It is also suitable for solving problems with complicated interrelationships between multiple factors and variables (Kose *et al.*, 2013). The advantage of grey approach over fuzzy theory is that the grey approach considers the condition of the fuzziness and flexibility in dealing with inconsistent information in group decision-making situations (Deng, 2005). In fuzzy theory, the initial representation of criteria would be in fuzzy linguistic values, then converted into known exact values. In the case of grey approach, the fuzziness in terms of uncertainty represented in criteria using linguistic values would continue until the estimation of weights and evaluation of alternatives (Zhang *et al.*, 2005). Grey theory is also suitable for solving problems with complicated interrelationships between multiple factors and variables (Kuo and Liang, 2011) and it can achieve satisfactory outcomes using a rather small amount of data or with a large amount of variability in the factors (Fu *et al.*, 2012).

One of the advantages of the grey methodology over other decision-making techniques is that in this method, the opinions of experts can be gathered separately and then integrated into the model (Hashemi *et al.*, 2015). This makes the proposed model more flexible compared to other models utilizing methods such as TOPSIS or AHP, in which opinions have to be integrated at the beginning of the process. It also reduces the fatigue associated with a large number of pairwise comparisons as experienced in AHP or ANP. Grey methodology has an added advantage in vendor selection problem, as it includes the evaluation of both qualitative and quantitative attributes (Rajesh and Ravi, 2015). Grey method solves MCDM problems by combining the entire range of attribute values being considered for every alternative into one, single value. This reduces the original problem to a single attribute decision making problem. Therefore, alternatives with multiple attributes can be compared easily after the application of grey methodology (Zhang *et al.*, 2013). The methodology followed in this research is represented in Figure 1.
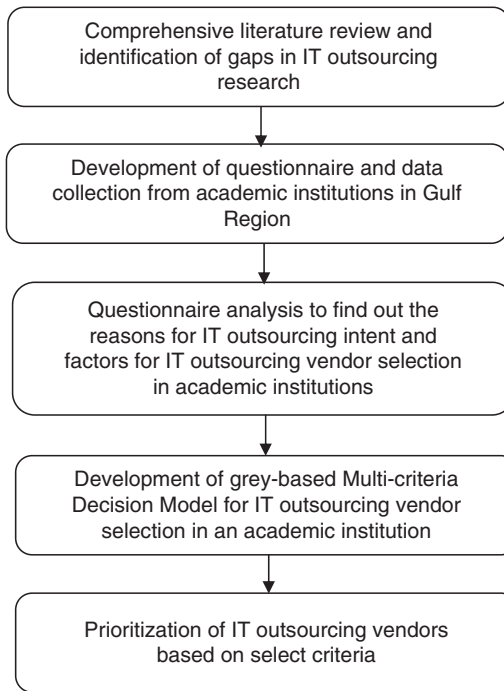
Figure 1.
Research
methodology

Research findings
Demographic profile
The descriptive statistics of the respondents are analyzed as shown in Table I. It presents the demographic characteristics of the respondents from 53 academic institutions.

Reasons for IT outsourcing intent
Table II provides the results for the survey question on determining the factors that academic institutions consider important in its intent for IT outsourcing. Facilitating access to new technology is considered as most important (33.9 percent), followed by focus on core-competence (24.5 percent), saving staff costs (18.9 percent) and improved customer service (13.2 percent).

Importance of factors for IT outsourcing vendor selection
Respondents were also asked to rate the importance of factors considered for IT outsourcing vendor selection. Table III presents the findings which indicate that reputation of vendor, access to the state of art technology, quality of service, and knowledge of industry were considered as the most important factors.

IT outsourcing vendor selection: grey theory-based MCDM
The extant literature on IT outsourcing and the results of empirical study shows that the cost of outsourcing cannot be the sole criteria to be taken into account regarding decisions on outsourcing selection. It can be inferred that different attributes have to be considered by the decision-maker, such as quality of service and access to the state of art technology (Almeida, 2007). Selection among a set of alternatives is a

Demographic characteristic	Items	Frequency	%
Gender	Male	46	88.79
	Female	07	11.21
Employee experience	10-15 years	18	33.96
	16-20 years	20	37.73
	more than 20 years	15	28.30
Age	⩽ 40 years	14	26.42
	41-50 years	31	58.50
	> 50 years	08	15.09
Academic degree	Bachelors	13	24.52
	Masters	38	71.69
	Doctorate	2	3.77
	Additional certifications	40	27.39
Number of registered students in the institution	⩽ 2,000	8	15.09
	2,001-5,000	17	32.07
	> 5,000	28	52.83

Table I.
Descriptive statistics
of the questionnaire
survey

	Small institutions (⩽2,000 students)	Medium-sized institutions (2,001-5,000 students)	Large institutions (> 5,000 students)	Total
Focus on core-competence	2 (3.7)	4 (7.6)	7 (13.2)	13 (24.5)
Increasing flexibility	0 (0)	1 (1.9)	1 (1.9)	2 (3.8)
Facilitating access to new technology	3 (5.7)	5 (9.4)	10 (18.8)	18 (33.9)
Reducing the risk of obsolescence	0 (0)	1 (1.9)	1 (1.9)	2 (3.8)
Saving staff costs	1 (1.9)	3 (5.7)	6 (11.3)	10 (18.9)
Saving technology costs	0 (0)	1 (1.9)	0 (0)	1 (1.9)
Improved customer service	2 (3.7)	2 (3.7)	3 (5.8)	7 (13.2)
Total	8 (15.1)	17 (32.1)	28 (52.8)	53 (100)

Table II.
Reasons for IT
outsourcing intent

Factor	Small institutions Mean (SD)	Medium-sized institutions Mean(SD)	Large institutions Mean(SD)
Reputation of the vendor	4.91 (0.456)	4.78 (0.377)	4.56 (0.365)
Access to the state of the art technology	4.37 (0.317)	4.21 (0.421)	4.88 (0.367)
Quality of service	4.21 (0.289)	3.89 (0.476)	3.75 (0.439)
Financial stability of the vendor	3.21 (0.431)	3.58 (0.568)	3.34 (0.674)
Outsourcing contract management	1.76 (0.356)	2.91 (0.472)	2.99 (0.368)
Knowledge of industry	4.71 (0.561)	4.61 (0.671)	4.83 (0.537)
Ability to set up measurement systems	1.5 (0.177)	1.78 (0.212)	2.19 (0.227)
Willingness to negotiate	1.91 (0.233)	2.21 (0.371)	2.57 (0.317)

Table III.
Importance of
factors for IT
vendor selection

decision-making problem, because there is, in reality, more than one criterion influencing this decision making (Faisal and Banwet, 2009). In such cases it quite reasonable to acknowledge that it is very difficult for a decision maker to simultaneously consider all the criteria and thus to reach a decision, the most important criteria should be considered (Tavares *et al.*, 2008). An MCDM deals with the problem decision making considering the impact of several criteria on the objective and selecting the best available choice from a set of alternatives. MCDM approaches takes care of the subjectivity in the criteria ratings and can also be considered as a trade-off analysis that compares the impacts of each alternative and indicates which alternative most nearly satisfies all relevant criteria (Chung and Lee, 2009). The decision-making process is facilitated by the data collected through a variety of sources like surveys, field studies, in depth interviews, focus groups so as to reach the optimal decision. Usually in the cases where MCDM model is applied it is observed that obtaining all the information remains impossibility; and thus therefore decisions are usually made in grey process, i.e. without complete information. This is where grey theory, finds application in solving MCDM problems (Goyal and Grover, 2012).

Grey system theory (Deng, 1982; Liu *et al.*, 2009) is a new mathematical theory that was based on the concept of grey set. It is according to the degree of information. If the information is known entirely, the system is called a white system. If the information is being incomplete, it is called a grey system. If the information is unknown, it is called a black system. The sources of imprecision include: unquantifiable information, non-obtainable information, incomplete information, and partial ignorance (Huang, 2011). A "grey number" is such a number whose exact value is unknown but a range within which the value lies is known (Liu and Lin, 1998). It is concerned with solving problems which involves uncertainty or systems with incomplete information (Wang and Tong, 2003). The major advantages that has led to a rapid grey theory is the requirement of small sample size and incomplete information to solve problems (Li and Chen, 2013). The scientific fields covered by grey system theory include systems analysis, data processing, modeling, prediction, decision making, and control; these fields are neither deterministic nor totally unknown, but rather they are partially known (Wei *et al.*, 2015). Grey models require only a limited amount of data to estimate the behavior of unknown systems and thus they can be considered as superior method as compared to conventional statistical techniques like linear regression models (Huang, 2011).

This paper follows the approach proposed by Li *et al.* (2007) and followed by Baskaran *et al.* (2012), Khan and Faisal (2015), and Golmohammadi and Mellat-Paras (2012). This method is very suitable for solving the group decision-making problem in an uncertain environment. Assume that $V = \{V_1, V_2 ..., V_m\}$ is a discrete set of m possible IT outsourcing vendor firm alternatives and $C = \{C_1, C_2 ... C_n\}$ is a set of n attributes/criteria of IT outsourcing vendor firms' selection. The criteria are additively independent and $w = \{w_1, w_2, ..., w_n\}$ is the vector of criteria weights. In this paper, the attribute weights and ratings of vendor firms are considered as linguistic variables. Here, these linguistic variables can be expressed in grey numbers by the 1-7 scale shown in Table IV. The attribute ratings $\otimes G$ can also be expressed in grey numbers by the 1-7 scale shown in Table V. The detailed methodology is presented below.

Step1: criteria weight identification
This step is facilitated by a group of decision makers (DMs) who identify the attribute weights of vendors. These DMs are considered to be well versed in the terminology and are acquainted with area in which the decision is required to taken. Considering a

group of K DMs, the attribute weight of attribute Q_j can be calculated as:

$$\otimes w_j = \frac{1}{K}\left[\otimes w_j^1 + \otimes w_j^2 + \ldots + \otimes w_j^K\right] \quad (1)$$

where $\otimes w_j^K$ $(j = 1, 2, \ldots, n)$ is the attribute weight of Kth DMs and can be described by grey numbers $\otimes w_j^K = \left[\underline{w}_j^K, \overline{w}_j^K\right]$.

Step 2: criteria rating value in linguistic variables
Use linguistic variables for the ratings to make an attribute rating value. Then, the rating value can be calculated as:

$$\otimes G_{ij} = \frac{1}{K}\left[\otimes G_{ij}^1 + \otimes G_{ij}^2 + \ldots + \otimes G_{ij}^K\right] \quad (2)$$

where $\otimes G_{ij}^K$ $(i = 1, 2, \ldots, m; j = 1, 2, \ldots, n)$ is the attribute rating value of Kth DMs and can be described by the grey number $\otimes G_{ij}^K = \left[\underline{G}_{ij}^K, \overline{G}_{ij}^K\right]$.

Step 3: establish the grey decision matrix
Establish the grey decision matrix:

$$D = \begin{bmatrix} \otimes G_{11} & \otimes G_{12} & \cdots & \otimes G_{1n} \\ \otimes G_{21} & \otimes G_{22} & \cdots & \otimes G_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \otimes G_{m1} & \otimes G_{m2} & \cdots & \otimes G_{mn} \end{bmatrix} \quad (3)$$

where $\otimes G_{ij}$ are linguistic variables based on the grey number.

Scale	$\otimes w_j$
Very low (VL)	[0.0,0.1]
Low (L)	[0.1,0.3]
Medium low (ML)	[0.3,0.4]
Medium (M)	[0.4,0.5]
Medium high (MH)	[0.5,0.6]
High (H)	[0.6,0.9]
Very high (VH)	[0.9,1.0]
Sources: Li *et al.* (2007), Baskaran *et al.* (2012)	

Table IV.
The scale of attribute weights $\otimes w_j$

Scale	$\otimes G_{ij}$
Very poor (VP)	[0,1]
Poor (P)	[1,3]
Medium poor (MP)	[3,4]
Fair (F)	[4,5]
Medium good (MG)	[5,6]
Good (G)	[6,9]
Very good (VG)	[9,10]
Sources: Li *et al.* (2007), Baskaran *et al.* (2012)	

Table V.
The scale of attribute ratings $\otimes G_{ij}$

Step 4: normalize the grey decision matrix
Normalize the grey decision matrix:

$$D = \begin{bmatrix} \otimes G_{11}^* & \otimes G_{12}^* & \cdots & \otimes G_{1n}^* \\ \otimes G_{21}^* & \otimes G_{22}^* & \cdots & \otimes G_{2n}^* \\ \vdots & \vdots & \ddots & \vdots \\ \otimes G_{m1}^* & \otimes G_{m2}^* & \cdots & \otimes G_{mn}^* \end{bmatrix} \tag{4}$$

where for a benefit attribute, $\otimes G_{ij}^*$ is expressed as:

$$\otimes G_{ij}^* = \left[\frac{\underline{G}_{ij}}{G_j^{max}}, \frac{\overline{G}_{ij}}{G_j^{max}} \right] \tag{5}$$

$$G_j^{max} = max_{1 \leqslant i \leqslant m} \left\{ \overline{G}_{ij} \right\};$$

For a cost attribute, $\otimes G_{ij}^*$ is expressed as:

$$\otimes G_{ij}^* = \left[\frac{G_j^{min}}{\overline{G}_{ij}}, \frac{G_j^{min}}{\underline{G}_{ij}} \right] \tag{6}$$

$$G_j^{min} = min_{1 \leqslant i \leqslant m} \left\{ \underline{G}_{ij} \right\}.$$

The normalization method mentioned above is to preserve the property that the rangers of the normalized grey number belong to [0, 1].

Step 5: develop the weighted normalized grey decision matrix
Develop the weighted normalized grey decision matrix. Considering the different importance of each attribute, the weighted normalized grey decision matrix can be established as:

$$D^* = \begin{bmatrix} \otimes V_{11} & \otimes V_{12} & \cdots & \otimes V_{1n} \\ \otimes V_{21} & \otimes V_{22} & \cdots & \otimes V_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \otimes V_{m1} & \otimes V_{m2} & \cdots & \otimes V_{mn} \end{bmatrix} \tag{7}$$

where $\otimes V_{ij} = \otimes G_{ij}^* \times \otimes w_j$.

Step 6: set ideal vendor alternative as referential vendor alternative
Make the ideal alternative as a referential alternative. For m possible vendor alternatives set $S = \{V_1, V_2, ..., V_m\}$, the ideal referential vendor alternative $V^{max} = \{\otimes G_1^{max}, \otimes G_2^{max}, ..., \otimes G_n^{max}\}$ can be obtained by:

$$V^{max} = \left\{ \left[max_{1 \leqslant i \leqslant m} \underline{V}_{i1}, \ max_{1 \leqslant i \leqslant m} \overline{V}_{i1} \right], \left[max_{1 \leqslant i \leqslant m} \underline{V}_{i2}, \ max_{1 \leqslant i \leqslant m} \overline{V}_{i2} \right], ..., \right.$$
$$\left. \left[max_{1 \leqslant i \leqslant m} \underline{V}_{in}, \ max_{1 \leqslant i \leqslant m} \overline{V}_{in} \right] \right\} \tag{8}$$

Step 7: calculate the grey possibility degree
Calculate the grey possibility degree between compared vendor alternatives set $V = \{V_1, V_2, \ldots, V_m\}$ and ideal referential vendor alternative V^{max}:

$$P\{V_i \leqslant V^{max}\} = \frac{1}{n} \sum_{j=1}^{n} P\{\otimes V_{ij} \leqslant G_j^{max}\}. \tag{9}$$

Step 8: prioritize vendors
Rank the order of vendor alternatives. When $P\{V \leqslant V^{max}\}$ is smaller, the ranking order of V_i is better. Otherwise, the ranking order is worse.

According to the above procedures, we can determine the ranking order of all suppliers' alternatives and select the best from among a set of feasible suppliers.

Case application of the MCDM
This section provides the application of proposed model developed in the last section for the selection of IT outsourcing vendor for a large public university in GCC. The university is experiencing a very high growth in the number of students' population and the current in-house IT department is finding it hard to cope with the demands of the increase number of students, faculty and staff. A discussion with the IT head and section heads for networking and data center reveal that they are assessing the options for selective outsourcing. Further the discussion brought forth the important issue of vendor selection where all of them conveyed that cost is the major factor of selection of vendor. They had little idea how to develop a MCDM model and apply for a more rational decision for vendor selection. Four most important criteria C_i ($i = 1, 2, \ldots 4$) were selected based on the results of the empirical study and extant literature. These criteria are access to state of the art technology, reputation of the vendor, knowledge of industry, and quality of service. Similarly, three vendors V_i ($i = 1, 2 \ldots 4$) out of five potential applications were shortlisted, two were rejected due to their inexperience in IT outsourcing. The DMs now had a problem before them that all the three vendors has quoted very similar prices for the services they would render. Thus the proposed model was applied and the IT head and the section heads of networking and data center acted as the three DMs for the application of the model.

Step1: criteria weight identification using grey numbers
DMs identifies the criteria weights of the vendors. The group has three DMs, and the criteria weight for the criteria is the simple average of the group for that criteria. The weights for criteria are shown in Table VI.

Criteria (C_j)	DM$_1$	DM$_2$	DM$_3$	$\otimes w_j$
C_1	H	VH	H	[0.7000,0.9333]
C_2	H	H	M	[0.5333,0.7667]
C_3	H	M	MH	[0.5000,0.6667]
C_4	VH	MH	H	[0.6667,0.8333]

Table VI.
Criteria weights for four decision making criteria

Step 2: criteria rating value in linguistic variables
In this step each of the vendor was evaluated by each of the decision maker with respect to each of the selected criteria considered important for IT outsourcing decision. According to Equation (2), the results of attribute rating value shown in Table VII.

Step 3: establish the grey decision matrix
The values as obtained in Table VII are transposed to establish the grey decision matrix as per Equation (3). The resulting table is for the grey decision matrix for the outsourcing vendors is shown in Table VIII.

Step 4: normalize the grey decision matrix
The values as obtained in Table VIII are now normalized. This would entail the use of Equation (4) and the grey normalized decision values are shown in Table IX.

Step 5: establish the weighted normalized Grey decision matrix
In this step the weights (importance) of the criteria as established by the DMs in Table I are utilized as per Equation (7) to develop a grey weighted normalized decision matrix shown in Table X.

Criteria(C_j)	V_i	DM_1	DM_2	DM_3	$\otimes G_{ij}$
C_1	V_1	G	VG	G	[7.00,9.33]
	V_2	G	MG	G	[5.67,8.00]
	V_3	MG	MG	G	[5.33,7.00]
C_2	V_1	MG	G	F	[5.00,6.67]
	V_2	G	MG	VG	[6.67,8.33]
	V_3	F	F	F	[4.00,5.00]
C_3	V_1	F	F	MG	[4.33,5.33]
	V_2	MG	F	G	[5.00,6.67]
	V_3	MP	F	MG	[4.00,5.00]
C_4	V_1	MG	G	F	[5.00,6.67]
	V_2	G	MP	MG	[4.67,6.33]
	V_3	MG	F	F	[4.33,5.33]

Table VII.
Attribute rating values for outsourcing vendors

V_i	C_1	C_2	C_3	C_4
V_1	[7.00,9.33]	[5.00,6.67]	[4.33,5.33]	[5.00,6.67]
V_2	[5.67,8.00]	[6.67,8.33]	[5.00,6.67]	[4.67,6.33]
V_3	[5.33,7.00]	[4.00,5.00]	[4.00,5.00]	[4.33,5.33]

Table VIII.
Grey decision matrix

V_i	C_1	C_2	C_3	C_4
V_1	[0.750,1.000]	[0.600,0.801]	[0.649,0.799]	[0.750,1.000]
V_2	[0.608,0.857]	[0.801,1.000]	[0.714,1.000]	[0.700,0.949]
V_3	[0.571,0.750]	[0.480,0.600]	[0.600,0.750]	[0.649,0.799]

Table IX.
Grey normalized decision matrix

Step 6: set ideal vendor alternative as referential vendor alternative
Values from Table VIII are selected to develop an ideal IT outsourcing firm V^{max} a referential alternative. According to Equation (8), the ideal IT outsourcing firm V^{max} is shown as follows:

$$V^{max} = \{[0.525, 0.933], [0.427, 0.767], [0.357, 0.667], [0.500, 0.833]\}$$

Step 7: calculate the grey possibility degree
Finally each vendor (V_1, V_2, V_3) are compared with respect to ideal referential outsourcing vendor firm alternative V^{max}. According to Equation (9), of the grey possibility degree are shown as follows:

$$P(V_1 \leqslant V^{max}) = 0.5918$$

$$P(V_2 \leqslant V^{max}) = 0.4770$$

$$P(V_3 \leqslant V^{max}) = 0.7800$$

Step 8: prioritize vendors
The three IT outsourcing vendors are prioritized based on grey possibility values as calculated in Step 7, the result of ranking order is shown as follows: $V_2 > V_1 > V_3$.

Based on the above results it can be concluded that outsourcing vendor 2 is the best followed by vendor 1. This conclusion is based on the criteria considered in the MCDM.

Discussion
Outsourcing has seen a tremendous growth and has become an increasingly popular strategy since the beginning of twenty-first century (Zhang, 2015). Scholars from wide variety of disciplines have conducted empirical studies to understand the outsourcing phenomenon to provide recommendations to the industry for productive partnerships and healthy relationships (Lahiri, 2015). Due to very fast pace of technology change IT arena has seen much more outsourcing as compared to other sectors and since the Kodak outsourcing experiment the literature has been enriched by studies on various dimensions of IT outsourcing. However, no study was conducted on IT outsourcing in academic institutions in the Gulf region which is experiencing high economic growth and more outlays by the governments on education in recent years. Thus the present study fills this gap to provide an understanding of IT outsourcing in context of academic institutions in Gulf region.

As a result of the magnitude and risk of IT expenditures, senior managers continually search for opportunities to reduce costs, enhance returns, and mitigate risk from IT activities. To achieve these goals IT outsourcing is a widely used strategy for

V_i	C_1	C_2	C_3	C_4
V_1	[0.525,0.933]	[0.320,0.614]	[0.325,0.532]	[0.500,0.833]
V_2	[0.426,0.800]	[0.427,0.767]	[0.357,0.667]	[0.467,0.791]
V_3	[0.400,0.700]	[0.256,0.460]	[0.300,0.500]	[0.433,0.665]

Table X.
Grey weighted normalized table

managing IT spending and capabilities (Kobelsky and Robinson, 2010). Studies like Dibbern *et al.* (2004) and Mahnke *et al.* (2005) considers the most common objectives cited are reducing the cost of IT and gaining access to IT capabilities not available in-house. This may be attributed to the size and specialization of vendors who may gain greater access to a broader variety and deeper pool of IT expertise than any one of their customers, especially for new and highly specialized technologies (Loh and Venkatraman, 1992). Our study also corroborate the findings of previous research in the area of IT outsourcing that the major reasons for outsourcing are reduction of cost, focus on core competencies, and access to state of the art technology. IT outsourcing leads to cost efficiency and improvements in productivity (Agrawal and Haleem, 2013) and thus organizations considering IT outsourcing are looking forward for an IT support that adds value to the organization and improves business (Michell and Fitzgerald, 1997). The present research also shows that improved customer service resulting from enhanced IT capabilities is one of the important factor considered for IT outsourcing intent.

Superior performance can be achieved by an organization by using complementary resources like possession of advanced technology, technological expertise and working in similar projects by IT outsourcing vendor (Gorla and Somers, 2014). The empirical study reported in this paper supports these findings. For academic institutions the most important factor for IT outsourcing is facilitating access to new technology. This factor is considered important as it is increasingly becoming difficult to maintain pace with fast changes in IT development. According to resource-based view, outsourcing provides access to specialized resources and capabilities and helps the client organization to focus on its core competencies thereby improving competitiveness (Lahiri, 2015). Our study also shows that focus on core competency which in our case is the teaching and research as the study was conducted for academic institutions emerges as an important reason for IT outsourcing intent. IT outsourcing market is becoming very competitive and thus in order to provide more value from the outsourcing relationship thereby helping to retain the customer, IT service provider or vendor should understand its customer needs (Bairi and Manohar, 2011). The present research would help vendors to understand the reasons because of which the academic institutions are opting for IT outsourcing which would help them devise suitable strategies to meet their customer requirements in a better way.

Each organization will have its own reasons for outsourcing as there is a more complex decision criteria process that needs to be considered for outsourcing (Hartshorne, 2015). In extant literature no research was found that provided a MCDM for IT outsourcing vendor selection in academic institutions though according to Ketler and Walstrom (1993) and Baldwin *et al.* (2001) selection of vendor is one of the most important determinant of a successful IT outsourcing relationship. The problem with analyzing an MCDM system is a lack of data, especially in empirical works. To address this constraint, grey relational methods can be applied (Arce *et al.*, 2015). Our research contributes by providing a MCDM utilizing grey methodology. The results provide a prioritization of vendors based on the criteria used in the model. IT outsourcing may turn out to be a good strategy in academic institutions because these organizations do not have a very fast pace of technology change and as per Perrons and Platts (2004) argument, outsourcing can be more effective in the industries that have a medium-speed technology change. Our research also confirms this as majority of the academic institutions would like to focus on their core competence and outsource the support task of providing IT to an outside expert.

Conclusions

The contribution of the paper is twofold; first it carries out an empirical investigation to understand the reasons for IT outsourcing intent and factors considered important for outsourcing vendor selection. Based on the results of empirical study a MCDM is developed using grey theory for the selection of the IT outsourcing vendor. The model developed is considered a better decision making tool as it has taken into account multiple criteria that might affect IT outsourcing vendor selection decision. Our findings support the results of previous studies on factors considered important for an IT outsourcing decision and factors considered important for IT outsourcing vendor selection.

Implications for theory and practice

From the theoretical perspective, this study raised the important issue of IT outsourcing vendor selection based on multiple criteria. In fact, this paper also contributes to general outsourcing literature as IT outsourcing is an emerging phenomenon in academic institutions. Using a survey approach, this research attempts to fill a gap in the literature on IT outsourcing research by considering a new domain of IT outsourcing. Our study also adds to the literature on IT outsourcing that emphasizes the importance of the decision of IT vendor selection on successful IT outsourcing.

As IT outsourcing have a long-term consequences for the organization, the results of this study have several implications for practitioners. It suggests a new approach in making an informed decision for the selection of an IT outsourcing vendor. The present study also provides reasons which would lead to IT outsourcing in academic institutions. Our findings provide a guideline for designing effective IT outsourcing agreements with an understanding of factors considered important in outsourcing vendor selection. Managers would also be supported by the proposed decision making approach by finding the qualities of an ideal referential IT outsourcing vendor so as to get indication on how better a vendor can perform in comparison to others considered as a choice for IT outsourcing.

Limitations of the study

Several limitations need to be considered when interpreting the results. The limitations of this study offer opportunities for future research. First limitation is the results obtained from grey method are highly dependent on the experts' opinions. The weightings and rating of attributes by these experts are subjective and depends upon their knowledge and expertise. One possible solution to address this issue would be to increase the number of experts. The second limitation of this study is the composition of the sample used for questionnaire-based study. The sample lacked randomness because many responses were possible only through personally contacting the respondents through phone or through a person working in that institution.

Another limitation might be inadvertently neglecting a factor that might influence the decision of IT outsourcing vendor selection. Some recent studies suggest factors like business impact, user satisfaction in addition to traditional IT outsourcing benefits like cost savings and access to latest technology. An extension of this study might consider these additional factors for developing a multi-criteria model. Finally, the results of this study may include some biases because the sample was restricted to academic institutions from Gulf region where education sector is expanding due to significant focus by the governments and a relatively higher growth in the population.

Thus, the results have to be carefully interpreted. The replication of this study in other regions is also needed to improve the generalizability of the findings. These limitations need future in-depth investigation.

Future directions of research
In IT outsourcing one of the important aspects is the relationship management. As IT outsourcing is a new phenomenon for academic institutions in Gulf region, future studies may look into this aspect. Further, literature on IT outsourcing suggest several models like "total outsourcing," "insourcing," "multiple supplier sourcing," and "strategic alliance sourcing." Thus in future, studies might look into these options in context of academic institutions and provide recommendations to opt for a specific model. As performance of the organization is important, future studies might also look into the impact of IT outsourcing on various measures of performance like productivity, quality, and improved customer service. In addition future studies might explore the issues related to contracts management like legal, structural, economic, and performance for IT outsourcing in academic institutions. Finally an area worth exploring in context of IT outsourcing in academic institutions is management of risks in outsourcing partnerships.

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