CRITICAL FACTORS IMPORTANT FOR EFFECTIVE INDUSTRY- INSTITUTE INTERACTIONS (III): AN INDIAN PERSPECTIVE

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ABSTRACT

The management of Industry-Institute Interactions (III) has been found to be an important aspect in today's market. In this paper an attempt has been made to identify Critical Factors (CFs) and rank these for effective III from an Indian perspective. The present paper is based on two research stages. Initially, an extensive literature review was conducted to identify CFs of III. Forty three CFs for effective III were identified and categorized into nine dimensions based on input from experts. In the second stage, the Analytical Hierarchy Process (AHP) was utilized to rank these dimensions and CFs for effective III from an Indian perspective. Paired comparisons in AHP were based on the opinions of experts (selected from academia and industry). The proposed decision framework may offer some valuable guidelines for policy makers to develop their plan of action in terms of design of short and long term policies and strategies to promote effective III in India. A sensitivity analysis was also performed to investigate the robustness and priority ranking stability of CFs in the proposed framework. This paper may help India to achieve and manage effective III leading to potential economic, social, political, cultural and environmental advantages.

Keywords: Critical factors (CFs), Indian perspective, Industry-Institute Interactions (III), Analytical Hierarchy Process (AHP), research and development (R & D), sensitivity analysis

1. Introduction

A limited number of organizations benefit directly from universities/institutions (as a source of information/knowledge) for their innovative activities and/or the development of innovative products and processes through appropriately managing research and

development projects (Laursen & Salter, 2004). In fact, organizations may acquire knowledge and technology from many external sources and these sources may include competing organizations, research organizations, government laboratories, industry-institute research associations and universities (Santoro & Chakrabarti, 2002). Industrial organizations use a variety of relationships with university/institute research centers to accomplish various knowledge and innovation based targets and goals. Large organizations have more intense knowledge transfer capabilities and research support relationships (to strengthen skills and knowledge) for gaining access to university/institute facilities to advance technologies (Santoro & Chakrabarti, 2002).This may be for the simple reason that they have a large amount of funds available/allocated for this. Industry–university/institute alliances may represent an evolving trend for advancing knowledge and new technologies supporting the idea of establishing effective and efficient Industry-Institute Interactions (Chakrabarti & Lester, 2002).

The journey of interactions and cooperation among industry and institutes has taken different forms which include problem solving, curriculum development, study/industrial visits, scholarships, and apprenticeship training and incubation centers. However, industry has not been involved in taking sustainable financial, technical and operational risks in the design, financing and building and operation of educational projects (Majumdar, 2008). Institute-industry collaborations have been encouraged in many countries by policy-makers, and institutes may play a key role as the economic/technical/knowledge/ innovations facilitator to create an altogether new mechanism for economic development (Bozeman, 2000; Etzkowitz & Leydesdorff, 2000).

1.1 Innovation and knowledge management

Innovation may be visualized as the successful creation, development, implementation and use of knowledge for new or structurally improved products, processes, services and/or organizational forms (Greenhalgh et al., 2006). On the other hand, knowledge management has been one of the hottest topics over the past few decades in both the industry and information research worlds (more specifically in universities/institutes), but there is no universal definition of this term, just as there has not been consensus about what constitutes knowledge in the first place (Alrawi & Alrawi 2011). Innovation and knowledge management may play an effective role in motivating, encouraging and channeling Industry-Institute Interactions to gain value for customers, organizations, supply chains, and society (Chen & Huang, 2007).

1.2 Problem areas in Industry-Institute Interactions in India

In India, Industry-Institute Interactions are not noticeably observable, and therefore it is necessary to have better (in terms of quality and quantity) interactions among institutions and industry. These interactions and collaborations should have a greater impact and influence on course frame work, curriculum development, student exposure to the industrial atmosphere in the form of industrial visits, research associations, and subsequent placement of young graduates/post graduates/doctorates in industries across the country. With the advent of globalization and the opening up of the Indian economy, competition among industries has become significantly stiff. India's vast network of academic infrastructure churns out over 2 million graduates annually. However, there are growing concerns about parts of the existing available talent pool being unsuitable for employment due to a skill gap between graduate's skill level and requirements of

industry (National Knowledge Commission, 2008). It has become apparent that there is an urgent need to prepare engineering/professional students so that they are skilled and employable in multinational organizations by exposing them to newer technologies and making them aware of various engineering/professional/management methodologies. This may only be achieved well by bridging the gap between industry and the academic institutes (Wallin et al., 2014). In India, several problem areas exist in attaining effective Industry-Institute Interactions and collaborations among industries and institutes and experts from academia and industry (Kulkarni et al., 2011).These include lack of vision, lack of appropriate policy planning and implementation, a more theoretical approach to business, management, technical/engineering and professional education, outdated syllabi and less frequent syllabi modification, lack of regular interaction and vital contribution of industry experts in the design of syllabi to match recent industry requirements, lack of industrial exposure of faculty, insufficient inclusion of professionals from industry in research programs, lack of invitations to engineers, executives and experts from industry to deliver lectures in institutes (which may go a long way to ensure and establish linkages between academia and industry), limited use of practical methodologies (like role playing, brainstorming, Delphi, case studies etc.), copying irrelevant western business practices without consideration of the Indian mind set and culture, inhibitions and reservations, a total divide between industry and educational institutes, and insufficient funding. The above problems need to be appropriately addressed, however to do this an open, conducive environment needs to be provided to the many individuals in academic institutions that have bright and innovative ideas that may be useful for industries (Vest, 2005).

In our study, we have considered universities (government and private); colleges (government and private) - offering engineering, business administration and economics, commerce, arts, and other technical and professional courses; schools (government and private); and other research organizations. We have used a single word, "Institute", for all of these throughout the rest of this paper. A brief summary of the organizations involved in research, directly or indirectly, in India has been given in Appendix I.

1.3 Need and objectives of the research

Today, there continue to be relevant compelling reasons for industrial organizations and institutes to work together, which include access to highly trained students, facilities and faculty as well as an enhanced image when collaborating with a prominent academic institution (Fombrun, 1996). Close interaction between the institute and industry/enterprise is seen as the platform for showcasing best practices, latest technological advancements and their implementation, and impact on the industry (Majumdar, 2008). The problem areas discussed gave direction to the present research.
The objectives of the research are:

- To identify Critical Factors (CFs) important for effective Industry- Institute Interactions from an Indian perspective;
- To prioritize the importance of identified CFs for effective Industry- Institute Interactions to develop a decision framework;
- To check the sensitivity of the obtained priority results of the identified CFs.

A literature review was performed to identify relevant Critical Factors for effective Industry- Institute Interactions. A literature review is an integral part of any research to

identify the conceptual content of the field, and gives guidance towards theory development (Luthra et al., 2014). In the present research, we propose to use an AHP approach for prioritizing the importance of various CFs for effective III in India. The AHP is a multi-criterion decision making (MCDM) approach which was developed by Thomas L. Saaty in 1980. It assists in the decomposition, organization and analysis of a complex problem, and its conversion into a multi-level hierarchical structure comprised of an objective function, criteria and sub-criteria (Saaty, 1980; Luthra et al., 2015). The results may be used to compare and rank the alternatives and, hence, assist the decision maker in making a choice (Saaty, 2008; Kumar et al., 2009).

2. Literature review

The university may play an increasingly important role in the innovation of knowledge-based societies as explained in the triple helix theory (Etzkowitz & Leydesdorff, 2000).This triple-helix model of university-industry-government interactions and its contribution to entrepreneurship, and economic and social development has been outlined in Etzkowitz (2011). Different possible resolutions of the relations and interactions among these three spheres may help to generate alternative strategies for economic growth, social transformation and sustainable development (Etzkowitz and Leydesdorff, 2000). The evolution of innovation systems and research and probable solutions for effective university–industry interactions and relations may be reflected in the varying institutional arrangements of university–industry–government relations (Wixted & Holbrook, 2013). Some important contributions for effective Industry-Institute Interactions from research papers published from 2007 to 2014 are presented in Table 1.

Table 1
Important contributions in the area of effective Industry-Institute Interactions

Researcher/s and their Contributions
Bercivitz and Feldman (2007): This paper examined how innovation strategy influences firm's level of involvement with university-based research. The results suggested that firms with internal R&D strategies more heavily weighted toward exploratory activities allocate a greater share of their R&D resources to exploratory university research and develop deeper multifaceted relationships with their university research partners.
Tether and Tajar (2008): This paper explored the use of specialist knowledge providers as sources of information in the innovation activities of manufacturing and service firms.
Perkmann and Walsh (2009): This paper analyzed the impact of university–industry relationships on public research. Their learning-centered interpretation qualified the notion of entrepreneurial science as a driver of applied university–industry collaboration.
Jia et al. (2010): This paper suggested cellular automaton model to analyze the diffusion of innovation in industrial clusters. The result of the simulation suggested that industry-university-institute cooperation is better especially when enterprise's R&D capability is very weak or the technology is very difficult. Intensifying the external support from local government, industry associations and financial institutions has a positive effect on the diffusion of innovation in industrial clusters.
Lai (2011): This paper analyzed the willingness to engage in technology transfer (TT) in industry university collaborations (IUCs) from three vantage points: technology transferor (university), technology transferee (industry), and the TT intermediary institute. From the vantage point of universities, this study showed that the "transferor's incentive" and "capability of transferor" variables positively influence willingness to participate in TT in an IUC. From the vantage point of industry, the results indicated that "capability of transferee" and "incentive for establishing technological resources" have major influence on willingness to participate in TT in an IUC. From the vantage point of TT intermediary institutes, the results showed that "intermediary's fundamental resources" and "intermediary's transferring process" have a positive impact on willingness to participate in TT.
Perkmann et al. (2011): This paper investigated how university research quality shapes their engagement with industry. They found that in technology-oriented disciplines, departmental faculty quality is positively related to industry involvement. In the medical and biological sciences they found a positive effect of departmental faculty quality but establish that this does not apply to star scientists. In the social sciences they found some support for a negative relationship between faculty quality and particularly the more applied forms of industry involvement. The implication for science policy makers and university managers was also suggested.
Vauterin et al. (2012): The paper employed interpretive phenomenological research methods, an investigative case-based approach to study the boundaries, boundary roles and processes involved in university-industry collaborative interaction in the context of Finnish international higher education. The findings suggested that conceptualization of the university-industry boundary-spanning processes in international higher education needs to be extended to incorporate elements concerning the power, impact and management of the boundary roles. A better understanding and adequate managing of the boundary roles may help to decrease the perceived market demand uncertainty surrounding international higher education.
Xias and Jin (2012): This paper analyzed the impact of organizational features and context variables on the proneness of university-industry cooperation in the R&D and engineering process. They suggested that the probability of cooperation with university significantly depends on various organizational factors including firm size and enterprise absorptive capacity. They also suggested that the actual pay tax the collection of business-to-market and technical information, and market position are also important driving factors to the engineering research cooperation between enterprises and universities, but their influences vary with the type of product innovation and process innovation.

Researcher/s and their Contributions
Şendoğduand Diken (2013): Industry sector needs to be in collaboration with university in order to reach the information that will contribute its performance. This paper investigated the level at which the university and industry collaboration exists in Konya province, to ascertain the frequency of collaboration subjects and the problems encountered during this collaboration.
Salleh and Omar (2013): This paper proposed a successful model for university-industry collaboration focusing on the interaction between university, government, and industry. They emphasized the role of university, government, and industry to work mutually to achieve successful collaboration.
Guan and Zhao (2013): This paper investigated the effects of multiplicative interaction between clustering and reach on members' knowledge creation and patent value based on complex network analysis in nano bio pharmaceuticals field.
Fiaz (2013): This paper investigated the growing phenomenon of university-industry (U–I) collaboration in high-tech strategic projects in China. He explored the U–I collaboration patterns among Chinese universities and high-tech industry on the basis of quantitative analysis using a research instrument. The results showed that U–I collaboration is established and encouraged due to factors such as: R&D tendency, R&D risks and R&D promotion factors such as state incentives.
Liew et al. (2013): This paper presented the strategic and tactical approaches on university and industry collaboration in the contemporary commercial climate. This paper provided a commercial approach which may be adopted by the university in propagating the collaboration resulting in a win-win situation.
Jung (2014): This paper examined the National Nanotechnology Initiative of U.S. government science and technology (S&T) program, affects the nature of university research in nanotechnology. The findings suggested that, at least in the case of the NNI, targeted government S&T programs may increase the efficiency of university research, but potentially do so at a price.

3. Critical Factors (CFs) identified for effective Industry-Institute Interactions (III)

To accomplish the task of identifying Critical Factors (CFs) for effective III, a literature survey was conducted by searching various key words like critical factors of III in India, factors important for successful III, key factors for III in India etc. Google search and Google scholar search engines were used for collecting supporting literature from national and international journals, proceedings of national and international conferences, authentic websites of government and non-government organizations, and reports published by various government/non-government departments and research organizations. Forty three CFs for effective III were identified from the literature review. Nine experts (five from academia and four from the manufacturing industry) participated in an idea engineering workshop to validate these critical factors. In the first session of the workshop, the utility of the identified CFs was confirmed, and after a long brainstorming session, the forty three CFs were classified into nine dimensions through expert's judgments based upon their similarity. These dimensions are as follows: financial interactions, government/nation/regulatory perspectives, technical interactions, markets and customer's interactions, social interactions, green and environmental interactions, intellectual properties perspectives, human resource interactions and motivation from mutual benefits. In the second session of the workshop, experts were asked to rate the identified dimension and CFs (other details regarding data collection have been provided in Section 4).The identified dimensions of CFs and the CFs that are important for effective III from an Indian perspective are shown in Table 2.

Table 2
Critical Factors important for effective III in an Indian perspective

CFs S.N.	Dimensions of CFs identified for effective III(Reference)	CFs S.N.	CFs identified for effective III	References
1	Financial interactions (Gidley et al., 2010; Fiaz, 2013)	1.1	Maintained/improved business margins	Korres (2012)
		1.2	Increased market share	Czarnitzki et al. (2011)
		1.3	Increase of shareholder returns and goodwill	Muscio et al. (2013)
		1.4	Higher profits	Korres (2012)
		1.5	Incentives and subsidies	Salter and Martin (2001)
		1.6	Fund allocation for nation's R&D	Mowery (2012); Fiaz (2013)
		1.7	Fund allocation for industry's/institute's R&D	Santoro and Chakrabarti (2002)
2	Government/nation/regulatory perspectives (Bozeman, 2000)	2.1	Government policies	Parthaand David (1994); Bruneel et al. (2010); Dai et al. (2013)
		2.2.	Improved image of nation	Bodas Freitas et al. (2012); Fiaz (2013)
		2.3	Stability of centre and state government	Ostrom (2007)
		2.4	Coordination and cooperation among centre/state governments	Etzkowitz and Leydesdorff (2000)
		2.5	Visionary and strategically able leadership	Dai et al. (2013)
		2.6	Improvement in national education system	Dai et al. (2013)
3	Technical interactions (Numprasertchai and Igel, 2005)	3.1	Improved efficiency	Albury (2005); Faems et al. (2005); Peng et al. (2013)
		3.2	Technological innovations	Kaufmann and Tödtling (2001)
		3.3	Technology adaptation towards adoption	Archibugi and Pietrobelli (2003)
		3.4	Technical advancement stage of country	Santoro and Chakrabarti (2002)
		3.5	IT enablement and communication systems	Siegel et al., (2003); Numprasertchai and Igel (2005); Fontana et al. (2006)

CFs S.N.	**Dimensions of CFs identified for effective III (Reference)**	**CFs S.N.**	**CFs identified for effective III**	**References**
4	Markets' and customers' interactions (JIA et al., 2010; Wilson, 2012)	4.1	Access to new costumer's and market	Muscio and Nardone (2012)
		4.2	Improved timing for market introduction	Barney (1991)
		4.3	Customer satisfaction	Siegel et al. (2003)
		4.4	Managing demand and supply balance	Polt et al. (2001); Xias and Jin (2012)
		4.5	Eagerness to test innovative products	Sawhney et al. (2005); Nambisan (2009)
		4.6	Income and education level of customers	Straughan and Roberts (1999); Diamantopoulos et al. (2003); Hartono (2009)
		4.7	Role of media, advertisement & marketing agencies	Wells (2007)
5	Social interactions (Wilson, 2012)	5.1	Better utilization of social resources	Siegel et al. (2003); Laursen et al. (2011)
		5.2	Social justice	Orecchini et al. (2012)
		5.3	Better standard of life	Peng et al. (2013)
		5.4	Caste system towards specialized workforce	Yeravdekar and Tiwari (2012)
		5.5	Belief and values	Bruneel et al. (2010)
6	Green and environmental interactions (Luthra et al., 2011)	6.1	Encouragement to green efforts	Erkuş-Öztürk and Eraydın (2010); Zhu et al. (2012)
		6.2	Environment organizations' efforts	Kumar et al. (2013); Kumar et al. (2014)
		6.3	Pollution and environment regulations and legislation	Chien and Shih (2007); Mudgal et al. (2010); Kumar et al. (2013); Luthra et al. (2013);
7	Intellectual properties perspectives(Bruneel et al., 2010)	7.1	Better opportunities for interactions	Bruneel et al. (2010)
		7.2	Regular workshops, seminar, conferences	Lagendijkand Cornford (2000); Cummings and Kiesler (2005); Cummingsand Kiesler (2007)
		7.3	Encouragement to knowledge and innovation management	Meyer-Krahmer and Schmoch (1998); Edmondson et al. (2012)

CFs S.N.	**Dimensions of CFs identified for effective III (Reference)**	**CFs S.N.**	**CFs identified for effective III**	**References**
8	Human resource interactions (Laine, 2008)	8.1	Support and quality Of human resource	Maslach et al. (2001)
		8.2	Better employment opportunities	Afonso et al. (2012)
		8.3	Training programs	Salleh and Omar (2013)
		8.4	Research based incentive/promotion system	COM (2007)
9	Motivation from mutual benefits(Mohan, 2011; Vauterin et al., 2012)	9.1	Better positioning and brand image	Khanna et al. (2014)
		9.2	Long term competitive advantage	Bruneel et al. (2010);Şendoğdu and Diken (2013)
		9.3	Top and middle management commitment and support	Cameron and Quinn (2005); Edmondson et al. (2012)

4. Methodology

The methodology adopted in this paper utilized two well established approaches:

- Literature review - relevant literature was reviewed to establish the background of the research and identify CFs.
- Idea engineering workshop and Analytical Hierarchy Process - a work shop was conducted in two sessions. The first session was conducted to validate CFs and identify appropriate dimensions of CFs for effective III. In the second session of the workshop nine experts brainstormed to make pair wise comparisons among the identified dimensions and CFs for effective III according to Saaty's scale (Saaty, 1980). Based on the ratings, matrices were formed and the priorities were synthesized appropriately using the step wise procedure of the AHP technique. An AHP framework of CFs for effective III in the Indian perspective was structured as a hierarchy which included three levels: goal of achieving effective III in India, nine dimensions of CFs, and the CFs under each dimension.

The Analytic Hierarchy Process (AHP) was an appropriate technique to rank the dimensions and CFs for effective III in India because of its methodical and systematic approach. It is a well-established multi attribute decision support tool which uses a multilevel hierarchical structure of objectives, criteria, sub-criteria and alternatives. AHP technique evaluates and ranks the alternatives with respect to various criteria in a natural, pair-wise mode and also compares criteria, or alternatives with respect to a criterion, in a natural, pair-wise mode (Saaty, 1980). To do so, it uses a fundamental scale of absolute numbers that has been proven in practice and validated by physical and decision problem experiments. It converts individual preferences into ratio scale weights that can be combined into a linear additive weight for each alternative. The resultant can be used to compare and rank the alternatives and, hence, assist the decision maker in making a choice (Saaty, 2000, 2008; Kumar et al., 2009; Luthra et al., 2015b).

5. Data analysis and results

5.1 Constructing the hierarchy of dimensions of CFs important for effective III: 2nd level

In the second level of the hierarchy, nine identified dimensions of CFs for effective III were identified. Table 3 shows the weights that were given by the experts to the dimensions of CFs.

Table 3
Ranking of dimensions of CFs important for effective III from an Indian perspective

Maximum Eigen Value=9.40178;
C.I. = 0.0502219
Pair wise comparison matrix of dimensions of CFs

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Global Priority Weighting**	**Rank**
1	1	2	1	1	4	2	2	1	1	0.1568	2nd
2	0.5	1	1	2	1	1	0.3333	0.3333	0.25	0.0720	8th
3	1	1	1	1	2	1	1	0.5	0.333333	0.0928	5th
4	1	0.5	1	1	1	1	0.5	0.5	0.5	0.0780	6th
5	0.25	1	0.5	1	1	1	0.5	0.5	0.5	0.0643	9th
6	0.5	1	1	1	1	1	0.5	0.5	0.5	0.0734	7th
7	0.5	3	1	2	2	2	1	1	1	0.1362	4th
8	1	3	2	2	2	2	1	1	1	0.1545	3rd
9	1	4	3	2	2	2	1	1	1	0.1720	1st

From the results shown in Table 3, 'Motivation from mutual benefits (0.1720)' is the most important dimension for effective III followed by 'Financial interactions(0.1568)', 'Human resource interactions'(0.1545), 'Intellectual properties perspectives (0.1362)', 'Technical interactions (0.0928)','Market's and customer's interactions (0.0780)','Green and environmental interactions (0.0734)','Government/nation/regulatory perspectives (0.0720) 'and 'Social interactions (0.0643)'.

5.2 Constructing the hierarchy of CFs of dimensions important for effective III: 3rd level

In the third level of the hierarchy, the CFs under each dimension were rated by experts. The maximum Eigenvalues, C.I. and pair wise comparison matrix of CFs under various dimensions for effective III have been shown in Appendix II. Consistency ratio (C.R.) values are well within the acceptable range for all CFs of the dimensions matrices, which ensure the decision-makers reliability (see Appendix II).

Global preference weights of CFs were obtained by multiplying the preference weight values of each dimension with the relative weight of each specific CF. Based upon the global preference weights of CFs, the dimensions of CFs that are important for effective III were ranked. The overall ranking of dimensions and CFs important for effective III in an Indian perspective is summarized in Table 4.

Table 4
Overall ranking of dimensions and CFs important for effective III in an Indian perspective

S. No.	**Dimensions of CFs identified for effective III**	**Preference weight of the dimensions**	**Rank**	**CFs S. No.**	**CFs identified for effective III**	**Relative weight of CFs**	**Global weight of CFs**	**Overall ranking of CFs**
1	Financial interactions	0.1568	2nd	1.1	Maintained/improved margins	0.0723	0.0113	31th
				1.2	Increased market share	0.1045	0.0164	23rd
				1.3	Increase of shareholder' returns	0.0637	0.0100	33th
				1.4	Higher profits	0.1452	0.0228	16th
				1.5	Incentives and subsidies	0.1891	0.0297	10th
				1.6	Fund allocation for nation's R&D	0.1694	0.0267	15th
				1.7	Fund allocation for industry's/institute's R&D	0.2558	0.0401	6th
2	Government/nation/ regulatory perspectives	0.0720	8th	2.1	Government policies	0.0726	0.0052	40th
				2.2	Improved image of nation	0.0801	0.0058	39th
				2.3	Stability of centre and state government	0.2625	0.0189	18th
				2.4	Coordination cooperation among centre/state governments	0.2415	0.0174	22nd
				2.5	Visionary and strategically able leadership	0.2109	0.0152	25th
				2.6	Improvement in national education system	0.1324	0.0096	34th
3	Technical interactions	0.0928	5th	3.1	Improved efficiency	0.1352	0.0125	27th
				3.2	Technological innovations	0.1934	0.0179	19th
				3.3	Technology adaptation towards adoption	0.1686	0.0156	24th

S. No.	Dimensions of CFs identified for effective III	Preference weight of the dimensions	Rank	CFs S. No.	CFs identified for effective III	Relative weight of CFs	Global weight of CFs	Overall ranking of CFs
				3.4	Technical advancement stage of country	0.1910	0.0177	20th
				3.5	IT enablement and communication systems	0.3118	0.0289	12th
4	Markets' and customers' interactions	0.0780	6th	4.1	Access to new costumers and market	0.0974	0.0076	37th
				4.2	Improved timing for market introduction	0.1218	0.0096	34th
				4.3	Customer satisfaction	0.1466	0.0114	30th
				4.4	Managing demand and supply balance	0.1098	0.0086	36th
				4.5	Eagerness to test innovative products	0.1299	0.0101	32th
				4.6	Income and education level of customers	0.1707	0.0133	26th
				4.7	Role of media, advertisement and marketing agencies	0.2238	0.0175	21st
5	Social interactions	0.0643	9th	5.1	Better utilization of social resources	0.1469	0.0094	35th
				5.2	Social justice	0.1897	0.0122	29th
				5.3	Better standard of life	0.4777	0.0307	9th
				5.4	Caste system towards specialized workforce	0.0697	0.0045	41th
				5.5	Belief and values	0.1160	0.0075	38th

S. No.	Dimensions of CFs identified for effective III	Preference weight of the dimensions	Rank	CFs S. No.	CFs identified for effective III	Relative weight of CFs	Global weight of CFs	Overall ranking of CFs
6	Green and environmental interactions	0.0734	7th	6.1	Encouragement to green efforts	0.1692	0.0124	28th
				6.2	Environment organizations' efforts	0.3874	0.0284	13th
				6.3	Pollution and environment regulations and legislation	0.4434	0.0325	8th
7	Intellectual properties perspectives	0.1362	4th	7.1	Better opportunities for interactions	0.400	0.0545	4th
				7.2	Regular workshops, seminar, conferences	0.200	0.0272	14th
				7.3	Encouragement to knowledge and innovation management	0.400	0.0545	4th
8	Human resource interactions	0.1545	3rd	8.1	Support and quality Of human resource	0.2326	0.0359	7th
				8.2	Better employment opportunities	0.1238	0.0191	17th
				8.3	Training programs	0.2778	0.0429	5th
				8.4	Research based incentive/promotion systems	0.3658	0.0565	3rd
9	Motivation from mutual benefits	0.1720	1st	9.1	Better positioning and brand image	0.1692	0.0291	11th
				9.2	Long term competitive advantage	0.3874	0.0666	2nd
				9.3	Top and middle management commitment and support	0.4434	0.0763	1st

The results have been compiled as follows:

- 'Fund allocation for industry's/institute's R&D' was the highest ranked CF and 'Increase of shareholder returns' was the lowest ranked CF in dimension 1 (Financial interactions).
- Similarly, 'Stability of centre and state government' was the most important CF and 'Government policies' was the least important CF in dimension 2 (Government/nation/regulatory perspectives).
- In dimension 3 (Technical interactions), 'IT enablement and communication systems' obtained the highest rank and 'Improved efficiency' obtained the lowest rank.
- 'Role of media, advertisement and marketing agencies' was ranked highest and 'Access to new customers and market' was ranked lowest in dimension 4 (Markets and customers).
- 'Better standard of life' was the highest ranked CF and 'Caste system towards specialized workforce' was the lowest ranked CF in dimension 5 (Social interactions).
- 'Pollution and environment regulations and legislation' was the most important CF and 'Encouragement to green efforts' was the least important CF in dimension 6 (Green and environmental interactions).
- 'Better opportunity for interaction' was the highest ranked CF and 'Regular workshops, seminar and conferences' was the lowest ranked CF in dimension 7 (Intellectual properties perspectives).
- 'Research based incentive/promotion system' was the highest ranked CF and 'Better employment opportunities' was the lowest ranked CF in dimension 8 (Human resource interactions).
- 'Top and middle management commitment and support' was the highest ranked CF and 'Better positioning and brand image' was the lowest ranked CF in dimension 9 (Motivation from mutual benefits).

The overall ranking of these forty three CFs is as follows:

- 'Top and middle management commitment and support (0.0763)', 'Long term competitive advantage (0.0666)' and 'Research based incentive/promotion systems (0.0565)'are the top ranked three CFs; and
- 'Improved image of nation (0.0058)', 'Government policies (0.0052') and 'Caste system towards specialized workforce (0.0045)'are the bottom three CFs;

6. Sensitivity Analysis

In this research, the 'Motivation from mutual benefits' dimension of CFs for effective III in an Indian perspective had the highest preference weight (Table 4), and therefore influences the other dimensions of CFs. For that reason, the 'Motivation from mutual benefits' dimension has been selected with its value varying from 0.1 to 0.9 with 0.1 as the increment and this change has been reflected in the other dimensions. The changes in other dimensions of CFs for effective III in an Indian perspective have been tabulated in Table 5.

Table 5
Dimension values when increasing 'Motivation from mutual benefits' dimension of CFs for effective III in an Indian perspective

Listed dimensions ↓	**Values of preference weights for listed dimensions of CFs for effective III**									
1	**0.1568**	0.1704	0.1515	0.1280	0.1136	0.0947	0.0755	0.0568	0.0379	0.0189
2	**0.0720**	0.0783	0.0696	0.0609	0.0522	0.0435	0.0347	0.0261	0.0174	0.0087
3	**0.0928**	0.1009	0.0897	0.0784	0.0672	0.0560	0.0447	0.0336	0.0224	0.0112
4	**0.0780**	0.0848	0.0754	0.0659	0.0565	0.0471	0.0376	0.0283	0.0188	0.0094
5	**0.0643**	0.0699	0.0621	0.0543	0.0466	0.0388	0.0310	0.0233	0.0155	0.0078
6	**0.0734**	0.0798	0.0709	0.0620	0.0532	0.0443	0.0353	0.0266	0.0177	0.0089
7	**0.1362**	0.1480	0.1316	0.1151	0.0987	0.0822	0.0656	0.0493	0.0329	0.0164
8	**0.1545**	0.1679	0.1493	0.1306	0.1120	0.0933	0.0744	0.0560	0.0373	0.0186
9	**0.1720**	0.1000	0.2000	0.3002	0.4000	0.5000	0.6013	0.7000	0.8000	0.9001
Total	**1**	1	1	1	1	1	1	1	1	1

Further, due to variation in dimension weights, specific CF's weights also change accordingly. At the 0.1 value of 'Motivation from mutual benefits'dimension, the CF 'Research based incentive/promotion system (8.4)' holds the highest value and the CF 'Caste system towards specialized workforce (5.4)' holds the lowest value. The CF 'Research based incentive/promotion system (8.4)' retains the highest weight value until the normal value (0.1720) of 'Motivation from mutual benefits'dimension. When the 'Motivation from mutual benefits' dimension weights value is varied (from 0.1720 to 0.9), the CF 'Top and middle management commitment and support (9.3)' holds the highest weight value, and the weight values of other CFs also vary accordingly. The changes in the values of other CFs in order to promote III in an Indian perspective have been tabulated in Appendix III. Global preference weights for specific CFs based on the sensitivity analysis are presented in Appendix IV. It can be inferred that, global preference weights of the specific CFs vary with respect to the change in weight values of the 'Motivation from mutual benefits' dimension. Therefore, it may be concluded that the 'Motivation from mutual benefits' dimension is very important for effective III in an Indian perspective.

7. Discussion and managerial implications

Due to globalization, intense global competition, rapid technological changes, shorter product life cycles, and environment and social issues Indian industries are under tremendous pressure to incorporate changes into their business practices and are exploring innovative methods to reduce environmental and social impacts, operating costs, lead time, and inventory to sustain their growth in the market. Institute research may be beneficial to Indian industries by facilitating the advancement of knowledge and new technologies to increase sustainability in today's business environment. Government/regulatory bodies and universities are making efforts to increase academic engagement to solve economic, environmental and other societal issues and to raise revenue for universities (Perkmann et al., 2013). This paper provided the identification and ranking of various dimensions of CFs and CFs under each dimension for effective III in an Indian perspective. A comprehensive literature review and idea engineering workshop were carried out to identify and rank these dimensions and the CFs under each dimension. Nine dimensions and forty three CFs for effective III were identified from extensive literature review and expert's input. AHP methodology was used to rank these

identified dimensions and CFs for effective III in an Indian perspective. The 'Motivation from mutual benefits' dimension had the highest global weight, and the 'Social interactions' dimension was weighted the lowest. These dimensions were ranked 1st and 9th respectively. Further, ranking of various CFs under each dimension was done.

In order to recognize, identify and exploit opportunities from a global perspective, it is critically important to understand what boundaries stand between university-industry partnering initiatives in international higher education and what interaction processes span these boundaries (Vauterin et al., 2012). Research projects are usually long term and future oriented 'series of activities' systematically planned and executed to gain a competitive advantage through:

- Reduction of cost by involving innovations in raw material types and usage, and processes;
- Introduction of truly innovative products and services capable of:
  a) attracting new segments of prospective customers, and b) maintaining existing customers;
- Sharing of R&D costs and cutting down many consultancy expenditures; and many more.

Perceived expected better positioning and enhanced brand image may motivate industry players and institutes (organizations involved in research) to collaborate and share the benefits resulting from this agreement to move together towards achieving research goals. India is a democratic country with no condition for limiting the maximum number of political parties leading to the possibility of many uncertainties/instabilities. These uncertainties include:

- Conflicts of interest may arise from governments composed of two different political parties in states and at the centre.
- Difficulty in reaching consensus because the chances of governments of different political parties in Indian states (28 states) are high.
- In the case where no political party has a clear majority, there are two possibilities: a) formation of government by more than one political party; b) re-election.

All of these situations/consequences may hamper long-lasting, stable, cordial and fruitful 'interactions and relations' among institutes and industries in their efforts to carry out collaborative research, share knowledge and management, and produce innovative management. In fact, stable government funding to universities may complement funding from research contracts and consultations, which may further contribute to a considerable increase in university's collaborations with industry towards accelerating the knowledge transfer processes (Muscio et al., 2013).

Budget announcements, annual and periodic, reveal fund allocation for various fields, where the team of ministers, planners and experts from finance and economics contribute to understand, perceive, plan, analyze, and refine the recommendations on the basis of information. This information is gathered through collecting primary data (by using techniques like questionnaire based survey etc.), considering secondary data (government reports, organization's annual report, comparative reports etc.), comparison of cases of

developed countries and countries passing through the same development phase, and conducting various conferences, workshops and sessions (Sanders et al., 2015).In fact, all actors involved must be actively involved in efforts to find appropriate methods for effective III.

Our research has implications for international and national bodies, policy makers, industrial organizations and practitioners/managers with an interest in effective industry institute interactions to motivate research and innovation. This research also has implications for scholars who may use the framework and propositions to direct new theoretical and empirical analyses of III. Top managers are concerned with policy-making and the establishment of procedures to facilitate research and innovation activities (Zohar, 2010). Sufficient fund allocation may help to procure appropriate technology, machinery and research equipment and to hire research experts, scientists and analysts at the national and international level. A variety of skills (technical, professional, administrative, and managerial) are required to carry out the implementation and completion of collaborative- research and innovation projects, which may open up new opportunities for employment of trained and skilled professionals. Financial objectives and measures for the growth stage will stem from the development and growth of the organization which will lead to increased sales volumes, acquisition of new customers, growth in revenues etc. The economic, social, political, and cultural results of III are a long process (Ayla and İşgören, 2010).

8. Conclusions

Effective III may create new opportunities for academia and business to collaborate for mutual advantage. In this research study, an attempt was made to identify various dimensions and CFs for effective III in an Indian perspective from an extensive literature review. An idea engineering workshop was conducted for pair wise comparison of dimensions and CFs. The AHP methodology was utilized for ranking these identified dimensions and CFs. In conclusion, the robustness of the proposed solution model for this research was monitored through a sensitivity analysis test. The 'Motivation from mutual benefits' dimension was ranked first. This paper may play an important role in understanding various CFs and ranking them will help to achieve effective III in India. Systematically designed and critically planned and effectively implemented training and skill enhancing programs, in fact, may lead to successful collaboration for achieving certain preset goals towards research and innovation.

All pair comparisons in AHP were made on the basis of expert's opinions (selected from academia and industry). It is natural that the opinions of experts may be biased. It should also be noted that the experts were not selected randomly. Based on the literature review and expert opinions, various dimensions and CFs under each dimension for effective III in an Indian perspective were identified and ranked. Different multi-criteria decision making models may be applied for the same problem and results can be compared in future studies. Further, questionnaire based surveys and case studies may be conducted to validate our research work. Also, the interactions among the dimensions and CFs may be examined using CIAHP approach proposed by Kumar (2014).

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APPENDIX I

Organizations involved in education/research in India

Authority/ organizations involved in education/research in India	**Hierarchy**	**Focus**	**Description/Role/ Functions**	**Reference/ Website**
Central Government	The Ministry of Human Resource Development (MHRD) is under the overall charge of the human resource development minister.	Formulation, implementation and control of educational and research policies	The central government continues to play a leading role in the formulation and implementation of educational policies and programs such as National Policy on Education (NPE), 1986 (modified in 1992). Other initiatives include: providing universal access, ensuring retention and improving quality in elementary education, special emphasis on education of girls, establishment of pacesetting schools, inter-disciplinary research, starting more open universities in the states, strengthening of AICTE, encouraging sports, physical education, Yoga and adoption of an effective evaluation method, etc.	http://mhrd.gov.in
Ministry of Human Resource Development (MHRD)	The Ministry of Human Resource Development has two Departments i.e. Department of School Education & Literacy and the Department of Higher Education.	All-round development of Indian citizens	The essence of HRD is education. The all-round development of Indian citizens can be achieved by building strong foundations in education. In pursuance of this mission, the MHRD was created on September 26, 1985, through the 174th amendment to the Government of India (allocation of business) Rules, 1961. The main objectives of the ministry would be: formulating the national policy on education and ensuring its implementation; planned development, including expanding access and improving quality of educational institutions throughout the country; paying special attention to poor, females and the minorities; provide financial help in the form of scholarships, loan subsidy to deserving students from deprived sections of the society; encouraging international cooperation in the field of education.	http://mhrd.gov.in

Authority/ organizations involved in education/research in India	**Hierarchy**	**Focus**	**Description/Role/ Functions**	**Reference/ Website**
Department of School Education and Literacy	Headed by a Secretary to the Government of India.	Education of equitable quality for all citizens of India	The vision of the department of school education & literacy is to ensure education of equitable quality for all in order to fully harness the nation's human potential. It has its eyes set on the "universalization of education" and making better citizens out of our young brigade. For this, various new schemes and initiatives are taken up regularly and recently, those schemes and initiatives have also started paying dividends in the form of growing enrolment in schools.	http://mhrd.gov.in
Department of Higher Education	Headed by a Secretary to the Government of India.	World class opportunities of higher education and research to the country	The vision of the department of higher education is to realize India's human resource potential to its fullest in the education sector, with equity and excellence. The department of higher education is engaged in bringing world class opportunities of higher education and research to the country so that Indian students are not found lacking when facing an international platform. For this, the Government has launched joint ventures and signed MoUs to help the Indian student benefit from the world opinion.	http://mhrd.gov.in
State Government	HRD Minister is assisted by two Ministers of State.	Promote education & research in state	State government plays an important role in the formulation, implementation and control of educational and research policies in state in accordance with central government policies	*haryana.gov.in/*
University Grant Commission (UGC)	The UGC has a mandate for coordination and determination of standards in higher educational institutions	Academic and research environment in the university system	To improve the academic environment in the university system by promoting collaboration and formal linkages with other Universities, National Laboratories, Institutes of national importance and Industrial R & D Laboratories in all branches of knowledge through programme of teaching, training and research.	www.ugc.ac.in

Authority/ organizations involved in education/research in India	**Hierarchy**	**Focus**	**Description/Role/ Functions**	**Reference/ Website**
Other Apex Bodies in Universities and Higher Education	These perform under the Department of Higher Education (DHE), Ministry of Human Resource Development	Various academic and research issues	There are seven other apex bodies in universities and higher education: Indian Council of Historical Research (ICHR), New Delhi; Indian Council of Social Science Research (ICSSR), New Delhi; Indian Council of Philosophical Research (ICPR), New Delhi; National Council of Rural Institutes (NCRI), Hyderabad; Indian Institute of Advance Study(IIAS), Shimla; Association of Indian Universities(AIU); Centre for Studies in Civilization, Project of History of Indian Science, Philosophy and Culture(PHISPC)	www.ichrindia.org www.icssr.org www.icpr.nic.in www.ncri.in www.iias.org www.aiuweb.org www.phispc.nic.in
All India Council for Technical Education (AICTE) and Council of Architecture	Apex bodies in technical education	Promote technical education and research in the country	The AICTE has also framed various norms and standards to regulate the technical institutions in the country for maintaining quality in these institutions. These norms and standards are uniformly applicable to all the college. Similarly Council of Architecture frames norms and regulations for architecture education imparting colleges.	www.aicte-india.org www.coa.gov.in
Department of Technical Education (DTE) of State	Reports to State Government	To promote technical education and research in the state	Technical education is the supreme component of HRD with an infinite potential for supplementing greater value to products and services and for improving the quality of life of the people. The DTE explicitly provides technically trained manpower in various fields of engineering & technology encompassing diploma, post diploma, degree & post graduate level courses conducted through technical Institutions like polytechnics/engineering colleges/ institutions of management/ computer/pharmacy.	http://techeduhry.nic.in
Central Government Universities	Work under MHRD, DHE and UGC	Academic and research in university	Forty central universities have been involved in imparting higher education at university level.	http://mhrd.gov.in

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Authority/ organizations involved in education/research in India	**Hierarchy**	**Focus**	**Description/Role/ Functions**	**Reference/ Website**
State Government Universities	UGC	Academic and research in university	State universities are run by the state government of each of the states and territories of India and are usually established by a local legislative assembly act. As of 30 November 2011, the UGC lists 285 state universities have been involved in imparting higher education at state level.	www.ugc.ac.in ;
Deemed Universities- Private Self Financing	UGC	Academic and research in university	The UGC list from 23 June 2008 lists 130 deemed universities and the UGC list of private universities from 7 June 2012 lists 112 private universities. These are involved in imparting higher education.	www.ugc.ac.in
Government Colleges and Organizations	State Government/ Universities	Academic and research in college under university	This category includes Indian Institutes of Technology (sixteen), Indian Institutes of Management (thirteen), National Institutes of Technology (thirty), Indian Institutes of Information Technology (four), Indian Institute of Science & Indian Institute of Science Education & Research (six), National Institute of Technical Teachers' Training & Research (four), four Boards of Apprenticeship Training and other technical & language institutes.	www.aicte-india.org; www.ugc.ac.in
Private Self Financing Colleges	State Government/ University	Academic and research in college under university	The higher education system in India includes both private and publicly funded universities. These private self-financing college works under state universities to impart higher education in the state.	
Government Research Organizations	Government of India	Motivate research and innovation in the country	The government of India has set up many research organizations like Indian space research organization (ISRO), Central Electronics Engineering Research Institute (CEERI); Indian Institute of Chemical Biology; Indian Institute of Tropical Meteorology; Indira Gandhi Centre for Atomic Research and Industrial Engineering and Operations Research. Space commission and department of space (DOS) in June 1972.	http://www.isro.org http://www.ceerichennai.org/ http://www.iicb.res.in/iicb1.htm

Authority/ organizations involved in education/research in India	**Hierarchy**	**Focus**	**Description/Role/ Functions**	**Reference/Website**
Private Research Organizations	National Research Development Corporation under Government of India	Motivate research and innovation in the country	The government of India has set up many research organizations like Hi-Tech Bio Laboratories, Shriram Institute for Industrial Research, DCM Limited, Varanasi Glucose Company, Madhu Chemicals Limited. NRDC also acts on behalf of large companies who develop technologies in their R&D laboratories and choose to license them out for commercialization.	http://www.nrdcindia.com
Central Board of Secondary Education and others	Work under Department of school Education & Literacy	Promote education	There are seven bodies: Central Board of Secondary Education, New Delhi; National Council for Educational Research and Training (NCERT) New Delhi; National Institute of Open Schooling, Noida, Uttar Pradesh; Central Tibetan Schools Administration (CTSA), Delhi; NavodayaVidyalayaSamiti, New Delhi; KendriyaVidyalayaSangathan, New Delhi; National Council for Teachers .	www.cbse.nic.in www.ncert.nic.in www.nos.org www.ctsa.nic.in www.navodaya.nic.in www.kvsangathan.nic.in www.ncte-india.org

APPENDIX II

Ranking of CFs under various dimensions for effective III

Ranking of CFs of "Financial interactions" dimension
Maximum Eigen Value= 7.32176; C.I. = 0.0536266
Pair wise comparison matrix of CFs of "Financial interactions" dimension

	1.1	1.2	1.3	1.4	1.5	1.6	1.7	Global Priority Weighting	Rank
1.1	1	0.5	1	1	0.25	0.5	0.25	0.0723	6th
1.2	2	1	1	1	0.5	0.5	0.5	0.1045	5th
1.3	1	1	1	0.5	0.25	0.25	0.25	0.0637	7th
1.4	1	1	2	1	1	1	1	0.1452	4th
1.5	4	2	4	0.5	1	1	0.5	0.1891	2nd
1.6	2	2	4	0.5	1	1	0.5	0.1694	3rd
1.7	4	2	4	1	2	2	1	0.2558	1st

Ranking of CFs of "Government/nation/regulatory perspectives" dimension
Maximum Eigen Value= 6.25234; C.I. = 0.0504681
Pair wise comparison matrix of CFs of "Government/nation/regulatory perspectives" dimension

	2.1	2.2	2.3	2.4	2.5	2.6	Global Priority Weighting	Rank
2.1	1	1	0.25	0.25	0.2	1	0.0726	6th
2.2	1	1	0.5	0.333	0.333	0.5	0.0801	5th
2.3	4	2	1	1	2	2	0.2625	1st
2.4	4	3	1	1	1	2	0.2415	2nd
2.5	5	3	0.5	1	1	1	0.2109	3rd
2.6	1	2	0.5	0.5	1	1	0.1324	4th

Ranking of CFs of "Technical interactions" dimension
Maximum Eigen Value= 5.23553; C.I. = 0.0588814
Pair wise comparison matrix of CFs of "Technical interactions" dimension

	3.1	3.2	3.3	3.4	3.5	Global Priority Weighting	Rank
3.1	1	1	0.5	1	0.333	0.1352	5th
3.2	1	1	2	1	0.5	0.1934	2nd
3.3	2	0.5	1	1	0.5	0.1686	4th
3.4	1	1	1	1	1	0.1910	3rd
3.5	3	2	2	1	1	0.3118	1st

Ranking of CFs of "Markets' and customers' interactions" dimension
Maximum Eigen Value= 7.77297; C.I. = 0.128829
Pair wise comparison matrix of CFs of "Markets' and customers' interactions" dimension

	4.1	4.2	4.3	4.4	4.5	4.6	4.7	Global Priority Weighting	Rank
4.1	1	0.5	0.333	1	1	0.5	1	0.0974	7th
4.2	2	0.5	1	1	0.5	0.5	1	0.1218	5th
4.3	3	1	1	0.5	1	1	1	0.1466	3rd
4.4	1	1	2	1	1	0.333	0.2	0.1098	6th
4.5	1	2	1	1	1	1	0.5	0.1299	4th
4.6	2	2	1	3	1	1	0.5	0.1707	2nd
4.7	1	1	1	5	2	2	1	0.2238	1st

Ranking of CFs of "Social interactions" dimension
Maximum Eigen Value= 5.50371; C.I. = 0.125927
Pair wise comparison matrix of CFs of "Social interactions" dimension

	5.1	5.2	5.3	5.4	5.5	Global Priority Weighting	Rank
5.1	1	0.5	0.167	2	3	0.1469	3rd
5.2	2	1	0.25	3	2	0.1897	2nd
5.3	6	4	1	4	2	0.4777	1st
5.4	0.5	0.333	0.25	1	0.5	0.0697	5th
5.5	0.333	0.5	0.5	2	1	0.1160	4th

Ranking of CFs of "Green and environmental interactions" dimension
Maximum Eigen Value=3.01829; C.I. =0.00914735
Pair wise comparison matrix of CFs of "Green and environmental interactions" dimension

	6.1	6.2	6.3	Global Priority Weighting	Rank
6.1	1	0.5	0.333	0.1692	3rd
6.2	2	1	1	0.3874	2nd
6.3	3	1	1	0.4434	1st

Ranking of CFs of "Intellectual properties perspectives" dimension
Maximum Eigen Value=3; C.I. = 2.22045e-16
Pair wise comparison matrix of CFs of "Intellectual properties perspectives" dimension

	7.1	7.2	7.3	Global Priority Weighting	Rank
7.1	1	2	1	0.4	1st
7.2	0.5	1	0.5	0.2	2nd
7.3	1	2	1	0.4	1st

Ranking of CFs of "Human resource interactions" dimension
Maximum Eigen Value=4.04582; C.I. = 0.0152731
Pair wise comparison matrix of CFs of "Human resource interactions" dimension

	8.1	8.2	8.3	8.4	Global Priority Weighting	Rank
8.1	1	2	1	0.5	0.2326	3rd
8.2	0.5	1	0.5	0.333	0.1238	4th
8.3	1	2	1	1	0.2778	2nd
8.4	2	3	1	1	0.3658	1st

Ranking of CFs of "Motivation from mutual benefits" dimension
Maximum Eigen Value= 3.01829; C.I. =0.00914735

	9.1	9.2	9.3	Global Priority Weighting	Rank
9.1	1	0.5	0.333	0.1692	3rd
9.2	2	1	1	0.3874	2nd
9.3	3	1	1	0.4434	1st

APPENDIX III

Global preference weights for CFs by sensitivity analysis when 'increasing "Dimension 9 (Motivation from mutual benefits)" of CFs changes from 0.1 to 0.9'

CFs for effective III	9=0.1	9=0.1720 (Normal)	9=0.2	9=0.3	9=0.4	9=0.5	9=0.6	9=0.7	9=0.8	9=0.9
1.1	0.0123	0.0113	0.0110	0.0093	0.0082	0.0068	0.0055	0.0041	0.0027	0.0014
1.2	0.0178	0.0164	0.0158	0.0134	0.0119	0.0099	0.0079	0.0059	0.0040	0.0020
1.3	0.0109	0.0100	0.0097	0.0082	0.0072	0.0060	0.0048	0.0036	0.0024	0.0012
1.4	0.0247	0.0228	0.0220	0.0186	0.0165	0.0137	0.0110	0.0082	0.0055	0.0027
1.5	0.0322	0.0297	0.0286	0.0242	0.0215	0.0179	0.0143	0.0107	0.0072	0.0036
1.6	0.0289	0.0266	0.0257	0.0217	0.0192	0.0160	0.0128	0.0096	0.0064	0.0032
1.7	0.0436	0.0401	0.0388	0.0328	0.0291	0.0242	0.0193	0.0145	0.0097	0.0048
2.1	0.0057	0.0052	0.0051	0.0044	0.0038	0.0032	0.0025	0.0019	0.0013	0.0006
2.2	0.0063	0.0058	0.0056	0.0049	0.0042	0.0035	0.0028	0.0021	0.0014	0.0007
2.3	0.0205	0.0189	0.0183	0.0160	0.0137	0.0114	0.0091	0.0068	0.0046	0.0023
2.4	0.0189	0.0174	0.0168	0.0147	0.0126	0.0105	0.0084	0.0063	0.0042	0.0021
2.5	0.0165	0.0152	0.0147	0.0128	0.0110	0.0092	0.0073	0.0055	0.0037	0.0018
2.6	0.0104	0.0095	0.0092	0.0081	0.0069	0.0058	0.0046	0.0035	0.0023	0.0012
3.1	0.0136	0.0125	0.0121	0.0106	0.0091	0.0076	0.0060	0.0045	0.0030	0.0015
3.2	0.0195	0.0179	0.0173	0.0152	0.0130	0.0108	0.0086	0.0065	0.0043	0.0022
3.3	0.0170	0.0156	0.0151	0.0132	0.0113	0.0094	0.0075	0.0057	0.0038	0.0019
3.4	0.0193	0.0177	0.0171	0.0150	0.0128	0.0107	0.0085	0.0064	0.0043	0.0021
3.5	0.0315	0.0289	0.0280	0.0245	0.0210	0.0175	0.0139	0.0105	0.0070	0.0035
4.1	0.0083	0.0076	0.0073	0.0064	0.0055	0.0046	0.0037	0.0028	0.0018	0.0009
4.2	0.0103	0.0095	0.0092	0.0080	0.0069	0.0057	0.0046	0.0034	0.0023	0.0011
4.3	0.0124	0.0114	0.0110	0.0097	0.0083	0.0069	0.0055	0.0041	0.0028	0.0014
4.4	0.0093	0.0086	0.0083	0.0072	0.0062	0.0052	0.0041	0.0031	0.0021	0.0010
4.5	0.0110	0.0101	0.0098	0.0086	0.0073	0.0061	0.0049	0.0037	0.0024	0.0012
4.6	0.0145	0.0133	0.0129	0.0113	0.0096	0.0080	0.0064	0.0048	0.0032	0.0016
4.7	0.0190	0.0175	0.0169	0.0148	0.0126	0.0105	0.0084	0.0063	0.0042	0.0021
5.1	0.0103	0.0094	0.0091	0.0080	0.0068	0.0057	0.0045	0.0034	0.0023	0.0011
5.2	0.0133	0.0122	0.0118	0.0103	0.0088	0.0074	0.0059	0.0044	0.0029	0.0015
5.3	0.0334	0.0307	0.0297	0.0260	0.0223	0.0185	0.0148	0.0111	0.0074	0.0037
5.4	0.0049	0.0045	0.0043	0.0038	0.0032	0.0027	0.0022	0.0016	0.0011	0.0005
5.5	0.0081	0.0075	0.0072	0.0063	0.0054	0.0045	0.0036	0.0027	0.0018	0.0009
6.1	0.0135	0.0124	0.0120	0.0105	0.0090	0.0075	0.0060	0.0045	0.0030	0.0015
6.2	0.0309	0.0284	0.0275	0.0240	0.0206	0.0172	0.0137	0.0103	0.0069	0.0034
6.3	0.0354	0.0325	0.0314	0.0275	0.0236	0.0197	0.0157	0.0118	0.0079	0.0039
7.1	0.0592	0.0545	0.0526	0.0460	0.0395	0.0329	0.0262	0.0197	0.0132	0.0066
7.2	0.0296	0.0272	0.0263	0.0230	0.0197	0.0164	0.0131	0.0099	0.0066	0.0033
7.3	0.0592	0.0545	0.0526	0.0460	0.0395	0.0329	0.0262	0.0197	0.0132	0.0066

8.1	0.0391	0.0359	0.0347	0.0304	0.0260	0.0217	0.0173	0.0130	0.0087	0.0043
8.2	0.0208	0.0191	0.0185	0.0162	0.0139	0.0116	0.0092	0.0069	0.0046	0.0023
8.3	0.0467	0.0429	0.0415	0.0363	0.0311	0.0259	0.0207	0.0156	0.0104	0.0052
8.4	0.0614	0.0565	0.0546	0.0478	0.0410	0.0341	0.0272	0.0205	0.0137	0.0068
9.1	0.0169	0.0291	0.0338	0.0508	0.0677	0.0846	0.1017	0.1184	0.1354	0.1523
9.2	0.0387	0.0666	0.0775	0.1163	0.1550	0.1937	0.2330	0.2712	0.3099	0.3487
9.3	0.0443	0.0763	0.0887	0.1331	0.1774	0.2217	0.2666	0.3104	0.3547	0.3991

APPENDIX IV

Sensitivity analysis of CFs for effective III in an Indian perspective