Review of Business and Technology Research, Vol. 13, No. 1, 2016, ISSN 1941-9414

System Dynamic Modeling for Policy analysis in Higher Technical Education

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Abstract

In the present study an attempt has been made to study the impact of placements of students through campus on the quality of the Institute. In the above study system dynamics has been used as methodology for constructing system dynamic model and results are drawn by simulating the model. By comparing the results an optimum policy has been suggested for long term planning for quality in higher technical education.

Introduction:

The Major role of higher education is to cast students by uplifting their Knowledge, skills, attitude and abilities and gradually empowering them as lifelong critical, reflective learners and can be seen as a public Asset as it benefits the society as a whole [1], [2], [3].The higher education system in India grew rapidly after independence. By 1980, there were 132 universities and 4738 colleges in the country enrolling around five percent of the eligible age group in higher education. Today, in terms of enrolment, India is the third largest higher education system in the world, behind China and the USA, with 17973 institutions (348 universities and 17625colleges).The number of institutions is more than four times the number in United States and entire Europe. Higher education in China having enrolment in a higher education institution in India is about 600-700 students, a higher education institution in United States and Europe would have 3000-4000 students and in China this would be about 8000-9000 students (Source, AICTE). This makes the system of highly fragmented one that is far more difficult to manage than any other system of higher education in world. But it is accepted and unfortunate facts that accept few premiere Institutes of national importance providing high quality higher education rest are substandard. Irony is that all premier Institutes get the creamy layer of intakes. Meritorious students getting admission in pioneer Institutes are natural professional. Unfortunately substandard Institutes get non creamy layer of intakes of are just producing Technical graduates having certificate but not required skills because of non quality practices. There is a need to find out the factors which affect the quality of the Technical education system.

Literature review:

Education in general and Technical education in particular represents too-process-oriented, Intangible and multiple-stakeholder situations. Most of the performance measurement systems of higher educational institutions do not reflect the full range of interested stakeholders and are not closely linked to the strategic management. Therefore, Cullen et *al* [3] propose the use of a balanced scorecard approach in order to reinforce the importance of managing rather than just monitoring performance. Garretson [5] confirms the importance of the expectation of key stakeholders in the educational process while exploring the meaning of quality through students' evaluation of an MBA programme using a combination of qualitative and quantitative approaches. Temponi [9] analyses the main elements of continuous improvement in higher education that Address the concerns of academia's stakeholders during the process of its implementation. Lomas [6] emphasizes the selection of a particular quality management model such as European Forum for Quality Management (EFQM) and Total Quality Management (TQM) for promoting continuous improvement of quality in education. In addition, a few studies highlight the method of pedagogy and selection of institutes of higher learning [4].

Methodology:

System dynamics is used as the methodology for analyzing the impact of placements of students on quality of the institute. System dynamics is an approach to understand the behavior of complex systems over time. [2]
Basic System Dynamics Modeling process of any feedback system can be summarized in following points [8]
1. Identify the problem. Define system boundaries and identify its individual components (also called variables) which determine system's behavior. .
2. Create a basic influence diagram, also known as causal loop diagram representing cause-effect relation between different variable.
3. Convert the causal loop diagram to a Stock-flow diagram. This diagram distinguishes variables between stock and flow.
4. Write the equations that determine the flows, and estimate initial conditions for stocks. These can be estimated using statistical methods, expert opinion, market research data or other relevant sources of information. .Simulate the model and analyze results. We will be explaining the feedback loops structures, Causal loop diagrams and Stock flow diagrams in the subsequent sections, as they are the building blocks of understanding the system dynamics modeling process.

Causal Loop Diagram of Higher Technical System:

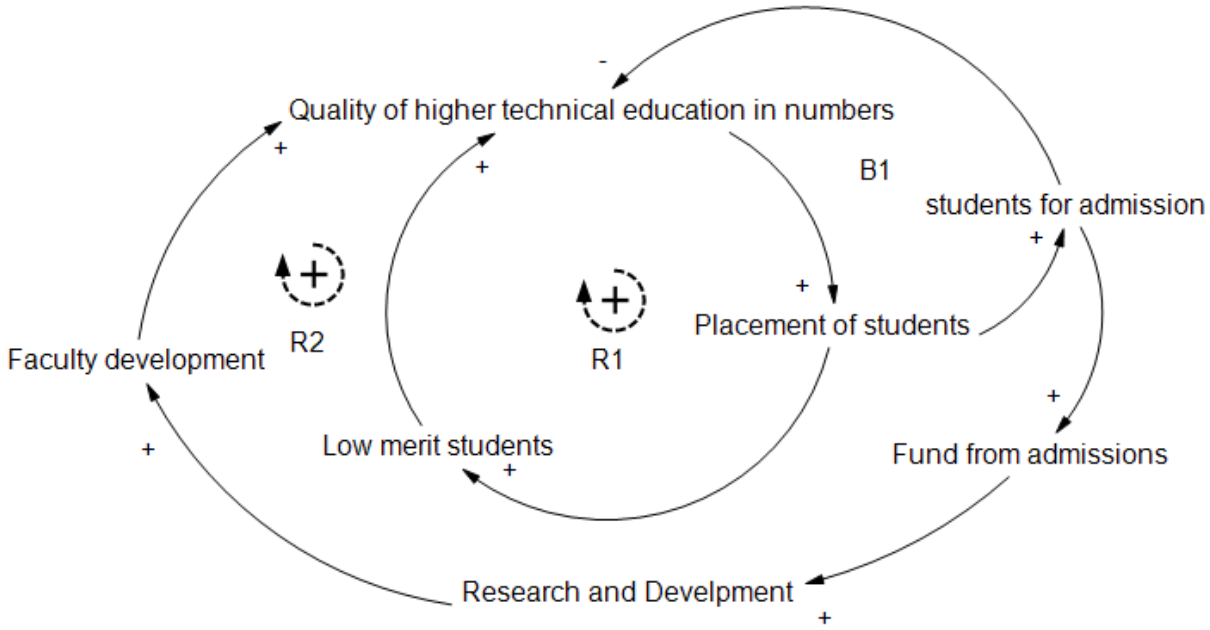

Figure.1.Cuasal Loop Diagram

Figure shows causal loop diagram of Placement sector of higher technical education system showing its impact on quality of the Institute. The loop has got two reinforcing loop R1,R2 and balancing loop B1.The reinforcing loop R1 depicts as quality of the institute in numbers increases the placement of students increases and as placement of students increases ,Low merit students come in technical education system resulting in decrease in quality of technical education system. The reinforcing loop R2 depicts as quality of higher education increases the students admission increases which increases fund in the form of tuition fee which increases research and development activity in the institute which results in faculty development which increases the quality of institute. Balancing loop B1 depicts as placement of student increases students admission increases which decreases quality of technical education.

Model Simulation

Based on the above causal loop the stock and flow diagram on Powersim 2.1 is developed and simulated for 10 years and the behavior of impact of placement on quality is studied and trends is depicted in the results.

Results

The table presented below shows the scenario generated from the model developed. The table shows the impact of increasing placement on quality of the Institute. The table shows that as the placement of the student is increased the quality of the institute also increases so in the long run for enhancing quality of the institute, Placement of students can be taken as policy for improving status of the Institute.

What-if Scenario if placement of students is increased to 30%

Scenario	Year	Quality in Number (with Total Assistant Professors of the Institute.)	Quality in Number (with Total Associate Professors of the Institute.)	Quality in Number (with Total Professors of the Institute.)
Student Placement	2004	13.25	8.32	13.50
	2005	183.51	184.06	184.05
	2006	172.13	172.45	171.97
	2007	158.93	159.15	158.72
	2008	78.79	79.14	78.68
	2009	134.88	135.29	136.00
	2010	125.47	125.45	125.54
	2011	165.93	165.87	165.88
	2012	166.64	166.55	166.82
	2013	168.44	168.14	167.40
	2014	110.46	110.54	110.18
	2015	112.17	112.24	111.87
	2016	113.87	113.94	113.58
	2017	115.57	115.64	115.27
	2018	117.27	117.35	116.97
	2019	118.97	119.04	118.67
	2020	120.67	120.75	120.36
	2021	122.37	122.45	122.06
	2022	124.07	124.15	123.77
	2023	125.77	125.86	125.47
	2024	127.47	127.56	127.16
	2025	129.17	129.26	128.86

What-if Scenario if placement of students is increased to 50%

Scenario	Year	Quality in Number (with Total Assistant Professors of the Institute.)	Quality in Number (with Total Associate Professors of the Institute.)	Quality in Number (with Total Professors of the Institute.)
Student Placement	2004	13.45	8.52	13.70
	2005	183.71	184.26	184.25
	2006	172.33	172.65	172.17
	2007	159.13	159.35	158.92
	2008	78.99	179.34	78.88

	2009	135.08	135.49	136.20
	2010	125.67	125.65	125.74
	2011	166.13	166.07	166.08
	2012	166.84	166.75	167.02
	2013	168.64	168.34	167.60
	2014	110.66	110.74	110.38
	2015	112.37	112.44	112.07
	2016	114.07	114.14	113.78
	2017	115.77	115.84	115.47
	2018	117.47	117.55	117.17
	2019	119.17	119.24	118.87
	2020	120.87	120.95	120.56
	2021	122.57	122.65	122.26
	2022	124.27	124.35	123.97
	2023	125.97	126.06	125.67
	2024	127.67	127.76	127.36
	2025	129.37	129.46	129.06

What-if Scenario if placement of students is increased to 80%

Scenario	Year	Quality in Number (with Total Assistant Professors of the Institute.)	Quality in Number (with Total Associate Professors of the Institute.)	Quality in Number (with Total Professors of the Institute.)
Student Placement	2004	13.90	8.97	14.15
	2005	184.16	184.71	184.70
	2006	172.78	173.10	172.62
	2007	159.58	159.80	159.37
	2008	79.44	79.79	79.33
	2009	135.53	135.94	136.65
	2010	126.12	126.10	126.19
	2011	166.58	166.52	166.53
	2012	167.29	167.20	167.47
	2013	169.09	168.79	168.05
	2014	111.11	111.19	110.83
	2015	112.82	112.89	112.52
	2016	114.52	114.59	114.23
	2017	116.22	116.29	115.92
	2018	117.92	118.00	117.62
	2019	119.62	119.69	119.32
	2020	121.32	121.40	121.01
	2021	123.02	123.10	122.71
	2022	124.72	124.80	124.42
	2023	126.42	126.51	126.12
	2024	128.12	128.21	127.81
	2025	129.82	129.91	129.51

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