# SYSTEM DYNAMIC MODELLING FOR QUALITYASSESMENT IN HIGHER TECHNICAL EDUCATION

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**ABSTRACT**

The primary focus of technical education is to grow skilled technical manpower in country. In today's scenario large number of professional graduates produced in India comes from Institutions managed by private organizations. Due to poor quality of these graduates in technical skills is the major hindrance in their employability. This has been reported several times by researches conducted by various Industrial organizations such as NAASCOM. In the present research findings an attempt has been made to study the impact of faculty satisfaction on quality of technical education system by constructing causal loop diagram of technical education system that is clearly understanding how faculty satisfaction is connected to other parameters of technical education system such as performance of students in exams, placements of students through campus selection etc. By taking the base of causal loop diagram system dynamic model is constructed for studying effect of faculty satisfaction on quality of technical education.
**Keywords:** *System Dynamics, Quality, Causal loop, Stock flow diagram, What-if Scenario.*

## INTRODUCTION

One of the challenges that technical education of India is facing is that of its sub standard quality as reported by major industries. The major goal of Technical education is to develop technical skills among the youth for creating technical man power in country. India produces large number of engineers annually. As per review report of All India council of technical education 2018 the total enrollment for engineering education is around 15 lakhs. In spite of having such a huge capacity of awarding technical education country is facing poor employability rate due to poor quality of engineers produced as per international bench mark Dewanga (2013). This is one of the major drawbacks for technical education of India and there is imperative need to review the existing policy and to redefine them and to test policy that can upgrade the existing quality Kurt (2003). Organizations like the IITs, NITs and a couple of other open and private specialized colleges are as a matter of fact performing admirably. The issue is that these establishments deliver under 5-10 for each penny of the architects in India. Most different organizations are in genuine need of change in their quality. A greater part of these are associated to colleges and educate the educational modules created by the affiliating college. Thus, they do not have the motivating force to persistently enhance the nature of educating and learning and are not equipped to adjust to the changing capability needs of the employment showcase. These schools for the most part concentrate on undergrad educating and their post-graduate projects are regularly powerless. Besides, they do not have a methodical limit building exertion in training and research. The quality affirmation and accreditation endeavors of these establishments can be described by "consistence" as opposed to "change" apparatus. The vast majority of them don't have a profound engagement with the businesses and are once in a while associated with provincial advancement and organizations with neighborhood monetary players. Without solid connections in the business, the schools have a shortage of entrepreneurial and advancement soul. What's more, thus, the understudies and the staff get little presentation and have next to zero experience with regards to taking care of reasonable issues.

## LITERATURE REVIEW

Number of research scholars has examined the effect of each individual item constituting the overall studying impression such as library, canteen, personnel, Infrastructure development etc and consequently their effect on students satisfaction. Jayassundra (2010) have worked in the area of library science and its affect on student satisfaction. Parasuraman (1998) has proposed model for measuring service quality and its affect on student satisfaction. Alves (2013) has found the influence of faculty reputation and budget on student satisfaction. Exclusively reviewing contributions made by system dynamics community in the field

quality of technical education there are some well known findings such as Kennedy (1998) elaborates model which incorporates factors such as planning, resources and human resource management. Vahdatzad, (2000) has proposed about the combined task of government and University for expansion of planned quality education. Kennedy (1999) reveals on the role of fund management for quality education. Barlas (1996) discusses the importance of facilities, infrastructure and projects for quality education. Mohamed (1999)emphasizes on the importance of faculty in quality education. Hermann (1996) overviewed role of academic planning for quality education. Badri (2010) in their paper proposed students index model.

## THE SIGNIFICANCE OF SYSTEM DYNAMICS AS A METHODOLOGY

System dynamics (SD) is a PC supported approach for breaking complex problems through plan and Investigation. The issues tended by SD depend on the premise that the structure of a system, that is, the way essential system components are associated, progresses its behavior (Luna-Reyes and Anderson, 2003). These problems highlights at least two features in like manner. To start with they are dynamic (involve quantities which change over time). Further more they involve the notion of feedback where, item x affects another item y and y in turn affects x perhaps through a chain of causes and effects (Forrester, 1998). Forrester further suggests that studying a link between x and y, independent of the other links between y and x cannot predict how the system will behave; only the study of the whole system as a feedback system can lead to correct results. Specific to HE issues is Kennedy's (2002) taxonomy for system dynamics models that include topics such as: external forces, corporate governance, planning, resources and budgeting, human resource management, teaching quality, teaching practice, micro worlds, and enrolment demand. Apart from this taxonomy, recent studies acknowledge complex interactions in modelling higher education issues, but use methods that don't capture nonlinearity and feedbacks in their inquiry. For instance, Try and Grøgaard (2003) measured the relationship between resources and outcomes in higher education in Norway using hierarchical linear modelling (HLM) but restricted institutional resources to student composition, financial and staff resources, and staff priorities. Ho et al. (2006) suggest three groups of resources: manpower (human resources), hardware (infrastructure type), and software (intangible effects e.g., conference facilitation) that can be prioritised and budgeted for using analytic hierarchy process concurrently with goal programming approach. Although Ho and colleagues incorporate a large section of resources, their approach is linear and therefore sacrificing non-linear dependency. For example, computing resources facilitate teaching, learning and research which in turn affect perceived quality of graduates. By using data warehousing approach, Vinnik and Scholl (2005) explore the relationship between university's educational capacity and resource management but they do not suggest quality implications. This paper adopts the SD approach to investigate the dynamics of student attendance on Quality of Technical education.

The Significance of SD in this examination is in its ability to:

- Demonstrate inputs or intelligent perspectives in unique frameworks like advanced education.
- Join non straight connections characteristic in higher instructive quality issues.
- Address many sided quality circumstances while testing their conduct after some time.
- Oblige delicate factors, for example, Scholastic Magnificence, Position of Understudies.

- *Causal loop Diagram*

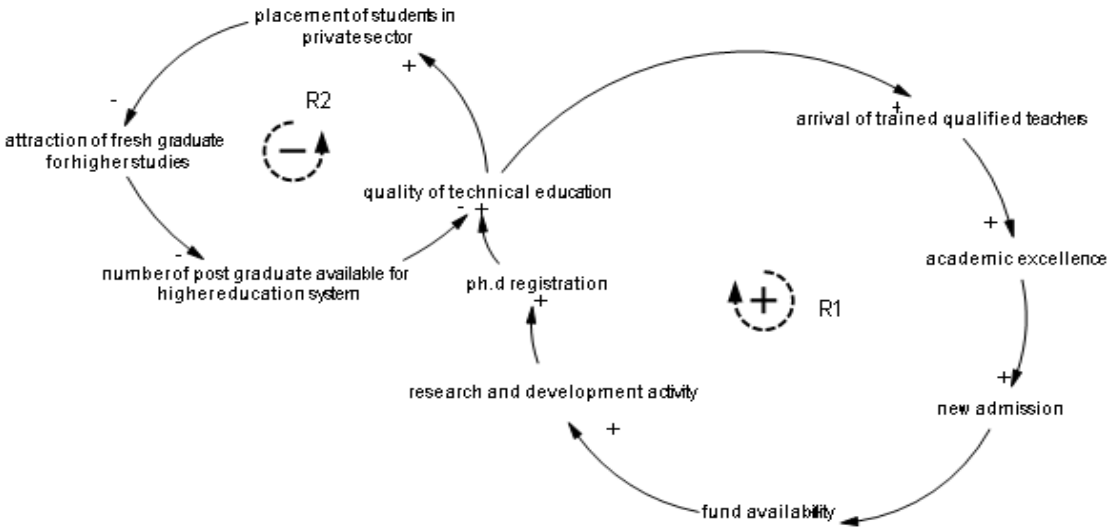


**Figure 1. Cuasal Loop Diagram**

The causal loop diagram shown in above figure.1.show that as quality of Institute in numbers increases as faculty arrival increases this increase also results in increase of academic excellence which increases new admission and as a impact fund availability increases which in turn increases research and development that finally increases research fellows which enhances quality of technical education in numbers again this loop is reinforcing loop R1.The balancing loop R2 depicts as quality increases placement in Industry of students increases this results in low merit people joining the technical education which ultimately decreases the quality of technical education in numbers.

- *Stock and Flow Diagram*

Based on the above causal loop the stock and flow diagram is generated which is system dynamic model which is simulated for 10 years and results are obtained by testing the impact of faculty satisfaction on quality of technical education.

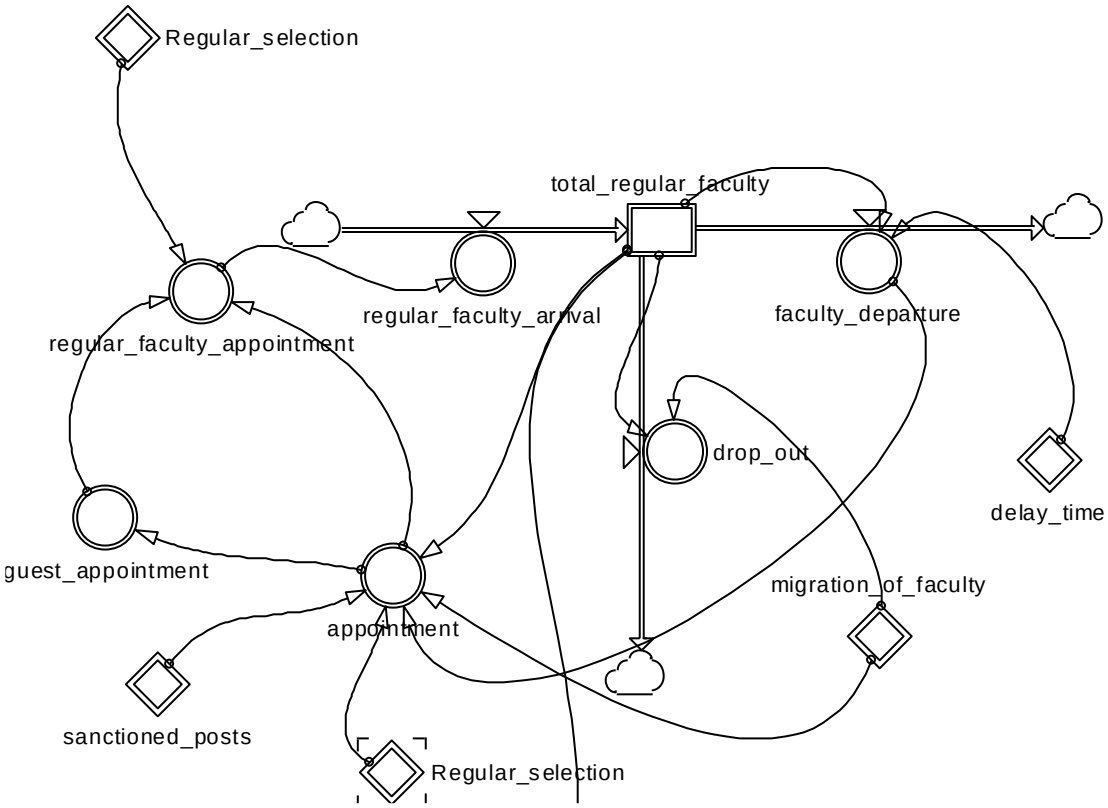


**Figure 2. Stock and Flow Diagram**

## RESULTS

**TABLE 1.** WHAT-IF SCENARIO INFRASTRUCTURE GROWTH

| YEAR | Faculty Satisfaction base case | Faculty Satisfaction Increased to 30% |
|---|---|---|
| 2004 | 12.10 | 13.40 |
| 2005 | 182.36 | 183.66 |
| 2006 | 170.98 | 172.28 |
| 2007 | 157.78 | 159.08 |
| 2008 | 77.63 | 78.94 |
| 2009 | 133.73 | 135.03 |
| 2010 | 124.32 | 125.62 |
| 2011 | 164.78 | 166.08 |
| 2012 | 165.49 | 166.79 |
| 2013 | 167.28 | 168.59 |

| YEAR | Faculty Satisfaction base case | Faculty Satisfaction Increased to 30% |
|---|---|---|
| 2004 | 12.10 | 13.40 |
| 2014 | 109.31 | 110.61 |
| 2015 | 111.01 | 112.32 |
| 2016 | 112.71 | 114.02 |
| 2017 | 114.42 | 115.72 |
| 2018 | 116.12 | 117.42 |
| 2019 | 117.82 | 119.12 |
| 2020 | 119.52 | 120.82 |
| 2021 | 121.22 | 122.52 |
| 2022 | 122.92 | 124.22 |
| 2023 | 124.62 | 125.92 |
| 2024 | 126.32 | 127.62 |
| 2025 | 128.02 | 129.32 |

## CONCLUSION

The present research work has aimed with the problem of finding the impact of faculty satisfaction on quality of technical education system by keeping in mind the real system, We find that a wide range of factors makes it complex to find there interrelatedness and their behavior, Therefore it is difficult to predict the quality of technical education system with the available wide range of measures. In the present research an attempt has been made to combine various factors that are important in quality of technical education system and to study their dynamic behavior under system dynamic modeling framework and a system dynamic simulation model has been developed to support policy planner. Following conclusions can be drawn from the scenario generated from the Simulation run of the model:

1. Real trends for the quality in numbers for an institute are obtained if the data is incorporated in the modeling framework. The results show the increase and decrease in quality with variation of faculty satisfaction defined empirically for quality computations.
2. With faculty satisfaction academic excellence is increased that increases the confidence of student this is real behavior of the system the result obtained from the model show the similar behavior this conclude that model is capturing real behavior of the system and can be used for testing policy related to quality of technical education.
3. From the above results depicted we can conclude that if faculty satisfaction in the institute is enhanced quality of technical education can be suitably increased.

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