

# Exploring the Implications of Digital Marketing for Higher Education using Intuitionistic Fuzzy Group Decision Making Approach

BIMTECH Business Perspective (BSP)  
1–19  
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DOI: xxxx

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## Abstract

This paper endeavours to identify the critical implications of digital marketing (DM) for the higher education sector (HES). Inbound marketing is a growing concern for the strategic decision-makers these days. Unlike the traditional 'push'-oriented outbound marketing, DM enables the organisation to understand customers better, build a long-term relationship, to design order-winning value propositions and customised products and services, and effective positioning of the brands through the creation of 'pull' factors. Hence, it stands as a source of a competitive advantage for the HES. In this paper, an expert opinion-based intuitionistic fuzzy multi-criteria group decision-making framework is used for examining the key implications of DM for the HES. It is revealed that identification of the needs, building of long-term relationships and engagement, and transparent communication have critical implications for DM in the context of higher education.

## Keywords

Digital marketing, higher educational sector, intuitionistic fuzzy multi-criteria group decision making, triangular intuitionistic fuzzy numbers, Kendall's concordance coefficient

## 1. Introduction

Behind any marketing effort, there is an underlying motive to build a long-term relationship with the customers. Although retention of the customers depends on meeting their stated and/or unstated needs by providing desired products and offering required service at an affordable price, it is the effort of relationship building that helps organisations to understand the consumer psychology and communicate

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effectively with them. Over the years, the decision-makers have understood the importance of thinking beyond achieving market share and getting more involved in relationship marketing (RM) rather than mere transactional marketing (TM) activities. RM enables the organisations to understand true requirements of the customers. Accordingly, organisations design and deliver an appropriate portfolio of products and services, which provide a value for money to the customers. Needless to mention, consumers are an essential strategic partner for any organisation (Parvatiyar & Sheth 1999). Traditional outbound marketing quite understandably gets faded out in these respects as compared with the growing field of inbound marketing based on technology-driven digital media. Marketing using a digital platform or DM generates a 'pull factor' in an open and convenient environment. Formally, DM is defined as "The practice of promoting products and services in an innovative way, using primarily database-driven distribution channels to reach consumers and customers in a timely, relevant personal and cost-effective manner is known in the theory and practice as digital marketing" (Wsi 2013).

DM relies on a customer-centric approach wherein 'pull' factors are created by using several digital media. Digital media in this regard include social networks (e.g., Blogs, Twitter, Facebook, Instagram, WhatsApp), videos, eBooks, search engine optimisation (SEO), search engine marketing (SEM), Google, emails, and many others.

Way back, Song (2001) advocated using DM in brand building and enhancement of traffic. Teo (2005) contemplated the view of Song (2001) and opined that extensive brand building and connectivity with the customers by using DM play critical role in defining the success for the organisations. In a country like India, where at present the average population is rather young in comparison with several countries, the decision-making process is largely influenced by digital media. Further, in recent years, the number of internet users is increasing at a faster rate in India. A large part of these internet users frequently uses social media and other online platforms for making purchase decisions, payments, and post-purchase recommendations. Hence, organisations need to extensively access these social media and other online platforms to get useful insights of the latent needs and preferences of the consumers by analysing the huge data that is available there. In effect, organisations can predict the future requirements and formulate strategic decisions accordingly. DM helps in a fast and convenient sharing of information and captures the opinions of a large number of customers while revealing many untold stories which are useful in anticipating the real needs (Boateng & Okoe 2015; Milewicz & Saxby 2013; Lee & Ma, 2012; DiStaso *et al.* 2011). Trusov *et al.* (2009) found the significant impact of DM in terms of building public opinions, creating awareness, and spread of the brands (through word of mouth). DM enhances the customer experiences (Mangold & Faulds 2009), establishes strong linkages between the firms and customers, fosters electronic word of mouth (e-WOM), which primarily impacts the brand equity (Jalilvand & Samiei 2012; Biedenbach & Marell 2010). Brand equity focuses on creating a mutually beneficial relationship among the consumers and the organisations (Schivinski & Dabrowski 2015; Yoo *et al.* 2000). Cetina *et al.* (2012) posited that online or digital experience affects consumer psychology, which influences purchase decision making quite significantly.

In tune with these observations, Sheth (2017) emphasised on formulating marketing strategies to win the 'share of heart' of the customers instead of focusing on getting the 'share of wallet'. The intention is to cross the business-minded territory within which all activities are geared to reap economic benefits and enter into a long-term relationship with the customers, which allows creating an emotional bonding blended with mutual trust, respect, and commitment and which is driven by passion and purpose. Sheth (2017) accentuated the contextual significance of social media (i.e., digital platform) in setting up and cultivation of a large brand community. Social media (SM) plays a helping role in connecting the consumers with the producers in a better way (Keegan & Rowley 2017). It may be noted that some of the researchers (Coyle *et al.* 2012; Dix *et al.* 2012; Mortazavi *et al.* 2014; Rios & Riquelme 2010; Rohm

*et al.* 2013) have observed little evidence of detailed investigations about the impact of digital media on brand equity. Quite understandably an effective mix of traditional and digital marketing at this point of time might help firms in creating brand awareness and brand loyalty.

It is contended that DM helps in designing a strategic marketing communication plan; service or product offerings as per the need and effectively integrating with the market, resulting in an improved operational efficiency; one-to-one marketing; and customised product and service offerings (Dholekia & Kshetri 2004; Hanna *et al.* 2011; Helm *et al.* 2013; Koiso-Kanttila 2004; Pai & Arnott 2013). Todor (2016) pointed out the utilities of DM such as cost efficiency, large scale interaction, market reach, faster operation, richness in contents, better monitoring and control, and flexibility. Shirisha (2018) highlighted some benefits of DM, such as cost-effectiveness, enhanced exposure, time efficiency, higher engagement of students, and brand building. One of the major concerns for organisations is to measure the impact of promotional activities like advertisements. In this regard, DM plays a crucial role in providing a cost-effective and timely solution (Pepelnjak 2009), which helps to measure the impact of promotional activities on the return on investment (ROI). Kannan (2017) pointed out that personification of products and services, augmentation of digital services with dynamic pricing, and yield management are some of the key differentiators of DM.

Over the past few decades, higher education sector (HES) has also gone through a radical change. In line with the transformational developments in information and communication technology (ICT), the knowledge sector has been experiencing an unstoppable transformation. Consequentially, HES is now exposed to an extreme level of competition (Bock *et al.* 2014; Joseph *et al.* 2012). The competition stems not only from the emergent requirement of understanding the value proposition of modern education but also from the need to recognise and appreciate the changing nature of stakeholders' requirements. A holistic assessment of the intentions and considerations of the decision-makers is of paramount importance. The effectiveness of the institutions and universities belonging to HES is realised through fulfilment of the combined needs and expectations of multiple stakeholders: students, parents, employers, regulatory bodies, government, and society (Maringe 2006). In a sense, the higher educational institutions (HEIs) deal with two primary customers: students (whom they offer the product in terms of the programme itself and render services to facilitate product delivery) and employers (whom they provide qualified and employable students as complete products). The others remain secondary stakeholders (Stensaker & D'Andrea 2007).

In a recent study in the context of selection of business management institutions for higher studies, Bhattacharjee *et al.* (2020) have attempted to identify the considerations of parents and students. The authors mentioned several factors which in a usual sense are not considered in the traditional thinking process of educational service providers. According to Bhattacharjee *et al.* (2020), quality of the teaching-learning process and infrastructure would not be the game changers in the coming decade. Rather, HEIs need to understand the students' needs from the perspective of lifelong utility. Fagerström and Ghinea (2013) have advocated co-creation of value as a necessity for HEIs and pointed out the drawbacks of the traditional marketing. According to them, the traditional promotional tools will no longer work since consumers in future will be taking evidence-based decisions. Information is no longer obtained on querying; instead, the trend is to utilise digital media for an active assimilation and dissemination of knowledge and wide-scale communication. Visibility, transparency, and connectivity are some of the characteristic features of this digital age, therefore, there is a conspicuous necessity to establish a connection between three dots, namely students/parents, HEIs, and industry/employers, while having the government as a support provider. In essence, building a mutually propitious and enduring interrelationship among the members, as mentioned above, is seen as one of the critical success factors for the HES in future. Marketing is no longer an outlandish term (in a business sense) as was perceived by HEIs (Maringe & Carter 2007; Whelan & Wohlfeil 2006).

With this as a backdrop, the present study intends to find the critical implications of DM for the HES using an intuitionistic fuzzy set-based multi-criteria group decision making (IF-MCDM) framework involving experts. The objective of this study is to understand how DM helps HEIs to connect with the prospective students and their parents, and eventually build up a relationship with them. In effect, HEIs can attract a substantial number of talents for enrolment. The rest of this paper proceeds as follows. In Section 2, implications of the DM for HEIs are highlighted while in Section 3, the research methodology is explained and the responses of the experts are presented. Section 4 provides the findings and draws inferences. Section 5 points out some of the implications of this study, while Section 6 concludes the paper with some directions for future research.

## 2. Digital marketing: How it helps HEIs

With the findings and arguments put forth by several researchers, it is quite evident that DM is an important strategic tool for HEIs. The implications of DM for higher education are summarised as follows.

### 2.1. Brand positioning

Branding is an important aspect of the marketing activities for HEIs. In the process of connecting with the prospective students/parents and other stakeholders through marketing efforts (Carvalho & de Oliveira Mota 2010; Chapleo 2005; Ivy 2001), HEIs attempt to position themselves in the mind of the stakeholders like prospective students for influencing their perceptions, attitude and decisions (Heslop & Nadeau 2010). In this regard, endeavour of the HEIs is to create a brand through their unique service value propositions and distinctive characteristics for sustaining in the competition and staying ahead of the curve (Kotler *et al.* 2014; Mount & Belanger 2004). Brand acts as an antecedent of satisfaction, trust, commitment, and, subsequently, loyalty of the students and alumni of a HEI (Dennis *et al.* 2016). DM plays an important role in positioning the brand in the mind of a large set of prospective students by using social media platforms. It helps the HEIs to cover a wide geographic area across countries as HEIs are now more inclined to recruit international students, collaborate with other institutes and universities for exchange programmes, and other short duration activities. Positioning of the brand also enables HEIs to connect with prospective recruiters (Camilieri 2019). Bélanger *et al.* (2014) presented an interesting case study of the Canadian universities who use social media platforms like Facebook and Twitter to highlight campus/student-related activities for promotion and institutional branding to attract domestic and international students. As a matter of fact, with the increasing use of smartphones, DM helps HEIs to stay in touch with the students round the clock in a personalised way (Pharr 2019). Customised branding activities in tune with the different consumer psychology (Dholakia & Acciardo 2014; Watkins & Gonzenbach 2013) and brand recognition are essential dimensions of competitive advantage for the HEIs today.

### 2.2. Micro-level market segmentation and targeting

In order to design and deliver products and services to fulfil the needs of customers, it is essential to first create a set of distinct clusters of consumers. By doing this, marketers can identify different patterns of shared values and norms, characters, behaviours, needs, decision making, and choices. Each of these clusters or 'segments' shows a homogeneous intra-group pattern and is heterogeneous to others.

Accordingly, organisations can formulate appropriate marketing strategy, effectively position the brand and deliver products and services to the target group (Hemsley-Brown & Oplatka 2015). In fact, effective market segmentation sets out order-winning value propositions which enable the organisation to reap a competitive advantage. In the case of HEIs, this segmentation process has a twofold significance as it impacts both the target audience (prospective students), who receive the service and the society, which depends on the socioeconomic development of these service users in the long run (Sudarikov *et al.* 2019). Therefore, a microlevel market segmentation is quite crucial for HEIs. However, this micro-level analysis posits a notable challenge, as the prospective students are widely different in terms of their career aspirations, learning orientation, sociocultural and economic backgrounds, lifestyle, and perspectives or opinions. Lewison and Hawes (2007) attempted to broadly classify the nature of the students such as ‘buyer’ and ‘learner’ types to prepare a basis for market segmentation by HEIs. Moving further, researchers (Hemsley-Brown, 2017; Kotler & Armstrong, 2018) have proposed four dimensions of market segmentation such as geographic, demographic, behavioural, and psychographic, which make the current discussion more interesting. All these dimensions have a unique relevance and influence on the needs and decision-making process of the primary stakeholders like prospective students. As a matter of fact, these dimensions also substantially control the act of the enrolled students and shape their career path. Needless to mention, all these dimensions interplay among themselves. DM helps to identify the hidden features and unveil non-conventional and unknown patterns of interdependencies and interactions, which eventually fosters microlevel market segmentation and targeting process.

### 2.3. Customer outreach

As relationship building has become a major success factor for any marketing campaign in recent time, customer outreach is of paramount importance. It is important to reach right people at right time to spread the brand story over a wide geographic area. Now, traditional tools for promotional activities have two major limitations, inability to provide customized services and cost. Finding the right people means understanding their psychology and designing the marketing communications accordingly to achieve a greater footfall. Presently, DM has changed the landscape of marketing with increased use of social media. A massive number of consumers can be reached and interacted with through social media (del Rocío Bonilla *et al.* 2019). Marketing communications can be more customised (Hendricks & Schill 2015). Some recent statistical reports (Statistica, 2020a, 2020b) say that in India the number of internet users will rise to over 600 million by 2021 while another forecasting for India says that there would be around 447.9 million social media users who presently (in 2019) are 351.4 million. It is therefore evident that social media has become the battle ground where DM is an integrated part of the next generation competitive strategy. Having said so, if we look at the HES, as the percentage of youth in the total population is increasing, social media-based campaigns seem more appealing to them. In this way, HEIs can reach to a large target audience (prospective students). Further, over the last few decades, programmes like student exchange, international study tour, faculty interaction, and online courses have drawn significant attraction. Using the DM platform, HEIs can collaborate with each other and penetrate the market for their niche products.

### 2.4. Relationship building and customer engagement

Over the past few years, the offerings in higher education have notably changed. Off-the-class activities (extra- and co-curricular activities, professional grooming, etc.) are emphasised more as industries

require employable graduates. Further, students also take part in different intercollegiate events and exchange ideas and information. This has led to a quantum increase in the magnitude and intensity of student engagement requirements. Alongside, prospective students also look for more information and consider several factors before making the final call (Kandiko & Mawer, 2013). Hence, institutions are required to take initiatives to engage the students throughout the year. As a matter of fact, progressive HEIs do not only focus on the potential students who may take admission shortly, but also emphasise engaging the students who would be enrolling in future. There is another important aspect. In recent time, a trend has been noticed in the area of curriculum design. Leading HEIs are adopting a 360-degree approach in designing the curriculum wherein they take inputs from the current students, alumni, employers, and experts in the respective fields. In effect, HEIs promote their brands and offerings to the prospective decision-makers in the marketplace and can involve them in the product/service design and delivery process. Therefore, relationship building and engagement activities are more focused and rigorous now. In this context, DM plays a conspicuous role through social media (Kumar & Nanda 2019). Social media in this regard enable HEIs to establish a psychological engagement with the stakeholders (particularly students), which helps in their marketing communication and brand positioning (Ashley & Tuten 2015).

### *2.5. Discovering latent expectations*

The present era demands a student-centric service design (Khodayari & Khodayari 2011; Mahadzirah & Wan 2003). According to Grönroos (2008), service quality should be assessed in terms of the offerings which the students perceive as important and relevant. Therefore, it is necessary to uncover their unstated or latent needs. For example, following the social media activities of students, their lifestyle, choices, and preferences, and behavioural natures can be learned, which can help in creating an individual holistic profile of a student. Sometimes, this exercise reveals some hidden qualities of a student which even he or she does not know. In some cases, students do not express their difficulties or disagreements explicitly. In this regard, one of the possible solutions is to design some student engagement activities or events using the digital media. For instance, HEIs can organize counselling sessions and design customized personality development programmes. In effect, HEIs can design customised grooming modules for the students and counsel them. In several instances, this customised student engagement programmes help the HEIs in reaping word-of-mouth benefits. This is also applicable to the prospective students as well. Manoj and Sinha (2019) mentioned that by understanding the latent expectations of the prospective students using artificial intelligence and advanced data mining software (used in DM), HEIs can segment the potential market and formulate and communicate the right message in a customised way to the relevant sample of prospective students on time through below the line (BTL) activities. As a result, HEIs benefit in lead generation and possible conversion in the process of admission campaign.

### *2.6. Communication and information sharing*

Information today is a strategic asset for any organisation. HEIs are not an exception. On one side, HEIs need to stay updated regarding market trends, employment opportunities and employability factors, latest developments in different disciplines, frontier concepts and practices, and students' expectation while dissemination of information through effective and timely communication to the internal stakeholders (e.g., current students, employees) as well as external stakeholders (e.g., prospective students and their parents, employers) are very critical to the success. Information may be of different

kinds such as statutory and regulatory, events and activities, and about achievements (of students, employees, and organisations). The objective is to build awareness and stay in tune with the stakeholders. In this regard, the websites of HEIs play a significant role and the social media platforms help to generate a sizeable traffic through DM campaigns.

## ***2.7. Cost-effectiveness***

Although of late HEIs have increased their marketing and advertisement budget, it still is on average significantly less as compared with the industries. Furthermore, the traditional promotional tools are costly and using these tools need extensive preparations; HEIs need to restrict the time frame for use also. On the other hand, DM tools are cheaper than the traditional ones and therefore reduces the cost burden of the HEIs. Further, promotional DM tools have the possibility of unlimited use throughout the year and the coverage area is also very large. As a result, HEIs can have a larger footprint at an affordable cost (Cheng & Wang 2018).

## ***2.8. Feedback and control***

With the increasing use of Internet, companies are now able to monitor the activities on a real-time basis. Also, all functional nodes can operate seamlessly. This is another area where DM can help HEIs to continuously receive the market feedback about its service offerings. Analysing this voluminous and widely varied data, HEIs can use appropriate corrective and preventive strategies to resolve a problem or a possible conflict and take the situation under control. In this way, HEIs can withstand uncertainties in operation and improve it (Scullion & Molesworth 2016).

## ***2.9. Lead-time reduction***

As DM relies on the accessibility and speed of the internet, it helps HEIs to stay connected with the stakeholders (particularly students) round the clock for an exchange of news and information (Nayar & Kumar 2018). Any service-related issues can be resolved, and any specific marketing communication can reach a wide population within a short time, which otherwise is not possible in the traditional offline marketing.

## ***2.10. Ease of operation***

With the increasing use of social media and smartphones, the young generation hardly refers to any printed documents unless it is really required. The prospective students thus prefer communication and interaction at their convenience. Hence, HEIs use more and more digital communication. Interview and counselling sessions are also more frequently conducted through videocalling. Of late, cloud-based online teaching and learning platforms have also created notable opportunities for the HEIs.

It is evident that the next-generation marketing strategy for HEIs will need to be formulated to ensure ease of access and convenience in operation, information availability and quality, mobility, visibility, and transparency. In a recent study, Basha (2019) suggested some of the benefits of using DM tools for HEIs: cost-efficiency, feedback and control, measurability of the performance, accessibility, and higher level

**Table 1.** Implications of digital marketing in higher education.

Description	Code
Brand positioning	R1
Microlevel market segmentation & targeting	R2
Customer outreach	R3
Relationship building & customer engagement	R4
Discovery of latent expectation	R5
Communication & information sharing	R6
Cost effectiveness	R7
Feedback & control	R8
Lead-time reduction	R9
Ease of Operation	R10

of conversion. Suhányi (2011) contended that in order to achieve a competitive advantage in future, HEIs need to follow an innovative approach in designing consistently evolving and customised products and services at affordable prices, supplemented by well-designed, directed, and well-executed marketing efforts. DM is perceived to orchestrate the process of co-identification, co-design, and co-execution of value proposition for the HEIs in the coming decades. Table 1 exhibits the implications of DM for higher education.

### 3. Data and Methodology

In this study, an expert decision-making framework is used. The steps followed in the present study are as follow.

#### *Step 1*

In this step, seven experts with significant experience and expertise with DM tools and solutions were invited. For a typical opinion-based group decision-making approach, minimum of seven experts are required (Turskis *et al.*, 2019, citing Kendall, 1948) where each expert represents a group of respondents of a substantial size. These experts have provided solutions to several sectors including HEIs and have worked for years (Table 2). They were requested to rank the implications of DM (Table 1) in HES according to their perceived importance from the perspective of primary stakeholders such as prospective students (1 = highest importance, 10 = lowest importance; no repetition in rank allowed). The item that obtains the lowest average rank value (where the geometric mean is calculated) is assumed to have the highest significance, and so on. In this context, to understand the consistency among the experts,

**Table 2.** Profile of the experts.

Experience (in years)	Nature of work
20+ years (01)	Faculty members: 02
15–20 years (03)	Trainers: 02
10–15 years (03)	Practitioners/Consultants: 03
<b>Total: 07</b>	



Kendall's dispersive coefficient of concordance is calculated (Ivlev *et al.*, 2015). Table 3 presents the ranking given by experts to the implications of DM.

### Step 2

In the next step, the experts were requested to evaluate the implications of DM as per their possible impacts on enhancing the competitive position and attractiveness among the primary stakeholders

**Table 3.** Relative importance-based ordering of the implications of DM (experts' opinion).

Implications of DM in higher education	Code	Opinions of the experts (E)						
		E1	E2	E3	E4	E5	E6	E7
Brand positioning	R1	5	5	3	4	4	2	1
Microlevel market segmentation & targeting	R2	4	6	5	5	6	4	5
Customer outreach	R3	8	4	4	7	5	6	7
Relationship building & customer engagement	R4	1	2	1	1	2	3	4
Discovery of latent expectation	R5	2	1	6	3	1	5	2
Communication & information sharing	R6	3	3	2	2	3	1	3
Cost effectiveness	R7	9	10	7	6	10	8	9
Feedback & Control	R8	10	9	9	10	8	9	6
Lead-time Reduction	R9	7	8	8	9	9	7	8
Ease of Operation	R10	6	7	10	8	7	10	10

**Table 4.** Triangular intuitionistic fuzzy numbers (TIFN) for the linguistic scale.

Linguistic Scale	TIFN
Low (L)	([0.10, 0.90, 0.20]; 0.40,0.40)
Medium (M)	([0.20, 0.80, 0.20]; 0.40,0.10)
Good (G)	([0.30, 0.60, 0.10]; 0.40,0.30)
Very good (VG)	([0.60, 0.30, 0.10]; 0.50,0.20)
High (H)	([0.80, 0.10, 0.10]; 0.60,0.10)
Very high (VH)	([0.90, 0.10, 0.20]; 0.70,0.10)

**Source:** Aikhuele and Odofin (2017).

**Table 5.** Rating of the implications of DM based on impact (experts' view).

Implications of digital marketing in higher education	Code	Expert opinion (E)						
		E1	E2	E3	E4	E5	E6	E7
Brand positioning	R1	VG	H	VH	H	VG	H	G
Microlevel market segmentation & targeting	R2	VG	H	VG	H	G	H	VG
Customer outreach	R3	VG	VG	L	L	M	H	VG
Relationship building & customer engagement	R4	VH	VG	H	VH	H	H	VG
Discovery of latent expectation	R5	G	G	M	L	G	VG	VG
Communication & information sharing	R6	M	H	M	M	G	VG	G
Cost-effectiveness	R7	H	VG	VG	G	G	M	L
Feedback & control	R8	VG	G	VH	G	H	G	VG
Lead-time reduction	R9	H	VG	H	VG	VH	G	M
Ease of operation	R10	H	VG	M	G	VG	H	VG

(prospective students and their parents) of the HEIs. For this purpose, a six-point fuzzy linguistic scale was used, since considerable impreciseness is involved in a multi-criteria group decision-making situation. The six-point scale and its corresponding triangular intuitionistic fuzzy numbers (TIFN) as used in the work of Aikhuele and Odofin (2017) are given in Table 4. Accordingly, the responses of the experts are summarised in Table 5.

### Step 3

In this step, the responses of the experts for each implication of DM are aggregated using a triangular intuitionistic fuzzy weighted geometric averaging (TIFWGA) operator (Aikhuele & Odofin 2017). The aggregation results in a TIFN for each implication. For each such TIFN, the values of the score and accuracy function are calculated. Then the ranking of the implications of DM is done accordingly. This ranking is a result of the impact-based rating of the implications of DM as evaluated by the experts.

### Step 4

In a typical group decision-making environment, consistency is desirable among the decision-makers. In Step 1, the same was checked by using Kendall's concordance coefficient. In this step, to validate the results obtained in Step 3, the ranking of the implications as per their relative importance (Step 1) and the ranking as per the impacts (Step 3) are compared using Spearman's rank correlation test.

## 3.1. Group decision making and Kendall's concordance coefficient

Let,

$n$  = Number of objects to be compared. In this study, there are 10 (implications of DM).

$m$  = Number of experts. In this case, 7.

The steps in line with the steps mentioned in the literature (Ivlev *et al.* 2015; Turskis *et al.* 2019) are given below.

Step 1: Determination of the average rank.

The average rank is given by:

$$\bar{r} = \frac{\sum_{j=1}^m r_{ij}}{m} \quad (1)$$

Where,  $r_{ij}$  is the opinion (i.e., rank assigned) by the  $j^{\text{th}}$  expert on  $i^{\text{th}}$  object.

Step 2: Determination of the importance of the objects (i.e., implications of DM as used in this study).

Significance of the  $i^{\text{th}}$  object is given by:

$$q_i = \frac{\bar{r}}{\sum_{i=1}^n \bar{r}} \quad (2)$$

Step3: Calculation of Kendall's concordance coefficient (W) for finding out the coherence of expert judgment (no repetition in rank is assumed).

$$W = \frac{12S}{m^2(n^3-n)} \quad (3)$$

Where,  $W \in [0, 1]$

$$S = \sum_{i=1}^n \left( \sum_{k=1}^m r_{ik} - \frac{1}{n} \sum_{i=1}^m \sum_{k=1}^m r_{ik} \right)^2 \quad (4)$$

Here, S is the sum of the squares of the deviation of the rank sums obtained by each object from the mean sum of ranks. More is the closeness of W to the value 1, more harmonious is the group decision.

Step 4: Verification of the significance of concordance factor (W).

In this study, the number of objects ( $n$ ) = 10 > 7. Hence, the verification is done by using the significance of Pearson's chi-square test as suggested by Kapetanopoulou and Tagaras (2011) and Legendre (2005). Accordingly, at a particular significance level  $\alpha$  and degrees of freedom  $df = n-1$ ; first the  $\chi^2$  is calculated as:

$$\chi^2_{\text{calc}} = m(n-1)W \quad (5)$$

If  $\chi^2_{\text{calc}} > \chi^2_{\alpha, \text{table}}(n-1)$  then a compatibility of the expert opinions is supported.

### 3.2. Triangular intuitionistic fuzzy number-based group decision making

To solve the real-life problems under uncertain environment with imprecise information, Zadeh (1965) proposed the concept of fuzzy sets (FS). As defined in his seminal work, a FS  $\tilde{A}$  in  $X$ , where  $X$  is a collection of objects  $x$ , is defined (Zimmermann, 2011) as a set of ordered pairs as given below.

$$\tilde{A} = \left\{ (x, \mu_{\tilde{A}}(x)) \mid x \in X \right\} \quad (6)$$

Here,  $\mu_{\tilde{A}}(x)$  is the membership function of  $x$  in  $\tilde{A}$  such that  $X \rightarrow [0, 1]$  (membership space). However, in many scenarios, only the degree of varying membership may not portray the nature of uncertainty or impreciseness involved. For example, if a particular situation involves two states like membership and indeterminacy, the definition as given in equation (6) cannot fully express the characteristics of the membership function and hence is less effective in drawing inferences or decision-making processes. In view of this complexity, Atanassov (1986) propounded the concepts of intuitionistic fuzzy sets (IFS) and intuitionistic fuzzy numbers (IFN) which is an extension of fuzzy sets and numbers as introduced by Zadeh (1965) by adding a 'non-membership function' represented by  $\nu_{\tilde{A}}(x)$ . Conventionally, the sum of membership and non-membership values is supposed not to exceed one (Deschrijver & Kerre 2007). Based on the concept proposed by Despi *et al.* (2013), Aikhuele and Odofin (2017) have defined a group of intuitionistic fuzzy aggregation operators using TIFN. In the present study, TIFWGA is used for fuzzy aggregation.

### 3.2.1 Definition of TIFN

The membership and non-membership function of a general TIFN denoted as  $\tilde{A}^I$ , defined by  $([a,b,c]; \mu_{\tilde{A}^I}, \vartheta_{\tilde{A}^I})$  is given as follows (Aikhuele & Odofin 2017):

Membership function:

$$\mu_{\tilde{A}^I}(x) = \begin{cases} \frac{(x-a)\mu_{\tilde{A}^I}}{(b-a)}; & a \leq x < b \\ \mu_{\tilde{A}^I}; & x = b \\ \frac{(c-x)\mu_{\tilde{A}^I}}{(c-b)}; & b < x \leq c \\ 0; & \text{Otherwise} \end{cases} \quad (7)$$

Non-membership function:

$$\vartheta_{\tilde{A}^I}(x) = \begin{cases} \frac{(b-x+\vartheta_{\tilde{A}^I}(x-a'))}{(b-a')}; & a' \leq x < b \\ \vartheta_{\tilde{A}^I}; & x = b \\ \frac{(x-b+\vartheta_{\tilde{A}^I}(c'-x))}{(c'-b)}; & b < x \leq c' \\ 0; & \text{Otherwise} \end{cases} \quad (8)$$

$$0 \leq \mu_{\tilde{A}^I}, \vartheta_{\tilde{A}^I} \leq 1; 0 \leq \mu_{\tilde{A}^I} + \vartheta_{\tilde{A}^I} \leq 1; a, b, c, a', c' \in \mathbb{R}.$$

The score function (SF) and accuracy function (AF) are defined as below (Li *et al.* 2010; Wan *et al.* 2016):

$$S(\tilde{A}^I) = \frac{(a+2b+c)\mu_{\tilde{A}^I}}{4} \quad (9)$$

$$H(\tilde{A}^I) = \frac{(a+2b+c)(1-\vartheta_{\tilde{A}^I})}{4} \quad (10)$$

If  $\tilde{A}^I_1$  and  $\tilde{A}^I_2$  are two TIFNs having SF as  $S(\tilde{A}^I_1)$ ,  $S(\tilde{A}^I_2)$  and AF as  $H(\tilde{A}^I_1)$ ,  $H(\tilde{A}^I_2)$  respectively, then the following conditions hold to compare the two TIFNs.

- i) If  $S(\tilde{A}^I_1) < S(\tilde{A}^I_2)$ ; then  $\tilde{A}^I_1 < \tilde{A}^I_2$
- ii) If  $S(\tilde{A}^I_1) = S(\tilde{A}^I_2)$  and  $H(\tilde{A}^I_1) < H(\tilde{A}^I_2)$ ; then  $\tilde{A}^I_1 < \tilde{A}^I_2$

iii) If  $S(\tilde{A}^1)_1 = S(\tilde{A}^1)_2$  and  $H(\tilde{A}^1)_1 = H(\tilde{A}^1)_2$ ; then  $\tilde{A}^1_1 = \tilde{A}^1_2$

### 3.2.2 Weighted aggregation of TIFNs

In line with the contribution of Liang *et al.* (2014), Aikhuele and Odofin (2017) have defined the TIFWGA operator. The general expression for TIFWGA is given below:

$$TIFWGA_w(\tilde{A}^1_1, \tilde{A}^1_2, \dots, \tilde{A}^1_k) =$$

$$\left( \left[ \prod_{k=1}^k (a_k)^{w_k}, \prod_{k=1}^k (b_k)^{w_k}, \prod_{k=1}^k (c_k)^{w_k} \right]; \prod_{k=1}^k (\mu_{\tilde{A}^1_k})^{w_k}, 1 - \prod_{k=1}^k (1 - \delta_{\tilde{A}^1_k})^{w_k} \right) \quad (11)$$

For the analysis, Microsoft Excel (Office 2010) and IBM SPSS (version 22) are used in this research.

## 4. Findings and discussion

Table 6 presents the relative order of the implications of DM according to their importance as perceived by the experts. It can be seen that R4, R6 and R5 hold the first three positions, which means that for HEIs, understanding the prospective students' needs, addressing the same to build up a fruitful relationship, getting them engaged in continuous activities, and communicating transparently and in a timely manner are the major benefits of using DM. On the other hand, experts believe that with strong communication and bonding, the issues like feedback and control, cost effectiveness, and ease of operations (R10, R7 and R8) provide extra benefits as they appear in the least priority group.

It is important to ensure a harmonious group decision. Hence, the consistency among the opinions of the experts is checked by calculating Kendall's concordance coefficient (W) (Table 7). It can be observed that the value of W (0.8031) is quite high and significant at  $\alpha = 0.05$  level as suggested by the  $\chi$  (calculated value) = 50.594 (much greater than the table value).

**Table 6.** Expert judgement-based ordering & Kendall's concordance coefficient.

Implications of DM	Sum of ranks	Square deviation	Aggregate rank (significance)
R1	24	210.250	4
R2	35	12.250	5
R3	41	6.250	6
R4	14	600.250	1
R5	20	342.250	3
R6	17	462.250	2
R7	59	420.250	9
R8	61	506.250	10
R9	56	306.250	7
R10	58	380.250	8
	Mean sum of ranks		38.500
	Sum of square deviation (S)		3246.500
	Kendall's concordance coefficient (W)		0.8031

**Table 7.** Test of significance.

$\chi$ (cal) = $m(n-1)W$	50.59480519
df	9
$\chi$ (table) at $\alpha = 0.05$	16.919

Proceeding further, experts have rated the implications of DM according to their possible impact on HEIs. The ratings are expressed on a six-point intuitionistic fuzzy linguistic scale and aggregated and, subsequently, the values of the score (SF) and accuracy (AF) functions are calculated. Table 8 exhibits the results. It is observed that no two implications have same score. Hence, the ranking of implications is done by using the score function only. Impact-wise, relationship building and customer engagement (R4), discovery of latent expectation (R5), and communication and information sharing (R6) hold the top three positions whereas lead-time reduction (R9), feedback and control (R8), and ease of operation (R10) are at the bottom three positions.

From the findings as summarised in Tables 6 and 8, it can be observed that relationship building and customer engagement (R4), discovery of latent expectation (R5), and communication and information sharing (R6) are adjudged as key implications of DM for the HEIs. Also, the value of Spearman's rank correlation test ( $\rho = 0.927$ , significant at 0.01 level) suggests a substantial consistency among the decisions taken by the experts (Table 9).

Hence, it can be inferred that the experts believe that understanding the latent needs of the customers, establishment of an effective and transparent communication channel and building a long-term

**Table 8.** Aggregate ranking of implications of DM (expert group decision making).

Implications of DM	Fuzzy aggregation					Score	Accuracy	Rank
	a	b	c	$\mu$	$\nu$	S	H	
R1	0.65140	0.17680	0.11041	0.54946	0.16047	0.15322	0.23410	4
R2	0.61474	0.20684	0.10000	0.52367	0.17448	0.14773	0.23289	5
R3	0.32027	0.40377	0.13459	0.46639	0.23791	0.14719	0.24052	6
R4	0.76209	0.13687	0.12190	0.59519	0.12978	0.17227	0.25187	1
R5	0.29499	0.54343	0.12190	0.42633	0.26261	0.16028	0.27721	2
R6	0.32027	0.47591	0.13459	0.43758	0.17633	0.15388	0.28966	3
R7	0.33936	0.42071	0.12190	0.45176	0.23566	0.14712	0.24892	7
R8	0.49220	0.29499	0.11041	0.48936	0.21864	0.14590	0.23296	9
R9	0.53437	0.23796	0.12190	0.51854	0.16047	0.14677	0.23762	8
R10	0.50429	0.27839	0.11041	0.49420	0.17448	0.14474	0.24177	10

**Table 9.** Consistency check.

Test Parameter	Impact based aggregate ranking	
Kendall's tau	Relative importance-based ranking	0.822**
Spearman's rho	Relative importance-based ranking	0.927**

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

relationship are critical factors in deciding the competitiveness of the HEIs in the coming decades, and DM in this regard will be instrumental in co-designing, co-developing and co-executing mutually beneficial value propositions for HEIs, students/parents, employers, and other stakeholders.

## 5. Managerial and social implications

The present study has some entrancing managerial and social implications.

DM enables build a transparent communication channel between service providers and service seekers. As a result of this in HES, a synergy between academic institutions and stakeholders is created. It enables organisations reach to and engage a large untapped section of the society, build awareness about brands, and make the potential service seekers a part of the brand. This has a significant business value in terms of maximisation of the impact of the brand. Eventually, the revenue increases without incurring substantial additional cost. With the help of DM, academic institutions can better understand the unstated needs of the students and the employers. In effect, DM fosters customisation of the products and services in a cost-effective way using the resources optimally while operating with less lead time. Therefore, it can be said that DM will be a potential source of a competitive advantage for the HES. The results obtained in the present study support this viewpoint.

On the other hand, DM facilitates inclusion of many potential students into the higher education system. In this way, HEIs can discharge their social responsibilities by identifying and developing young minds. Moreover, with the help of digital platforms, HEIs can unfold the talents of students to the prospective employers and thereby promote employment. In summary, use of DM by HEIs adds to their contribution to the growth of the nation.

## 6. Conclusion and future scope

The use of digital media in formulating and executing a marketing strategy is a growing practice as is evident in the product and service market. However, HES has started adopting digital media in recent times. Contrary to the traditional thinking prevalent in the educational sector, with the effect of revolutionary transformations at the information technology frontier, HEIs need to imbibe the concepts and practices of DM. Hence, understanding the critical implications of DM for the HEIs has become an essential requirement for the policymakers and executors. In this study, an attempt was made to map the benefits of DM to the changing requirements of the HES to derive the implications of DM and evaluate the same by engaging experts and using an intuitionistic fuzzy group decision-making framework. Understanding the real needs of the customers and staying connected with them through a well-established communication channel are of paramount importance. However, this study is an initial-level assessment, which can be extended to a large-scale empirical research to separately examine the impact of all these implications for students and employers.

Further, an opinion mining based on a large-scale subjective study may also be undertaken. At the higher education level, category-wise (engineering, science and management studies) investigation of the impacts of DM may also be conducted. Further, the linkage between the implications of DM and the service quality attributes for the HEIs may also be delved into. Overall, it may be hoped that the present study will open a new trajectory of research in the domain of customised branding and solution design for the stakeholders of the higher education sector.

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