Performance Evaluation of Indian Education Sector using Interpretive Structural Modelling

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Abstract: In twenty first Century, the performance of the service sector is much prominent than that of the other sectors comprising to the GDP of any country. The productivity of the service sectors of any country is dependent on type of the sectors, their culture, venture capital and availability of the skilled workers. The research paper highlights the different factors affecting the service productivity in different countries with different sectors. The paper also emphasizes the various techniques used to measure the performance of different service sectors. Finally, the paper attempts to propose a unique measurement methodology of a target sector for a specific country with some meaningful extracted key factors.

Keywords: Service sector productivity, different countries, key factors affecting, performance measurement methods.

1. Introduction: In this 21st Century, service sector is highly dominating part of gross domestic product (G.D.P.) for any country. It has remained the distinctive sector when it comes to the contributions to national and state incomes. Its notable contributions are also found in employment, foreign direct investment (F.D.I.) inflows and also trade flows. In an economic survey carried out during 2015-16 it was observed that 66.1 percent of the Indian G.D.P. growth obtained was from the Indian service sector. It was also interpreted that service sector made up 28 percent of the total employment for that year and 51 percent of total F.D.I inflows in India. Thus, it was evaluated from the observations that service sector has a high potential as a net foreign exchange earner and is very attractive for F.D.I. The present growth rate of the service sector in India is about 10 percent and also India has ranked among the top ten service exporters securing the number 8 spot. The service sector is considered to be the tertiary sector of Indian economy while the primary sector is associated with agriculture and fisheries and the second sector mainly highlighting the manufacturing domain. The services provided are not really physical in nature and consists of hospitality, banking and insurance services, retail, logistics, education, healthcare, community services, real estate, broadcasting services, defense, business services, tourism,
information technology, consultancy services, research and development services and shipping services.

2. Literature Review:

Table 2.1: Tabular representation of the studied papers

| Author                                | Country   | Sector      | Model            |
|----------------------------------------|-----------|-------------|------------------|
| Lee and Worthington (2016)             | Australia | Education   | DEA              |
| Prajogo and McDermott (2011)           | Australia | Retail      | IPA matrix       |
| Gomes and Andrade (2012)               | Brazil    | HR          | AHP              |
| Zareinjad (2014)                       | Brazil    | Education   | SERVQUAL         |
| Zsidóa et al. (2015)                   | Hungary   | Agriculture | DEA              |
| Islam & Rasad (2006)                   | Hawaii    | HR          | AHP              |
| Zhang et al. (2013)                    | China     | Logistics   | AHP              |
| Shaverdia et al. (2014)                | Iran      | OIL         | AHP              |
| Yarmohammadian et al. (2011)          | Iran      | Education   | SERVQUAL         |
| Jowkar et al. (2015)                   | Iran      | Supply Chain| ISM              |
| Naidoo et al. 2010                     | Mauritius | Public Service | SERVQUAL       |
| Gabriel et al. (2013)                  | Kenya     | HR          | Regression Analysis |
| Wadongo et al. (2010)                  | Kenya     | Hospitality | Custom Factorial Univariate Analysis of Variance |
| Ukko et al. (2012)                     | Finland   | HR          | REVIEW PAPER     |
| Lozano (2016)                          | Spain     | Banking     | DEA              |
| Kazan and Bayder (2013)                | Turkey    | Banking     | DEA              |
| Elango and Wieland (2015)              | USA       | All Sectors | AHP              |
| Shaout and Yousif (2014)               | USA       | HR          | Fuzzy, TOPSIS, FAHP, MCDM |
| Tyagi and Gupta (2013)                 | USA       | IT          | Balanced scorecard |
| Keebler and Plank (2009)               | USA       | Retail      | Triangulation approach |
| Dey et al. (2008)                      | United Kingdom | Healthcare | AHP              |
| Longbottom et al. (2011)               | United Kingdom | All Sectors | SERVQUAL       |
| McAdam et al. (2008)                   | United Kingdom | All Sectors | Performance measurement & lead benchmarking |
| Wilderom et al. (2012)                 | Netherlands | Public Service | PMS          |
| Nitirath and Bangchokdee(2011)         | Thailand  | Finance     | Path Analysis   |
| Hamali et al. (2011)                   | Thailand  | Banking     | SERVQUAL         |
| Shang et al. (2008)                    | Taiwan    | Hospitality | DEA              |
| Karimi et al. (2011)                   | Pakistan  | HR          | Regression Analysis |
| George et al. (2008)                   | India     | Railways    | DEA              |
| Bhanot and Singh (2012)                | India     | Logistics   | DEA              |
| Masson et al. (2016)                   | India     | All Sectors | DEA              |
| Kumar and Gulati (2009)                | India     | Banking     | DEA              |
| Jothimani and Sarmah (2013)            | India     | Retail      | KPI, SCOR model, FAHP and TOPSIS |
| V. and Manohar (2015)                  | India     | HR          | Regression Analysis |
| Author(s)                     | Country | Sector               | Research Method                           |
|------------------------------|---------|----------------------|-------------------------------------------|
| Tripathi et al. (2011)       | India   | HR                   | Regression Analysis                       |
| Katiyar et al. (2015)        | India   | Retail               | Fuzzy cross-impact matrix multiplication   |
| Satapathy (2014)             | India   | Retail               | Structural equation modelling             |
| Saad and Patel (2006)        | India   | Retail               | Factor Analysis                           |
| Ranjan et al. (2016)         | India   | Railways             | DEMATEL and VIKOR methods                 |
| Kiran Banga Chhokar (2010)   | India   | Education            | Review Paper                              |
| Chakraborty et al. (2015)    | India   | Tea Industry         | ISM                                       |
| Abdullah (2005)              | India   | Education            | HEdPERF, SERVPERF                         |
| Aich & Tripathy (2014)       | India   | Supply Chain         | ISM                                       |
| Arambewela & Hall (2009)     | India   | Education            | ANOVA                                     |
| Shankar et al. (2012)        | India   | Hospital             | ISM                                       |
| Dev et al. (2012)            | India   | Supply Chain         | ISM                                       |
| Gunasekaran et al. (2012)    | India   | Logistics            | ISM                                       |
| Dubey et al. (2016)          | India   | Utility              | ISM                                       |
| Kannan et al. (2012)         | India   | Logistics            | ISM                                       |
| Jayalakshmi and V. (2013)    | India   | IT                   | ISM                                       |
| Sharma et al. (2013)         | India   | All Sectors          | ISM                                       |
| Tripathy et al. (2012)       | India   | R&D                  | ISM                                       |
| Prashant et al. (2012)       | India   | Supply Chain         | ISM                                       |
| Joshi (2012)                 | India   | Education            | Review Paper                              |
| Khan and Haleem (2015)       | India   | HR                   | ISM and fuzzy-Micmac modelling            |
| Nangia et al. (2016)         | India   | Education            | ISM                                       |
| Sohani and Sohani (2012)     | India   | Education            | ISM                                       |
| Ravi and Shankar (2017)      | India   | Supply Chain         | ISM                                       |
| Karunes et al. (2016)        | India   | Education            | TQM                                       |
| Lokachari et al. (2010)      | India   | Education            | TQM                                       |
| Arulraj and Senthilkumar (2011) | India   | Education            | SQM                                       |
| Mahapatra and Sreekumar (2011) | India   | Education            | DEA                                       |
| Thakkar et al. (2007)        | India   | Supply Chain         | ISM                                       |
| Thakkar et al. (2008)        | India   | IT                   | ISM                                       |
| Tripathy et al. (2013)       | India   | R&D                  | ISM                                       |
| Umashankar and Dutta (2007)  | India   | Education            | Balanced Scorecard                        |
| Yeravdekar and Behl (2017)   | India   | Education            | ISM                                       |

**Identified factors:** From studying the above-mentioned papers, the factors affecting any educational institution are discussed below.

- **Modern Facilities (MF):** Modern facilities are an integral part of every educational institute now days. It aims for better convenience of the students and also helps them develop themselves. Modern facilities often include digital library, Wi-Fi, classroom accessories, etc.
- **Physical facilities and infrastructure (PFL):** Physical facilities and infrastructure includes a well-equipped lab, lay grounds, recreational areas, clubs and associations, modern canteens, etc. It is a vital factor which can directly influence the brand value of an institute.

- **Pre-placement training (PPT):** Now a day it is very crucial to receive a pre-placement training course before the commencement of campus. This may consist of training sessions as well as corporate talks and visits. It helps the student prepare and have a greater opportunity of getting placed as well as it can simulate the environment that goes on during the tests and interview. This can motivate the student leading to a higher place ability.

- **Accommodation (A):** The quality of accommodation as well the facilities available with the accommodation plays a crucial part in the performance of education institutes and can indirectly affect the brand name of the institute.

- **Safety and security (SS):** In today’s world safety and security is a very important aspect for the students. It can directly create effects on the brand name of the institute. The tighter the safety and security of an institution the higher will be the brand value and therefore the performance.

- **Brand name (BN):** It is a major factor that denotes the performance of the educational institutes on the basis of other direct and indirect factors like infrastructure, safety, etc.

- **Quality enhancement (QE):** Quality enhancement plays a major role in improving the brand name of the institute and also in improving the brand name. It can be done by optimizing various factors like placement, curriculum, infrastructure, etc.

- **Management vision (MV):** The accuracy and aim of management vision results in better efficiency achievement, better brand name, better alumni interaction, better employee motivation and also improving the efficiency of the students.

- **Relevant curriculum (RC):** A relevant curriculum helps the students become more efficient and they can performance more with more knowledge. It can directly affect the performance of the faculty too apart from influencing the quantitative and qualitative results and at the end industry readiness.

- **Staff motivation and development (SMD):** Staff motivation and development can be linked with providing welfare facilities, a better infrastructure, PBAS and encouraging professional development.

- **Quality lecture (QL):** Quality lecture can also be related to relevant curriculum and quantitative and qualitative results apart from influencing the performance of students and the brand name of the institute.

- **Industry interface (II):** Industry interface aids in improving the placements of the institute and also it helps in the self-development of the students by providing various courses that can enhance the knowledge and industry readiness.

- **Alumni focus (AF):** Alumni are considered to be assets of an institute if the connection between educational institutes and alumni are well established they can directly affect the placement of the institute along with various other developments that enhances the brand name.

3. **Proposed methodology: Interpretive Structural Modelling (ISM)** Interpretive structural modelling (ISM) is an established methodology to identify the interdependency among selected factors among higher technical education. Chakraborty et al. (2015) used ISM to evaluate the Indian tea industry with critical factors like wages, health & safety issues, housing issues, discrimination, labour casualisation, child labour, worker representation, etc. While Aich and Tripathy (2014), Dev et al. (2012), Prasant et al. (2012), Ravi and Shankar (2017), Thakkar et al. (2007) decided to use ISM as a tool for the scrutiny of the Indian supply chain sector where the key factors were green supply chain management, green procurement, environmental accounting,
green design, green manufacturing, green logistics, economic performance, environmental performance, management vision and direction, customer support, operational performance, supplier management, trust, adaptation, commitment, dependence, interdependence, co-operation, distributive justice, procedural justice, relational behaviour, satisfaction, mutuality, transparency, etc. Shankar et al. (2012) used ISM for a model generation between different critical factors like ERP, small incision cataract surgery, extracapsular cataract extraction, intracapsular cataract extraction, endophthalmitis, high pressure in the eye, drooping eyelid, detachment of the retina, choroidal haemorrhage, etc. Gunasekaran et al. (2012) and Kannan et al. (2012) focussed on the logistic sector of India and used ISM with factors like transitional processing, and delivery, reclaim, recycle, remanufacture, reuse and disposal, effective communication, service improvement, cost saving, and overall working relations, customer satisfaction, frequent updating, profitability, and employee morale, quality, cost, time, flexibility, customer satisfaction, and service, warehouse management, order management, supply chain planning, lack of application and knowledge of advanced information technology, lack of qualification for employees in TPL, environmental issues, etc. Dubey et al. (2016) focussed on India’s utility area using ISM considering factors like poor waste management planning, wrong selection of waste to energy technology, wrong selection of location, poor contract management, no benchmarking to assess efficiency of services, incomplete legislation and insufficient enforcement, etc. The Indian education sector was discussed using ISM by Yeravdekar and Behl (2017), Sohani and Sohani (2012), Nangia et al. (2016), Debnath and Shankar (2017) using factors like strategy orientation of regulatory body, curriculum design and development, academic flexibility, teaching learning process, teacher quality, evaluation process and reformation, research and promotion, extension activities and collaboration, physical facility and infrastructure, library and learning, student support and progression, vision and leadership, finance and resource management, quality enhancement, stake holder relationship, competitiveness of entrance exam, fees of the course, diversity of courses, extra co-curricular activities, diversity in background of students, advertisements, etc.

4. Research Methodology:
4.1 Questionnaire design: Questionnaire development being the most vital part of the present research work, utmost care was taken to design the same after thorough discussion with the quality experts. For the ease of filling by the target, the template was kept as simple as possible with close-ended questions only. The questions were clearly laid out which in turn made the respondents feel comfortable to be a part of the survey and give their precious views on the critical factors affecting the performance of their institutions. Form the questionnaires reviews we got some factors as inputs and outputs of education sector and on the basis of that a model is generated indicating the factors critically affecting the performance of education sector in India by applying ISM mathematical models.

4.2. Structural self-interaction matrix development: The contextual relationship among the 13 critical factors is developed with the help of 6 experts from the field of education. To express the relationship between key success factors, mainly four symbols are used for denotation of the direction of relationship between the factors $i$ and $j$ where it is assumed $i < j$. The symbols are as follows:

- A: parameter $j$ will lead to $I$,
- V: parameter $i$ will lead to $j$,
- X: parameters $i$ and $j$ will lead to each other,
- O: parameters $i$ and $j$ are unrelated.

Considering the contextual relationships above, a structural self-interaction matrix (SSIM) is developed in the table below.
Dependency

1. In the event that the \((i, j)\) in SSIM ends up being \(V\), at that point the \((I, j)\) in the reachability matrix is substituted by 1 and the \((j, I)\) is substituted by 0.

2. In the event that the \((I, j)\) in SSIM ends up being \(A\), then at that point the \((I, j)\) in the reachability network is substituted by 0 and the \((j, I)\) is substituted by 0.

3. In the event that the \((I, j)\) in SSIM ends up being \(O\), at that point the \((I, j)\) in the reachability matrix is substituted by 0 and the \((j, I)\) is substituted by 1.

4. In the event that the \((I, j)\) value in SSIM ends up being \(X\), at that point the \((I, j)\) in the reachability matrix is substituted by 0 and the \((j, I)\) is substituted by 1.

Reachability matrix construction: From the contextual relationships, the SSIM is constructed. Following this, conversion of SSIM into a binary matrix which is also termed as the initial reachability matrix by replacing \(A, V, X, 0\) by 1 and 0. The substitution is done on the basis of the following rules:

1. In the event that the \((i, j)\) value in SSIM ends up being \(V\), at that point the \((I, j)\) in the reachability matrix is substituted by 1 and the \((j, I)\) is substituted by 0.

2. In the event that the \((I, j)\) in SSIM ends up being \(A\), then at that point the \((I, j)\) in the reachability matrix is substituted by 0 and the \((j, I)\) is substituted by 1.

3. In the event that the \((I, j)\) in SSIM ends up being \(X\), at that point the \((I, j)\) in the reachability matrix is substituted by 1 and the \((j, I)\) is substituted by 1.

4. In the event that the \((I, j)\) value in SSIM ends up being \(O\), at that point the \((I, j)\) in the reachability network is substituted by 0 and the \((j, i)\) is substituted by 0.

![Table 4.1. Structural Self-Interaction Matrix](image)

4.3. Reachability matrix construction: From the contextual relationships, the SSIM is constructed. Following this, conversion of SSIM into a binary matrix which is also termed as the initial reachability matrix by replacing \(A, V, X, 0\) by 1 and 0. The substitution is done on the basis of the following rules:

Reachability matrix is developed for the critical factors by using the above rules. For both dependent and independent of each variable the driving power is also visualized. The driving power for each variable is the total number of variables, which it may help to achieve. Dependence is therefore the total number of variables which may help in achieving it. The driving power and dependency can be used to classify the variables into four groups namely autonomous, dependent, linkage and independent driver variables.

![Table 4.2. Reachability matrix](image)
5. Result and discussion: In this research work an attempt is being made to identify the various critical factors affecting performance of higher technical education through questionnaire survey. Among the cluster of factors to establish interrelationship, to understand the driver and dependence a systematic approach “Hierarchy based ISM” is proposed. In this model, the 13 operational factors which are base of improvement in performance of education sectors are well structured to interrelate & categorized them into Autonomous, Driver, Dependent, & Linkage variables. Finally, from the ISM model, it can be concluded that management vision drive factors like alumni focus, infrastructure and facilities, staff motivation. Again, alumni focus can control factors like pre-placement training, relevant curriculum and industry interface which are interdependent and influence each other directly. In case of infrastructure and facilities, the factors controlled are modern facilities and safety and security which are not inter dependent and not affect each other. Staff motivation can drive factors like quality lecture, etc. This all contribute to the overall quality enhancement and there by directly influencing the brand performance or the brand name of the institute.

6. Conclusion: This research was done taking data from a few numbers of colleges with limited number of operational factors. If more number of colleges are focused on in this study along with further incorporation of strategic factors, a better ISM model can be proposed with a clear understanding of the relationships among the factors and how they affect the performance. Along with the technical side of performance evaluation management side can be incorporated also giving this study a new dimension.

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