Neutrosophic Analysis on Internalization of Higher Education in Indian Perspective

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Abstract: The developing nations of the Asian continent, especially India, are trying to elevate the educational standards by inaugurating the portals of international institutional linkages. Collaboration with foreign universities provides opportunities for the aspiring students to confer degrees from world premier institutions by stationing in their host nation. At the same time, the consequential impacts of the institutional linkages beyond the contours of countries need special attention to investigate on the dimensions of social, economic and culture. This chapter aims to make an intensive study on the challenges and impacts of institutional linkages between Institutions belonging to developing and developed nations. In this research work the method of neutrosophic relational maps (NRM) is applied to analyze the association between the attributes of Institutional linkages and the consequential impacts of such a system of cross cross-cultural education with special reference to the Indian nation. The associational impacts based on the opinion of the educational experts are well examined using neutrosophic representations. Based on the findings of this research work, some of the suggestive measures of internalizing higher education and future directions are proposed in this chapter.

Keywords: Neutrosophic sets, Higher Education, Internalization

1. Introduction

Every nation is vesting time in planning for quality of education as it is embedded with the potency of persuading the thought process of mankind. A nation shall contribute to the quality enrichment of education by establishing quality culture in every higher educational institution. It is also possible by empowering the student community with employability potentials both at local and global levels. The educationalists feel that the students must acquire a global exposure and at the same time they also agree that it is not possible to provide such opportunities to all the students. But internalization of higher education can make this happen by dissolving the discernments.

Internalization of higher education refers to the institutional collaboration across the nations to offer twin degree programmes. The primary goal of internalization is to create opportunities for the students to confer their degrees from an international institution without migrating. Generally students migrate to other nations for pursuing professional programmes from their residing

countries. Some of the students with good economic backgrounds and recipients of merit scholarships are able to grab such opportunities at ease. But a very large number of aspiring students especially belonging to developing nations like India are disappointed with their unfulfilled dream of education abroad mainly due to the reasons of poor economy, partial scholarships, less sponsorships and limited seats. Internalization of education will definitely facilitate the overcoming of such obstructions by enabling the foreign universities to establish their campuses in the Indian nation. Internalization of higher education in India will alleviate financial burdens, migration problems and at the same time will surge the chances of global exposures. On the other hand, the Indian nation has to make an intense plan on the initiatives to promote the institutional linkages with the foreign universities. Simultaneously the impacts of internalization must also be studied in terms of political, economic, social and cultural dimensions. This chapter studies the relational impacts between the Indian institutional initiatives in strengthening the internalization of higher education and its impacts. As the study involves several factors associated with two different entities, the concept of neutrosophic relational maps is used with linguistic representation of neutrosophic sets.

Vasantha and Smarandache [5] introduced the notion of Neutrosophic relational maps to study the relational impacts of the factors associated with HIV infected women. The neutrosophic representations are highly compatible and comprehensible in making the relational representations. The NRM is applied only to a few decision making problems. Devadoss and Ismail [2] applied to NRM to make a study on the Islamic religious practices. Devadoss and Felix [3] used induced linked NRM to explore the impacts of emotions and personality on physical health. Gaurav, Bhutani, Aggarwal [4] used NRM in studying poverty problems. Savarimuthu and Yuvageswary [6] applied induced neutrosophic cognitive relational maps in studying the acquaintances of rag-pickers. The literature on the applications of NRM is very limited and it has not been applied to study any kinds of problems associated with education. This has influenced the authors to choose this method to study the interrelational impacts. The decision making problem chosen in this chapter has not been explored by the researchers in a mathematical sense. De and Altbach [1] have deliberated on the global trends of internalization. The educational researchers have presented only theoretical descriptions but not have made any kind of analysis by considering any specific case. As the phenomenon of internalization of higher education has recently emerged in the Indian system of education, it is essential to undertake such analytical research.

The contents of this chapter are structured as follows: Section 2 presents the steps involved in NRM. Section 3 describes the factors associated with the decision making problem. Section 4 presents the numerical computations, Section 5 discusses the results with future directions and conclusions.

MATHEMATICAL BACKGROUND

This section presents a brief presentation of the preliminaries of fuzzy and neutrosophic sets.

The theory of Fuzzy sets is developed by Loft.A.Zadeh as an extension of conventional sets.

A *fuzzy set* A of the universal set X is defined as the collection of all ordered pairs of the form $\widetilde{A} = \{(x, A(x), \forall x \in X\}$, where A(x) : X $\rightarrow$ [0,1].

A *fuzzy number* is basically a fuzzy set with the membership function defined from R $\rightarrow$ [0,1] and it is expected to satisfy the following properties

- Alpha-cut must be a closed interval

- Fuzzy set must be normal

- Support is bounded

The fuzzy sets are extended to neutrosophic sets with the inclusion of the concept of indeterminancy. Smarandache constructed the neutrosophic sets with three components.

A neutrosophic set N defined on universal set X is of the form (T_N, I_N, F_N) where T_N is the truth membership value, I_N is the indeterminate membership value and F_N is the false membership value. Also $0 \leq T_N(x) + I_N(x) + F_N(x) \leq 3$, where $T_N(x), I_N(x), F_N(x): X \rightarrow [0,1]$.

The *arithmetic operations* between neutrosophic sets and fuzzy sets shall be performed based on component wise.

The fuzzy representations and neutrosophic representations shall be converted into crisp value using the processes of *Defuzzification* and *Deneutrosophication*.

2. Methodology

This section presents the steps involved in neutrosophic relational maps.

Step 1 Decide on the two entities say I and II of decision making

Step 2: Collect the factors associated with the two entities say A1,A2,A3,…,.,An and B1,B2,B3,…, Bm.

Step 3 : Construct the relational matrix R comprising the relational impacts between the factors of the entities I and II of the below form. The values in each cell is of neutrosophic form with truth, indeterminate and falsity values are represented using linguistic variables. The linguistic variables are quantified using fuzzy numbers.

	B1	B2	……	Bm
A1	N11	N12	…….	N1m
A2	N21	N22	…….	N2m
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.
An	Nn1	Nn2	…….	Nmn

Step 4: The vector of the form (1 0 0 0..0) is multiplied with R and the resulting vector of the form (a1,a2,….ag) is updated using the following threshold values $\begin{cases} -1 \ if \ a_k < 0 \\ 0 \ if \ a_k = 0 \\ 1 \ if \ a_k > 0 \end{cases}$

Step 5 : The updated vector is multiplied with R^T and the resulting vector is again updated.

Step 6 : The above steps are repeated until the updated vectors in Step 4 and 5 remain alike.

DESCRIPTION OF THE DECISION MAKING PROBLEM

This section presents the decision making problem on studying the interrelational impacts between the two entities namely Initiatives to promote Indian Institutional Linkages with Foreign Universities and Consequences of Internationalizing Higher Education. The factors associated with these two entities are described as follows.

Factors associated with the first entity of Initiatives to promote Indian Institutional Linkages with Foreign Universities

The factors under this entity discuss the steps or the action of course that a developing nation like India that has to take up in facilitating the institutional linkages with other nations abroad.

I_1: Infrastructure Augmentation

If the foreign universities are invited to inaugurate their centres in Indian institutions, i.e the host institution, then essentially it the responsibility of the hosting institution to augment the infrastructure. The programmes offered in collaboration with the foreign universities certainly require well advanced research labs, well defined high tech classrooms. Hence it is necessarily very essential to make a wide range of modifications suiting the programmes, faculty and students.

I_2: Faculty exchange programme for adherence to multicultural competency

In the system of internalization of higher education, one of the most vital aspects to be focussed on is the faculty empowerment. The exchange of faculty between the host and the foreign institutions is a part of the system. The cultural awareness of both the nations is equally significant to knowledge gaining and sharing.

I_3: Planning of comprehensive curriculum

If the institutions are in consensus in beginning combined programmes then framing of curriculum is the next immediate step. The curriculum structure and the modalities of implementation must be designed with utmost care. The planning must provide space for flexibility to make learning more compatible.

I_4: Strengthening the portals of alumni networking

Alumni networking has to be enriched by the host institution to receive their physical and financial support in running twin programmes more effectively. The competent alumni who are more suitable shall be rightly channelized for the successful run of such programmes.

I_5: Creating conducive learning environment

India is basically a land of multilingual and multicultural ethnicities. An institution generally embodies students of diverse backgrounds and after the onset of internationalization, the range of diversity gets intensified. With the backdrop of such diversifications, the task of providing unified learning is more challenging. To do so, creating a conducive learning environment is a prerequisite.

I_6: Rapport building programmes for acquiring global citizenship

   Internationalization has come into effect with the objective of providing global exposures to the students. To accomplish this objective with ease, several training programmes have to be organized to discuss the aspects of global citizenship.

I_7: Exposures to global level programmes

   The faculty and students of the host institution must be provided with the opportunities of familiarizing themselves with the programmes at global level. As internationalization offers education beyond the borders the faculty and the students must be trained to prepare themselves for outsmarting and mastering at global levels.

I_8: Educational support through scholarships

   Internationalization is a boon to the students aspiring for abroad education. But still this twin programme system costs high in comparison to the existing higher educational programmes. The host nation must decide on new scholarship schemes to render monetary support to the students belonging to the marginalized. As the quota system is followed in Indian nation, the allocation of funds for promoting such programmes must be rightly channelized to avoid disputes on community discernments.

I_9: Enhancement of capacity through faculty development programmes

   In the system of twin programmes, the faculty are expected to play a key role as they have to set a balance between students of two different learning cultures. The faculty must be empowered with the recent advancements and developments of the concepts and technology. The newly emerging techniques must be imparted to them. Adding to it the faculty must be well equipped with new skill sets and robust pedagogy.

I_{10}: International education at affordable costs

   The host nation must make essential preparations in providing international education at an optimum cost. The Indian institutions must not consider it as a chance of earning money by causing financial burdens to the students. The aspirations must not be made as an investment of building institutional profit. The host nation must look into such affairs more seriously and the institutions with service motive and good standards must be given the opportunities for international collaborations.

I_{11}: Diverse programmes with need based courses

   The programmes designed must be diverse and novel in nature. The twin programmes must be distinct with more viable courses. The planning of such programmes is very essential to make internationalization of education more meaningful.

Factors associated with the second entity of Consequences of Internationalizing Higher Education

   The second entity deals with the consequences of internationalizing higher education. Both the positive and negative factors associated with the consequences are sketched out as follows

C₁: Quality learning

One of the positive impacts of internationalization of higher education is quality enhancement. There is no space of uncertainty on quality progression.

C₂: Transition towards global system of education

   The international exposure, designing of educational programmes at global level will certainly elevate the existing system of Indian education to global standards. The nation will experience a drastic change after the effective implementation of these twin programmes.

C₃: Overseas employment opportunities

   The probability of bagging employment opportunities for the students outside the host nation is very high. There are no territorial confinements for the students who have completed their twin programmes.

C₄: Deficit opportunities for fulfilling the local and national needs

   This is one of the consequences with less positive impact to the host nation. Education is meant to fulfil the needs of the nation and it is directly and indirectly connected with the growth of the nation. The twin programmes are aiming to fulfil the global needs but do it have any space or ideas for accomplishing the local or the regional needs? Certainly the space is low and hence this aspect has to be explored.

C₅: High possibilities of global citizenship

   The students after completing such programmes will definitely emerge as global citizens. It is indeed a great pride to the hosting nations for creating such a generation with global citizenship.

C₆: Cultural disintegration by westernization of education

    This is another consequence with very less positive impacts. The entry of IT companies in the Indian nation has invaded the holistic traditional belief systems. The western culture has distorted the heritage of the Indian value system. Beside profit and economic growth, Indian society is also witnessing such cultural distortions. Will such haphazard be staged in educational institutions after the onset of internationalization? Exchange of western ideas is inevitable but channelization may contribute towards development.

C₇: Challenges of evaluation and assessment

   The pattern of evaluation and assessment varies from nation to nation. The written mode of examinations is highly preferred in Indian nations but it is not so in other nations. The existence of certain conflicts in making assessments must be resolved and this may be one of the negative impacts of internationalization.

C₈: Low aspiration level of contributing to the host nation

   The students after receiving global exposures may deviate from the attitude of rendering service to their host nation. The prosperity and a good lifestyle in other nations may influence them and make them refrain from their bondage to their mother country

C₉: Chances of social disparities caused by quota system

The policies on internationalization must be well delineated to avoid any kind of communal rivalries on preferential ratings to different communities. As the policies are not yet well articulated, the probabilities of social disparities are high and the chances of settling it amicably are scanty.

C₁₀: Adaptation challenges to the new learning environment

The students who have enrolled for twin programmes have to make up their mind to learn the course of international standards in an Indian learning system. It is really a challenging task to attune to the customisation of the global exposure in the Indian context. This is one of the negative impacts of internationalization.

C₁₁: Establishment of rapport with faculty and peer group

Certainly this is one of the inevitable negative consequences of any kind of new learning environment. Kicking off a new sort of relationship with faculty and peer group will be a difficult one but it gets lightened in course of time. But still there are some problems during the period of rapport.

C₁₂: Financial burden in augmenting infrastructure to global standards

One of the negative consequences is huge financial investment both by the host nation and hosting institutions. It is naturally a huge financial burden initially laid to kick start internationalization.

NUMERICAL COMPUTATIONS

This section presents the applications of NRM with linguistic representations to the above set of entities and the associated factors. The objective of the problem is to find the relational impacts of the initiatives of promoting internationalization and the consequential impacts of internationalization. In the previous sections the factors are described but it is also equally essential to estimate the relational impacts between the factors and among the factors. One of the advantages of NRM is to find both inter and intra-relational impacts. The resulting vectors of NRM will present the intra relational impacts between the factors of entity I and the inter impacts between the factors of both entity I and II.

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12
I1	(M,L,L)	(VH, L,L)	(L,L, H)	(L,L, H)	(L,L, H)	(L,L, VH)	(L,L, H)	(L,L, H)	(L,L, H)	(L,L, H)	(L,L, H)	(VH, L,L)
I2	(H,VL, L)	(H,L, L)	(L,L, H)	(VL, L,H)	(M, L,L)	(M,L, L)	(M,V L,L)	(M,V L,L)	(M,V L,L)	(M,L, L)	(H,L, L)	(M,L, L)
I3	(VH,V L,VL)	(M,L, L)	(M, L,L)	(L,L, H)	(M, L,L)	(L,L, H)	(M,L, VL)	(M,L, VL)	(M,L, VL)	(M,L, VL)	(L,V L,H)	(M,L, L)

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12
I1	-1	-0.58	-1.2	-1.2	-1.2	-1.4	-1.2	-1.2	-1.2	-1.2	-1.2	-0.58
I2	0.09	-0.75	-1.2	-1.67	-1	-1	-0.16	-0.16	-0.16	-1	-0.75	-1
I3	0.68	-1	-1	-1.2	-1	-1.2	-0.58	-0.58	-0.58	-0.58	-0.41	-1
I4	-1.25	-0.75	-0.75	-1.62	-1	-1.2	-1	-0.58	-0.58	-0.41	-1	-1.25
I5	0.68	-0.75	-1	-1.2	-1.25	-1.25	-0.41	-0.41	-0.41	-1.67	-1	-0.41
I6	-1	-1	-1	-0.925	0.68	0.26	0.68	-0.58	-0.58	-0.58	-0.75	-1.25
I7	-1	-0.58	-0.75	-0.33	0.68	-0.58	0.68	-0.58	-0.58	-0.75	-0.16	-1.25
I8	-1	-1	-1.2	-1.2	-1.2	-1.2	-1.67	-1.67	-1.67	-1.25	-1.25	-0.75
I9	-1	-1.2	-1.2	-1.2	-1.2	-1.42	-1.25	-1.67	-0.75	-1.2	-1.2	-1
I10	-1	-1.2	-1.2	-0.41	-1	-1.2	-0.58	-0.58	-0.58	-0.75	-1	-0.58
I11	-0.75	-0.75	-0.58	-1.25	-0.16	-0.41	-0.16	-1.67	-1.67	-0.16	-0.41	-0.41

By considering the above modified relational matrix, the NRM is applied and the resultant vectors thus obtained are presented in Table 3.2

Table 3.2 Resultant Vectors of NRM

Factors in ON Position	Resultant Vectors
(10000000000)	(11111111111) (111111111111)
(01000000000)	(11111111111) (111111111111)
(00100000000)	(11111111111) (111111111111)
(00010000000)	(11111111111) (111111111111)

(00001000000)	(11111111111) (111111111111)
(00000100000)	(11111111111) (111111111111)
(00000010000)	(11111111111) (111111111111)
(00000001000)	(11111111111) (111111111111)
(00000000100)	(11111111111) (111111111111)
(00000000010)	(11111111111) (111111111111)
(00000000001)	(11111111111) (111111111111)

3. Discussion

The table 3.2 clearly states that each of the initiatives has a positive impact and hence these factors shall be considered in making decisions on internalization of higher education. As internalization is becoming an integral part of the modern educational system, the developing nations must be cautious in handling both the planning part and treating the consequences. Though some of the factors are having negative impacts, they do exist for a very short span of time. For instance in the entity II, the consequential factors C4, C6-C12 do have negative impacts but then the negativity shall be mitigated in course of time by fostering positivity in the minds of the students. The formulation of policies to weed out the commotion causatives will align the internationalization of higher education in the right order.

The instance of taking the Indian nation as a developing nation is mostly apt as it is one of the nations filled with the aspirations of overseas education and employment. Adding to it, this nation is also equally preferred by people of other nationalities to pursue their higher education. There is a high scope of expanding the standards of education in the Indian nation and the contents of this chapter will surely supplement it.

Conclusion

This chapter discusses the status and the effects of internationalizing higher education from an Indian perspective. The method of neutrosophic relational maps with linguistic representation is applied to investigate the relational impacts of the factors associated with two different entities. The theoretical arguments on internationalization is insuffice without mathematical interference. But this research has overcome the limitation by integrating the concepts of NRM with decision making. This research work is only a beginning as it has presented the factors based on predictions and intuitions. There are a lot of opportunities to extend this research work based on the survey from the students after completion of their twin programmes. Neutrosophic statistical techniques shall also be applied to make inferences.

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