Building World-Class Universities: Some Insights & Predictions

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Building World-Class Universities: Some Insights & Predictions

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ABSTRACT
Innovations in higher education model are finding importance than ever before due to enhanced higher education institutions and the advancement in technology adopted mass education opportunities. After privatization of higher education, there is an enhanced competition between universities to attract students globally. Universities are competing with each other in terms of their physical and intellectual assets. It is postulated that the six essential assets to be developed by a university based on our predictive analysis for the growth and prosper as world-class university are (1) Physical infrastructure, (2) Digital infrastructure, (3) Innovative academic & training Infrastructure for confidence building, (4) Intellectual property infrastructure, (5) Emotional infrastructure, and (6) Networked infrastructure. In this paper, we have determined the primary focus of these infrastructures along with their essential objectives in detail. We have also discussed the various generic strategies to be followed to develop such infrastructures along the lifecycle of the university including Survival, Sustainability, Differentiation, and Growth & prosperity are analysed. The necessary and sufficient conditions of developing such infrastructures using all the above strategies towards building World-class universities are identified. It is estimated that Physical, Digital, and Innovative Academic infrastructures are necessary conditions and Intellectual Property, Emotional, and Network infrastructures are sufficient conditions respectively.

Keywords: World-class universities, Essential assets, Physical infrastructure, Digital infrastructure, Academic & training Infrastructure, Intellectual property infrastructure, Emotional infrastructure, Networked infrastructure.

1. INTRODUCTION:
Higher Education, being one of the important service industries, plays a major role in the development of the economy of the country. Accordingly, innovations in the higher education model are finding importance than ever before due to enhanced higher education institutions and the advancement in technology adopted mass education opportunities. After privatization of higher education, there is an enhanced competition between universities to attract students globally. Universities are competing with each other in terms of their physical and intellectual assets. In many developed countries, private universities could establish a huge amount of physical infrastructures due to their autonomy and existence since a long time usually more than a hundred years. Compared to public universities which are depending on limited public funding, private universities could invest more funds on developing better infrastructure due to their autonomy in using funds on their accelerated development. World class universities are those universities from both public and private sectors focus both teaching and research which have made name and fame to attract global students for their multidisciplinary degree programmes through their quality & capability to provide world class education in varied areas. Times Higher Education (THE) Magazine, a university ranking agency has identified various parameters
as metric to rank universities. Based on such common parameters called performance indicators and comparison of scores under such parameters, it is announcing world ranking of universities every year. Times Higher Education World University Rankings evaluates more than 1000 world universities based on 13 performance indicators related to teaching, research, citations, international outlook, and industry income to provide the most comprehensive and balanced comparisons and hence is by far the most reliable and the most respected. One of the important parameters which play an effective role in the world ranking of universities and hence World-class universities is time duration of its existence i.e., length of its service to the society and hence its reliability. Many of the world top universities have a common factor of more than 100 years of their existence. Such a long existence and service to society is giving them a special reputation and advantage in the world ranking. The new universities born in the 21st century have a disadvantage of achieving this time based reputation and hence face a greater challenge to enter such university ranking list. However, by means of innovative and differentiated service, new universities can also compete with old universities using re-defining their quality of service, intellectual abilities, research contributions, industry networking, and physical assets to earn special recognition in world higher education scenario. In this paper, we made an attempt in a systematic way to identify such resources both tangible and intangible to accumulate in growing universities to be a world-class university.

2. RELATED WORKS:

There are many scholarly research publications on building and analysing world-class universities. These papers are either resource based analysis or geographic based analysis. This also includes policies, strategies, or contributions of universities globally to higher education and research. Table 1 summarizes the area and focus of various scholarly papers published during last few years in the 21st century.

| S. No. | Area                                                                 | Focus                                                                                                             | Reference                                      |
|-------|----------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| 1     | World class Universities                                            | Cost and benefits                                                                                                 | Altbach, P. (2015) [1]                        |
| 2     | Building world-class universities                                    | Different approaches to a shared goal                                                                             | Wang, Q., et al. (2013). [2]                  |
| 3     | Quest for building world-class universities in South Korea          | Outcomes and consequences                                                                                         | Byun, K.et al. (2013) [3]                     |
| 4     | Building the world-class research universities                       | A case study of China                                                                                              | Huang, F. (2015). [4]                         |
| 5     | How world-class universities affect global higher education.         | World class Universities in developing a nation's competitiveness in the global knowledge economy                 | Cheng, Y., (2014) [5]                         |
| 6     | Corporate universities                                              | Lessons in building a world-class work force                                                                      | Kottke, J. L. (1999). [6]                     |
| 7     | Building World Class Universities                                   | Governments involvement in terms of providing financial support to Higher Educational institutions                 | Krishnan, R. T. (2005). [7]                   |
| 8     | Third mission ranking for world class universities                  | Beyond teaching and research                                                                                      | Montesinos, P., et al. (2008). [8]            |
| 9     | National initiatives for                                             | Comparison between Asian and                                                                                      | Deng, Q., et al. (2010). [9]                  |
building world-class universities | European experiences
--- | ---
10 | An analysis of mobility in global rankings
   | Making institutional strategic plans and positioning for building world-class universities
   | Hou, A. Y. C., (2012). [10]
11 | Creating world-class universities in Japan
   | Policy and initiatives
   | Oba, J. (2008). [11]
12 | Creating world-class universities
   | Implications for developing countries
   | Lee, J. (2013). [12]
13 | India
   | World-Class Universities
   | Altbach, P. (2015). [13]
14 | World-Class universities
   | Can Young Universities Achieve World-Class Status?
   | Salmi, J. (2013). [14]
15 | World-Class universities
   | Successful strategies to be learnt from world-class universities
   | Bejinaru, R. Et al (2017). [15]

3. OBJECTIVES:
Innovations in higher education model are finding importance than ever before due to enhanced higher education institutions and the advancement in technology adopted mass education opportunities. The objectives this paper are:

1. To identify the essential infrastructures for autonomous institutions/universities to attain Excellency in imparting higher education globally.
2. To determine the primary focus of these infrastructures along with their essentials in detail.
3. To study each infrastructure in detail and strategies to be followed to develop such infrastructures.
4. To discuss how the above Infrastructures help to develop strategies for Survival, Sustainability, Differentiation, and Growth & prosperity.
5. To classify necessary and sufficient conditions of developing such infrastructures for all the above strategies towards building World class universities.

4. METHODOLOGY:
The methodology used in this study is called Focus group based Predictive analysis which deals with collection of information related to identified problem from a group of experts in the field and related fields and analysing such information in the context of predicting the future consequences of the identified present problem [16-18].

A simple method called predictive analysis is recently developed to address decision making problems related to predicting the future. Predictive analysis is an analytical method consisting of several techniques to predict future possibilities using present trends. It can be qualitative or quantitative. It is different from predictive analytics in such a way that it will support to predict future. On the other hand, predictive analytics is a method of generating information from historically available dataset to determine and predict future trends and outcomes [19].

Predictive analysis is a method consisting of several techniques to predict future possibilities using present trends. It is different from predictive analytics in such a way that it will support to predict future. On the other hand, predictive analytics is a method of generating information from historically available dataset to determine and predict future trends and outcomes. A qualitative predictive analysis is used to predict the future possibilities by studying present trends using self-developed predictive analysis model shown in figure 1 [20]. The procedure of predictive analysis of a system or an activity encompasses 4 steps:
Collect information on present trends, Develop postulates based on present trends, Generate argument based description, and Predict the future.
The six infrastructures identified based on our predictive analysis for world class universities are listed in Table 2 with their preliminary focus.

Table 2: List of Infrastructures required for attaining excellence and their focus

| S. No | Essentials for attaining Excellence                  | Primary Focus                                                                 |
|-------|------------------------------------------------------|-------------------------------------------------------------------------------|
| 1     | Physical Infrastructure                             | Comfortability                                                                |
| 2     | Digital Infrastructure                              | Openness & Ubiquitous accessibility                                           |
| 3     | Innovative academic Infrastructure                  | Confidence building                                                          |
| 4     | Intellectual Property Infrastructure                | Creating new knowledge & Innovation                                           |
| 5     | Emotional Infrastructure                            | Belongingness & Connectedness of all stakeholders                            |
| 6     | Industry Networked Infrastructure                    | Industry Interactions for Training, Placement, & entrepreneurship             |

It is known that ideal systems are hypothetical systems with ideal characteristics. There are many varieties of ideal systems are predicted, analysed, and discussed on possibility of realization of such ideal systems by different authors in their scholarly publications [21- 37]. Table 3 depicts the ideal expected level of essential infrastructure required for attaining global excellence.
| S. No | Essentials for attaining Excellence | Ideal Level of Expectation |
|-------|-----------------------------------|---------------------------|
| 1     | Physical Infrastructure           | Open outdoor natural place without any disturbance |
| 2     | Digital Infrastructure            | Free access to any & every information in any form |
| 3     | Innovative academic Infrastructure | Models and pedagogies to make ideal graduate with unlimited knowledge, skills, experience and hence confidence |
| 4     | Intellectual Property Infrastructure | Infinite ability to Creating new knowledge & new innovation (IP) by students & faculties. |
| 5     | Emotional Infrastructure           | Every stakeholder feels that the organization is of his own and every other stakeholder is his family member. |
| 6     | Networked Infrastructure           | Perfectly networked with all kind of industries in entire globe for open Placement & entrepreneurship |

(1) Physical infrastructure:
Physical infrastructure is required to provide comfortability and safety for the stakeholders for the teaching-learning process. Though a good and safety physical infrastructure at a comfortable location is desired, the ideal education system promotes an Open outdoor place without any disturbance. In reality the Country, Location, Land, Land connectivity, Landscaping, Students feeding area, Supporting industries, Attractive & green buildings, Structure & design of each buildings, Parking facilities, Roads with walking & bicycle path, Admission & Counselling Area, Classrooms, counselling rooms, faculty chambers, Meeting rooms, Laboratories, Studios, Gymnastics, Theatres, Cafeteria, Games & Sports facility, Auditorium, Library/Digital resource centre, Xerox & Printing centre, Hostels, Residents, Shops, Hospital, Student recreation facilities, International student centres, Research Park, etc. are considered essential components. Physical infrastructure provides comfort facilities to the stakeholders. It can be built for (1) minimum requirement with basic facilities to fulfil the objectives of higher education, or (2) for a fair level to satisfy the stakeholders and differentiate to gain competitive advantage, or (3) for a luxurious level to establish monopoly and high impact on stakeholders as mentioned in table 4.

| S. No. | Facility                          | Details of physical infrastructure |
|--------|----------------------------------|------------------------------------|
| 1      | Green building                   | The buildings of the university should be constructed with principle of open environment by using optimum models of water & energy consumption. Use of green energy, harvested water, renewable and recycled resources to produce and provide clean air, water, & food, light, electricity indecently internally in the Campus. |
| 2      | Roads with walking, Motoring & bicycle path | Entre Campus buildings should be surrounded by high quality motoring roads and bicycle paths to allow both students and staff to use bicycles or battery based vehicles for commuting inside the campus. |
|   | Facilities                  | Description                                                                 |
|---|----------------------------|-----------------------------------------------------------------------------|
| 3 | Admission & Counseling Area| Adequate amount of Admission & Counseling Area is required to conduct admission tests/personal interviews. |
| 4 | Classrooms                 | Classrooms of different size with comfortable seating arrangements and teaching-learning facilities should be available to accommodate 120, 80, 60, 40, & 12 students. |
| 5 | Counseling rooms           | Student counseling rooms of different size with comfortable seating arrangements and teaching-learning facilities should be available to accommodate 20, 12, & 5 students. |
| 6 | Strong Room                | Strong Room of adequate size to accommodate confidential documents & question papers for examination sections. |
| 10| Faculty chambers           | Adequate number of well equipped faculty chambers to accommodate all permanent faculty members, visiting faculty members, part-time faculty members, Research scholars, etc. |
| 11| Meeting rooms              | Meeting rooms of sufficient size for 10 to 20 Participants with furniture and Electronic communication/presentation facilities. |
| 12| Laboratories               | State-of-the art laboratories along with advanced super specialty research centres in selected scientific and technological areas. |
| 13| Computer Centre            | 1: 4 :: Computer: Student Ratio |
| 14| Cafeteria                  | Clean, neat, and adequate in size |
| 15| Dining Room                | For 10 People, 30 people, and 90 people size. |
| 18| Games & Sports facility    | Indoor Stadium of sufficient size to accommodate variety of games. |
| 19| Auditorium                 | One auditorium of sufficient size. |
| 20| Library/Digital resource centre | Adequate in size with reading rooms, stock areas for books & Journals with online information access facility. |
| 21| Xerox & Printing centre    | Student amenity (40 Sq. M.) |
| 22| Hostels                    | For at least 60 % students |
| 23| Parking                    | Adequate to fulfill the requirements of all stakeholders |
| 24| Office Rooms               | Adequate to fulfill the requirement of all staff members |
| 25| Exhibition Hall            | Adequate in number to fulfill the requirement of all co-curricular activities |
| 26| Guest House                | Adequate for university requirement |

**Fair Requirements**

|   | Facilities                  | Description                                                                 |
|---|----------------------------|-----------------------------------------------------------------------------|
| 27| Faculty Residents          | 2 – 3 Bedrooms                                                              |
| 28| Shops                      | For students and staff to purchase essential items |
| 29| Hospital                   | A modern round the clock functioning hospital with inpatient and outpatient facility |
| 30| Student recreation facilities | Adequate with modern touch |
| 31| Yoga & Meditation Centre  | Adequate with traditional touch |
| 32| Faculty Cubicals           | Adequate in number to fulfill the demand |
| 33| Departmental Libraries     | Adequate in size with reference books & online |
Students Waiting Room (Male) Adequate in size
Student Waiting Room (Female) Adequate in size
Faculty & Staff Quarters Adequate in number (1-2 Bedrooms)
Guest Hostels Star hotel type with accommodation, food, and recreation facility
Research Scholars Hostels Adequate in numbers with contemporary facilities

**Luxury Requirements**

Central Air Conditioned High Tech Buildings With modern clean-green environmental concept
Faculty Chamber with attached washroom for each faculty Ambient & adequate in number
Studios Modern studio with optimum sound control & recording facilities
Gymnastics With sufficient size & modern facilities
International student centres With contemporary student amenities
Research park With in-house industry R & D units & collaboration
International Student Hostels Adequate in size & number with aesthetically built modern facilities
High Tech Playgrounds Adequate
Swimming Pool Modern type with multiple user facilities
Shopping Complex Adequate
Stadium Modern type
Indoor Stadium Modern type
Botanical Park Natural type

Even though, an appropriate physical infrastructure with adequate facilities is essential to attract admissions of students, it cannot offer a competitive advantage to the university continuously over a long time because competitors can also develop better infrastructure with more luxurious facilities to attract students and teachers to the system quickly by finding an appropriate investor. Physical infrastructure

(2) Digital Infrastructure:
The digital infrastructure helps all stakeholders to simplify their job and to make their contribution effective. All information related to the HEI including about the organization, about academic programmes, about admissions, about academics, examinations & evaluations, about faculty & research, about industry collaborations & placements, about student activities, etc. are ubiquitously available globally through digital infrastructure. The various supporting facilities to enhance the effectiveness of the services and to minimize the time spent to avail such services by different stakeholders. The following table 5 lists various types of digital infrastructure required for a university to be considered as world-class university.

| S. No. | Types of digital infrastructure | Details of digital infrastructure & its usage |
|--------|---------------------------------|---------------------------------------------|
| 1      | Internet usage                  | Connecting external world to the stakeholders through an electronic device. |
| 2      | Website                         | For providing institutional information to the publics |
| 3      | WhatsApp groups of stakeholders | For vertical and horizontal communication between Stakeholders |
| 4      | Google Blogs & Google sites for | To provide course information and day to day progress |
|   |   |
|---|---|
| every course | of the students who enrolled to the course to stakeholders and publics. |
| 5 | Wi-Fi Campus | To access online ubiquitous information in the campus and classes. |
| 6 | Online Study material | Development of study materials both in audio, video, and text form as per the curriculum and providing them to concerned students online as additional support to classroom teaching – learning process. The study material in the form of PDF book to be stored in smart phone, tablet, or laptop computer will help ubiquitous reference for the covered portion of the course subjects. |
| 7 | Digital Library | Developing and updating digital library and providing digital library membership to every stakeholder of the university for ubiquitous access of books, periodicals, study materials, magazines, annual/year books of organizations, journals in digital form is the responsibility of University digital library. For this purpose, the University digital library can collaborate national digital library and Global digital libraries. |
| 8 | Digital Publication | The university should have its own publication for books, newsletters, magazines, journals, proceedings, and printing question papers for examinations. Online digital publication as open access publication globally is the best practice. |
| 9 | Paperless office | By developing academic administrative software the university should provide online office environment to cater the services of stakeholders. |
| 10 | Paperless exams | Adopting digital examination system eliminates the wastage of papers in examination process. |
| 11 | Online Evaluation | Automated & digitized online evaluation system eliminates the wastage of time of evaluators & speed up the evaluation process. |
| 12 | Website based result announcement | Ubiquitous reachability. |
| 13 | NAD marks cards Facility | A convenient and completely secure digital academic depository solution. |
| 14 | Online admission test | A ubiquitous facility for global admission |
| 15 | Education ERP | To integrate various departments of the university for timely exchange & access of information. |
| 16 | Plagiarism software facility | A software facility available to every stakeholder to check plagiarism content in the documents. |
| 17 | Online digital magazine & Student publication | In online digital format through University publication. |
| 18 | Online placement (Project, internship, & final) | Online ubiquitous support. |
| 19 | Video documentation of each course & each College | For open information access from globally |
| 20 | Video documentation in U-Tube | For open information access from globally |
| 21 | Facebook and Twitter based promotions | Information access & Brand building promotions |
Use of ICCT underlying technologies like AI, BA, CC, DS, MB, OC, VR & AR

Adopting present technologies in automating the services

Studio for video online classes

Studio for digitization of sound and scene

Video conference facility

For global information exchange in digital format

Online open Publication system

For exchange of new knowledge generated to everybody through open excess system

(3) Innovative academic Infrastructure:

Academic infrastructure is the most important infrastructure among all. It is the main purpose of the education system and decides the quality of teaching-learning process. An innovative academic infrastructure also decides the quality of the output students of the university. Table 6 lists various components of innovative academic infrastructure required for a university for growth and prosper.

Table 6: Lists various components of innovative academic infrastructure required for a university

| S. No. | Types of Innovative academic infrastructure | Details of innovative academic infrastructure & its usage |
|--------|--------------------------------------------|-------------------------------------------------------|
| 1      | Industry oriented curriculum                | To meet the present and future demands of the industry |
| 2      | Employability skill focused curriculum       | For increasing employability of the graduates          |
| 3      | Specialty & super specialty professional courses | Students can go deep in a specified subjects based on their interest and hence further growth in such areas are possible. |
| 4      | Experienced committed faculty                | Experienced and committed faculty is the asset of the organization and are the motivators of students to involve in research to create new knowledge or to do innovations. |
| 5      | Session wise teaching plan                   | Systematic planning in teaching and learning process is required which includes session wise teaching plan and following such teaching plan. |
| 6      | Study books prepared as per the syllabus,   | To provide equal amount of essential information to all the students in a class it is essential to provide study books prepared as per the syllabus of the subject. |
| 7      | Question bank                               | Question bank is a book containing all possible questions prepared as per the examination pattern. Such question bank eliminates the chance of asking questions out of the syllabus. |
| 8      | QB answers as assignments                    | The students are encouraged to work more by answering all question bank questions in the form of assignments. Periodic assignment submission with due date and offering internal marks systematically will enhances the responsibility of doing their work in right time. |
| 9      | Make-up exams                               | Students should be given enough opportunities to show their talents. Similarly, due to different reasons, if a student fail to take an exam or fail to perform well in the exam he should be given another opportunity without loss a year and so. |
| 10     | Value added employability skills enhancement Papers | Apart from core and elective papers in each semester, the university should identify some general skills required based on professional requirement and enhancing |
|   |                                |                                                                 |
|---|--------------------------------|-----------------------------------------------------------------|
| 11 | Experimental learning pedagogy | The teaching – learning pedagogy should contain substantial amount of experimental learning part related to their specialization through either real environment or virtual environment. |
| 12 | Co-curricular & extracurricular activities | These activities support all-round development of students and enhances their competency and confidence in facing any challenges. |
| 13 | Earn while learn facility & flexibility | Earn while learn model has dual objectives: it gives working skills for a student with responsibility and it also supports financial needs of a student so that he need not depend on his parents for his pocket money. |
| 14 | Multi-skill development & certification opportunities | The university, by using its academic autonomy, should design the UG & PG courses in such a way that students should be offered many opportunities in all areas of STEAM for multi-skill development. Additional certificate programmes across the field may be offered. |
| 15 | Provision of optimum utilization of time to develop liberal arts skills | The regular class times should be planned optimally in order to provide sufficient time for liberal arts skills training so that students develop additional skills with them by involving in inculcating cultural and traditional skills which enhances their design thinking ability. |
| 16 | Provision of opportunities to develop & utilize Research & innovative thinking skills. | The UG & PG curriculum should be designed in such a way that there must be enough research components which allows students to work for their projects independently under the guidance of their research guide either individually or in a team. Such effort enhances the innovative ability of students and increases their competency and confidence. |
| 17 | Academic activity to build confidence | Academic support to raise knowledge, skills, attitude, and experience based competency to improve confidence in doing innovation. |
| 18 | Co-curricular activities to mould good character for social benefit | Co-curricular activities in teams or groups related to social work and social contribution also moulds good character and team working skills of the students and incorporates collective responsibility in them. |
| 19 | Special training in Event management & disaster management training | Irrespective of specialization and type of Course, every student at UG level get special training on event management & disaster management training as a part of their curriculum to prepare them in public program execution and to face natural calamities. |
| 20 | Compulsory Environmental Science Education | To create awareness to carry the clean, green, and peace environment to the next generation. |

**(4) Intellectual property infrastructure:**

The university can prosper for longer time and establish name and fame at international level only if it focuses on enhancing intellectual 

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property infrastructure. A research university by objective has opportunity to contribute intellectual property of the country by focussing research and innovation leading to new knowledge creation. A list of various components of intellectual property infrastructure required for a university is shown in Table 7.

Table 7: Lists various components of intellectual property infrastructure required for a university

| S. No. | Types of intellectual property infrastructure | Details of intellectual property infrastructure & its generation |
|--------|-----------------------------------------------|---------------------------------------------------------------|
| 1      | Research oriented experienced faculty members | Research oriented faculty members are usually research inclined. They motivate students and other faculty members to involve in research and innovation which adds intellectual property infrastructure of the university. |
| 2      | API based faculty compensation                 | Developing and implementing an Academic Performance Indicator (API) score based faculty compensation system stimulates faculty interest in participating research & publication activities. API based compensation creates healthy competition among the faculty members for accelerated IP contribution. |
| 3      | Targeted research                             | The university identifies some emerging areas in different subjects and supports the expert faculties in those areas to do research and to publish papers as well as patents. This is called targeted research and the university can create IPR as well as international brand through such efforts. |
| 4      | Atomic Research centres for each faculty      | This is an innovative idea and best practice to be followed by Universities. Here, each faculty member identifies one or more area of research interest and develop an atomic research centre in his/her coordinate-ship. The centre develops the objective of the proposed research centre, methodology, and Expected outcome along with list of working papers, list of published papers in journals & proceedings. The centre may contain a list of researchers including coordinator, internal collaborators, and student members. |
| 5      | More Ph.D. & post doctoral research scholars  | The university must admit more research scholars within its capacity of support. The university should use its autonomy to appoint more research professors (might be retired from regular services) only for guiding research scholars. University should also develop post doctoral research programmes to keep the doctoral graduates in sustained research contribution. |
| 6      | More Faculty members with Ph.D.               | The university should implement a policy of increasing number of Ph.D. degree holders in its faculty group. In addition to serving as teaching faculty, the Ph.D. degree holders also available for guiding the research scholars for Ph.D. programmes. |
| 7      | Faculty encouragement for Book Publications, Research Publications, and Patents | In order to improve the Intellectual Property Rights (IPR) of the university, the university should have the policy to encourage IPR contributors who are none other than UG & PG Students, Research scholars, and Faculty members. Based on implementing conducive policies to encourage research and publications at all above levels university can enhance its... |
IPR infrastructure. Varieties incentives and supporting schemes will help such a mission.

|   |   |
|---|---|
| 8 | More conferences (At least two conferences per year per College) | Organizing research paper presentation conferences periodically keeps students, research scholars and faculty members create an opportunity to keep up targets and to compare them with other colleagues through networking. |
| 9 | Student involvement in Research | Students are the most important resources in the university system and if guided properly can do innovations by developing patentable inventions. Similarly, through systematic research, they can also come out with scholarly publishable results. By involving students at the graduate and postgraduate level, the university can boost its IPR infrastructure. |
| 10 | Industry collaboration & Consultation | Supports collaboration based research so that the university can create IPR along with industry personnel. This also gives the opportunity to use industry research facilities by university personnel. Further collaborative research leads to more patents & publications. |
| 11 | University Incubation centres | University Incubation centres supports students to plan to start their own business after graduation. Any ideas developed during project work or internship period can be nurtured and supported as a business proposal to initiate self employment. |
| 12 | University Publication through its own press | Many universities start own publication press to speed up their scholarly publications. This also simplifies or decreases the cost of publications and encourages the faculty members to make use of their press for publication of new knowledge created. Presently, digital and online publications are prevailing and considered as one of the most important strategies of world-class universities. |
| 13 | University publications & Citation service | As a facility to researchers, universities have started citation services to their faculty members and the stakeholders including public. This will further help researchers to enhance quality publications. |
| 14 | Compulsory patent claim for UG & PG projects in Professional subject areas | By fixing the target for UG & PG students for internship and continuously guiding & monitoring them for planning and applying for patents for their invention certainly improves the result. |
| 15 | Faculty Ranking (Annual) system | Announcement of annual faculty ranking based on API and grading them under different levels develops competitive spirit among them and faculty members continuously strive for excellence. In such cases, faculty monitoring at every stage can be reduced. |

(5) Emotional infrastructure:
Creating a sense of belongingness with the organization essential for all stakeholders is essential. The major elements of emotional infrastructure essential for all stakeholders are listed in table 8.

Table 8: Lists various types of emotional infrastructure required for a university

| S. No. | Types of emotional | Details of emotional infrastructure & its generation |
|--------|-------------------|---------------------------------------------------|

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| **infrastructure** | **Description** |
|-------------------|----------------|
| 1                 | Acceptable leader as role-model  
University must develop leaders who have shared vision of developing the university in a planned manner. The leader himself must be all-rounder and role-model in terms of motivating & target setting to others. |
| 2                 | Trust among stakeholders and outsiders  
University system should develop trust (self & mutual) among all stakeholders based on their commitment and contribution to the system. |
| 3                 | Institutional values (Core values)  
For example, (1) Team Work, (2) Respect, (3) Responsibility, (4) Ethics, (5) Etiquette, (6) Social service, (7) Character, Commitment, Competency, & Confidence, (8) Tech-savviness & Scientific thinking, (9) Quest for excellence, (10) Continuous improvement, and (11) Promotion of Open systems. |
| 4                 | Institutional Rituals & Tradition  
The objectives, values, rituals, and the tradition cultivated by the seniors of the institution from several years should be carried to further as an institutional culture to involve every stakeholder in strong emotional bondage. This improves the commitment of stakeholders to fulfill their responsibility towards organizational development. |
| 5                 | Create rich communication channels  
Information related to day-to-day activities, subject, and course based information, Information related to the evaluation of students & teachers should be openly available to respective stakeholders. Through the open system model, the university should try to provide the right information at the right time to its stakeholders. This enables the stakeholders to make an optimum decision towards the growth of the university. By using various features of Information Communication and Computation Technology (ICCT), through a properly designed website and internal communication system, University can achieve this. |
| 6                 | Alternative strategy & Support network  
Stakeholder service is very important in gaining emotional support to the university. Thus to provide continuous services which are promised in the beginning must be provided in any situation. Accordingly, the university should think of an alternative strategy to fulfill promises. College facilities, Hostel facilities, food & drinking water facilities, transportation facilities, quality faculty members to cover the syllabus, conducting exams and announcement of results in time are very essential in an academic environment and require alternative strategy [38] and support network. |
| 7                 | Set vision in every student  
Goal setting in every student by creating awareness about opportunities is a major responsibility among students. The university system should motivate every student and identify the best among them and support to set a vision to prosper. |
| No. | Category                                      | Description                                                                                                                                 |
|-----|-----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| 8   | Safety & Security                             | The university should give priority in providing the hassle free ambience to every student. The safety and security are prime factors in the university campus for every stakeholder. |
| 9   | Search for proximity (Local friends, Local food, local culture) | Students usually search for proximity during the first year of their study. Seeking local friends, local food, local cultures are the common expectations among the students. University has the responsibility in creating such an environment to keep students not to feel loneliness. |
| 10  | Comfortability but need not luxury            | The university should establish all facilities towards students basic needs and focus on providing students wants to ensure a certain level of comfortability in their campus life. |
| 11  | Legacy of the system                          | The university should carry further the traditions, cultures, and hence the legacy of the system by arranging the required number of such programmes, festivals, and other descent entertainment programs. The university also maintains organizational hierarchy in a dignified way. |
| 12  | Respect & perception about organization       | The legacy of the system should be maintained in such a way that every individual stakeholder of a system should show positive perception about the university and respect heartily as their alma-matter. |
| 13  | Openness in terms of information              | As a part of the emotional infrastructure of the university, it has to maintain openness and transparency in doing business. Openness & transparency in the admission process, academic teaching-learning processes, examination and evaluation system, research & publications, and investments & profitability are important. |
| 14  | Ability of the institution to fulfill the promises | One of the major challenges of higher education institutions is their inability to fulfill their own promises. Using autonomy of the university if it can solve its failures it can establish a good name in a short span of time. |
| 15  | Accountability measures                       | The university should adopt a system to check the accountability of every stakeholder and both positive incentives and negative punishments should be incorporated in the annual evaluation process. |

**Networked infrastructure :**

Connecting with the industry, with the alumni, with other higher education & research institutions creates synergy for collective development. By means of properly planned collaborations and implementing the objective of collaboration leads to positive-sum game. Organizations which focus on effective networking can encash more opportunities for self and mutual developments along with their brand image. Collaboration and partnership with local, national, and global agencies can be used to support other infrastructures like innovative academic infrastructure, intellectual property infrastructure, and emotional infrastructure. Table 9 lists various components of networked infrastructure required for a university.
Table 9: Lists various types of networked infrastructure required for a university

| S. No. | Types of infrastructure | Networked Details of networked infrastructure & its creation |
|--------|--------------------------|----------------------------------------------------------|
| 1      | Collaborations – Horizontal, Vertical & Diversified | Student progress should be planned and implemented to support industries, further education institutions, and for the social upliftment based on collaborating and involving with these institutions. University should create a situation where the industries, other educational-research institutions, and the whole society feel emotionally the importance and contribution of the university to society. |
| 2      | Alumni association & Networks | Keeping the alumni with their alma-matter, involving them in university progress, involving them in resource mobilization, and using their services as mentors to existing students is an effective strategy to enhance the emotional infrastructure of the university. |
| 3      | Industry integrated collaborations | Industry integrated collaboration by updating syllabus of study as per industry requirement, providing industry skills by involving industry experts, supporting industry projects through industry internship, etc. |
| 4      | Academic Integrated Collaborations | Collaborating with other academic institutions which have developed their core competency in related academic areas by creating synergy so that students can opt their subject in different universities / institutions to get dual degrees or to complete research internships etc. |
| 5      | Research Collaborations | Research collaborations between neighbouring organizations strengthen networking among the stakeholders. |
| 6      | Consultancy Collaborations | The faculty members, based on their professional specialization, should be encouraged to work as consultants in industries. This will improve industry-institute relationship and networking leading to enhanced synergy. |
| 7      | Placement Collaborations | The university should develop networking with local, national, and international companies of many industry sectors both for training the students during the internship and to provide campus job placement services to ensure that the graduates of the university are employable. |
| 8      | Collaborations for student - Earn While Learn model | As a new trend in higher education, the university should encourage the students to work during their free time to get working experience and at least to earn their pocket money through earn while learn model. |
| 9      | Collaborations with NGOs & Social service Organizations | The university should also work in close with various NGOs & social service organizations using its students and staff members. Such collaboration and networking with NGOs provide social service and fieldwork opportunities to the students of the university. |
The university should also improve its quality service by means of educational innovations and best practices. The quality and credibility of the organization can be verified by its recognition by national and international accreditation bodies.

| Membership with National & International Accreditation bodies for Quality & Credibility |
|----------------------------------------------------------------------------------------|

### 6. INFRASTRUCTURE DEVELOPMENT STRATEGIES:

**6.1 How to develop Physical Infrastructure:**
Physical infrastructure can be developed to any extent by investing in huge financial investment. By identifying investors as partners, a university in the private sector can create large and essential infrastructure. But due to preset heavy competition in the higher education service business, huge investment by means of borrowing money from lenders/banks with high annual interest is not viable. Many organizations in HEIs/universities have identified political leaders/Bureaucrats as partners for the investment of unaccounted money. Creating huge attractive infrastructure can support brand building initially, but the competitors can also follow such investment model and compete for the institution so that in larger scale this infrastructure may not give any differentiation advantage. Physical infrastructure should support both academic and research activities of various schools and departments of the universities. In public universities, the physical infrastructure investment is done by the government through various independent authorities whereas, in private universities, the decision is taken by sponsoring organization. Since the physical infrastructure can add value but in long term, it may not create differentiation due to the fact that any competitor university can also develop huge infrastructure during a small interval of time as a counter strategy. The list of physical infrastructure given in table 4 can be developed by any university within one or two years if they get suitable investment partner.

**6.2. How to develop Digital Infrastructure:**
Digital infrastructure includes a paperless office system using automatic learning management system which includes digital information processing of all teaching, learning, examination, and evaluation activities. All the stakeholders get online information from both push and pull format. The university website centered admission process, payment of all fees by the students and faculty compensation are in digital payment format. Digital infrastructure of a university can be improved by implementing educational ERP/LMS, Having a dynamic website, Online teaching systems, paperless environment, computerized examination and evaluation system, Digitized marks cards/credit score cards, online e-placement supporting systems, online alumni networking, etc. The university needs one to two years to digitize its infrastructure either by its own efforts or by outsourcing digitization work for an internationally experiences information technology enabled services organization.

**6.3. How to develop Innovative academic Infrastructure:**
Innovative academic infrastructure can be developed by means of various innovative academic activities for creating innovators by means of Planning, Implementation, Evaluation, Feedback, & Self-study report. The following steps may be helpful for developing innovative academic infrastructure:

1. Institutional SWOC analysis.
2. Developing best practices by doing ABCD analysis.
3. Developing future strategy through predictive analysis.
4. Creating & retaining a strong faculty base through faculty performance analysis.
5. Using appropriate industry experts in curriculum design & implementation.
6. Developing leaders as role models through commitment & multi-tasking analysis.
7. Developing students by offering confidence building education model through student integrated development model.
8. Growth & expansion of the university through environmental analysis.

To optimize the academic infrastructure, the
university needs 3 to 5 years time once it decides to invest in innovative academic structure. The academic infrastructure should provide unique teaching-learning model developed by the university as student integrated development model [39] to enhance their employability and innovatibility.

6.4 How to develop Intellectual property Infrastructure:
Development of intellectual property infrastructure is one of the biggest challenges for a university. A university can enhance its intellectual property infrastructure by implementing many strategies which include:
(1) Involving all stakeholders in research, innovation, & documentation in the form of scholarly publication.
(2) Developing a culture of innovative thinking through research & contribution to society.
(3) Promoting institutional research in a systematic manner with high performance and output but low cost.
(4) Having collaboration with many universities and research centres locally and globally to enhance joint research and publications.
(5) Inviting industry as a partner to support their research & development activities and intern gaining in IR infrastructure.
(6) Focusing equally on Research programmes leading M.Phil., M.Sc./M.Tech./M.S.(By research), Ph.D., Postdoctoral certificates, Postdoctoral degrees like D.Sc., D.Litt., etc. with compulsory Journal publication & patents/copyrights.
(7) Encouraging faculty members through incentives to bid for government & industry funded research projects.
(8) Through university policy, motivating faculty members through faculty ranking based on research based API scores and subsequent additional incentives.

Since developing intellectual property infrastructure is long term activity and depends on many factors, universities take a long time to establish in this area, usually 10 to 15 years to reach substantial amount even if they are fully focused on such activities. The most appropriate way of calculating the IPR infrastructure for a given time duration is proposed in ABC Model of Organizational Performance [40-41].

6.5 How to develop Emotional Infrastructure:
Creation of emotional surplus with respect to employees and customers is a big challenge for every organization [42]. Universities also should strive for emotional surplus as their essential infrastructure in order to accelerate their growth. Providing a good working environment for all stakeholders with ethical policies and transparent academic and administrative system and giving extra care in all service area of both higher education and research activities are the necessary and sufficient conditions for developing emotional infrastructure in the HEI organizations. Creating a substantial amount of emotional infrastructure for a university takes long time since it has to prove its long time credibility & identity through its dedicated and committed service to the society. Some of the strategies which support to develop emotional surplus as emotional infrastructure in universities are listed below:
(1) All regulations related to various services should be framed from learner centric.
(2) Honest effort of providing transparency in administration with democratic touch.
(3) Leaders should be visionary and have inherent intention to treat every stakeholder as the family member.
(4) Atmosphere to be created to build mutual trust and respect between stakeholders.
(5) Develop an institutional tradition and culture from local tradition and culture.
(6) Develop core values of commitment, dedication, and service among all stakeholders.
(7) Create a system where everybody should know their responsibility and struggle to achieve it.
(8) Create a system where every stakeholder gets security and justice.
(9) Openness & transparency in all administrative decisions.
(10) Accountability based on job description at all levels of the university.
(11) University social responsibility for economically weaker sections.

To create emotional infrastructure in substantial amount and use it as a resource for brand creation, the university has to make sustainable
efforts for long time period. Most of the existing universities all along the world with more than 100 years existence have advantage in accumulating emotional infrastructure compared to recently started universities. However, using innovative strategies, it should be possible for the present generation universities to create substantial emotional infrastructure for a time period of 10 to 30 years.

6.6 How to develop Networked Infrastructure:
Through effective networking with industries, other HEIs and various research organizations, universities can prosper and develop as one among world leader. The network collaborative model should have a systematic plan of involving industry experts in teaching-learning process. Starting from planning the courses and the subjects, developing the curriculum, collaborative training, collective evaluation, and offering employment, industry-institute interaction has the opportunity to add value to their services. Connecting with the industry, with the alumni, with other higher education & research institutions creates synergy for collective development.

The following steps may be helpful for developing networking infrastructure for universities and HEIs:
(1) Universities should realize that they are by the society and for the society so that by working with more organizations in a team, they can fulfil their objectives and contribute substantially for the society.
(2) Involving alumni in close confidence in many processes, universities can get huge benefit for their brand building exercise.
(3) Identifying and involving various industries which provide internship and employment opportunities in curriculum design.
(4) Networking with student feeding institutions by means of involving/admitting faculty members of such institutions in university research programmes.
(5) Collaborating with national and international universities for joint research & publications, Credit transfer Courses, Dual degree programmes, etc.
By means of properly planned collaborations and implementing the objective of collaboration leads to a positive-sum game. Organizations which focus on effective networking can encash more opportunities for self and mutual developments along with their brand image. Collaboration and partnership with local, national, and global agencies can be used to support other infrastructures like innovative academic infrastructure, intellectual property infrastructure, and emotional infrastructure.

The estimated time period required for development of the essential infrastructures for a university in a private sector where the board of directors have autonomy to make investment decision is shown in Table 10.

Table 10: Time period required to develop various infrastructure optimally

| S. No | Essentials Infrastructures for attaining Excellence | Time period required for reaching optimum level |
|-------|----------------------------------------------------|------------------------------------------------|
| 1     | Physical Infrastructure                           | 02 - 03 years                                   |
| 2     | Digital Infrastructure                            | 01 - 02 years                                   |
| 3     | Innovative academic Infrastructure                | 03 - 05 years                                   |
| 4     | Intellectual Property Infrastructure              | 10 - 15 years                                   |
| 5     | Emotional Infrastructure                          | 10 - 30 years                                   |
| 6     | Networked Infrastructure                          | 05 - 10 years                                   |

7. INFRASTRUCTURES FOR SURVIVAL, SUSTAINABILITY, MONOPOLY, DIFFERENTIATION, AND GROWTH & PROSPERITY STRATEGIES:

Another way of looking at the essential infrastructures are based on organizational strategy. The type of infrastructure to be focused by a university depends on what strategy it follows. As per one school of thoughts in strategic management, there are five generic strategies observed as organizational strategies.
This includes Survival strategy, Sustainable strategy, Monopoly strategy, Differentiation strategy, and Growth & prosperity strategy. Survival strategy is also called black ocean strategy where the objective is a survival from a catastrophic problem so that it can continue in the business instead of closing down [43]. Sustainable strategy is also called green ocean strategy where the objective of all decisions is long time sustainability so that the organization can continue in its business [44]. Monopoly strategy is also called blue ocean strategy where the objective is the decisions leading to competition less environment on their products or services [45]. Differentiation strategy is also called red ocean strategy where the objectives of all decisions are based on facing the competition of other firms from the same industry [46]. Growth & prosperity Strategy is also called white ocean strategy where the objective is to achieve the goal using a mixed strategy [47]. A university may use all these strategies at different point of time in its lifecycle. But the relationship between these strategies and their substantial infrastructural contribution can be predicted and is given in table 11.

Table 11: Relation between organizational strategy and their contribution

| S. No. | Organizational Strategy | Substantial Infrastructural Contribution          |
|--------|-------------------------|--------------------------------------------------|
| 1      | Survival                | Physical & Emotional                              |
| 2      | Sustainability          | Physical, IR, & Emotional                         |
| 3      | Differentiation         | Physical, Digital, Academic, IR, Emotional        |
| 4      | Growth & Prosperity     | Physical, Digital, Academic, IR, Emotional, & Network |

In general, a necessary condition is a condition that must be present for an event to occur and a sufficient condition is essential to produce the event. In this line, it is argued that the physical, digital, and academic infrastructures are Necessary conditions and IR, Emotional, and Network infrastructures are Sufficient conditions for creating World-class infrastructure.

Table 12: Necessary and sufficient conditions of different infrastructures

| S. No. | Conditions       | Substantial Infrastructural Contribution          |
|--------|------------------|--------------------------------------------------|
| 1      | Necessary Conditions | Physical, Digital, and Innovative Academic              |
| 2      | Sufficient Conditions | Intellectual Property, Emotional, and Network         |

8. CONCLUSION:

The important essential infrastructures required for a growing university to emerge itself as a world-class university are discussed. It is postulated that the six essential assets to be developed by a university based on predictive analysis for the accelerated growth and prosperity as world-class university are (1) Physical infrastructure, (2) Digital infrastructure, (3) Innovative academic & training Infrastructure for confidence building, (4) Intellectual property infrastructure, (5) Emotional infrastructure, and (6) Networked infrastructure [48]. The study focuses on various components of these infrastructures and how to develop these infrastructures for growing universities along with the essential objectives in detail. The various generic strategies to be followed to develop such infrastructures along the lifecycle of the university including Survival, Sustainability, Differentiation, and Growth & prosperity are analysed. The necessary and sufficient conditions of developing such infrastructures using all the above strategies towards building World-class universities are identified.

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