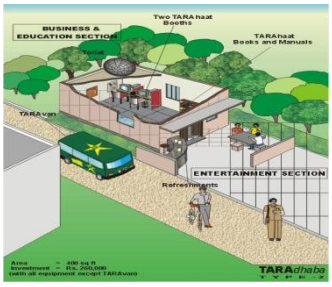
DRAFT 1.0

"Strategy Dynamics of a Social Enterprise in India"

– *Impacts of introducing system dynamics to conventional strategy formulation*

This paper presents a systems-based method for developing a strategic expansion plan for a leading social enterprise that delivers Internet-facilitated vocational training in rural India. A System Dynamics model was built to complement the main spreadsheet model prepared for the strategy exercise. The SD model provides a flexible testing environment that permits a clearer view of the dynamic elements of the business plan and enables the assumptions of a broader set of stakeholders to be incorporated.

*Most businesses rely on static spreadsheet modeling to design long-term strategies and action plans; this paper describes the importance of identifying, building and maintaining resources that generate revenue or social good, and effectively managing those resources that add costs. In particular, this paper focuses on the effect of delays in "**progression pathways**" (which are essential business processes to build service capacity) on the performance of the organization.*

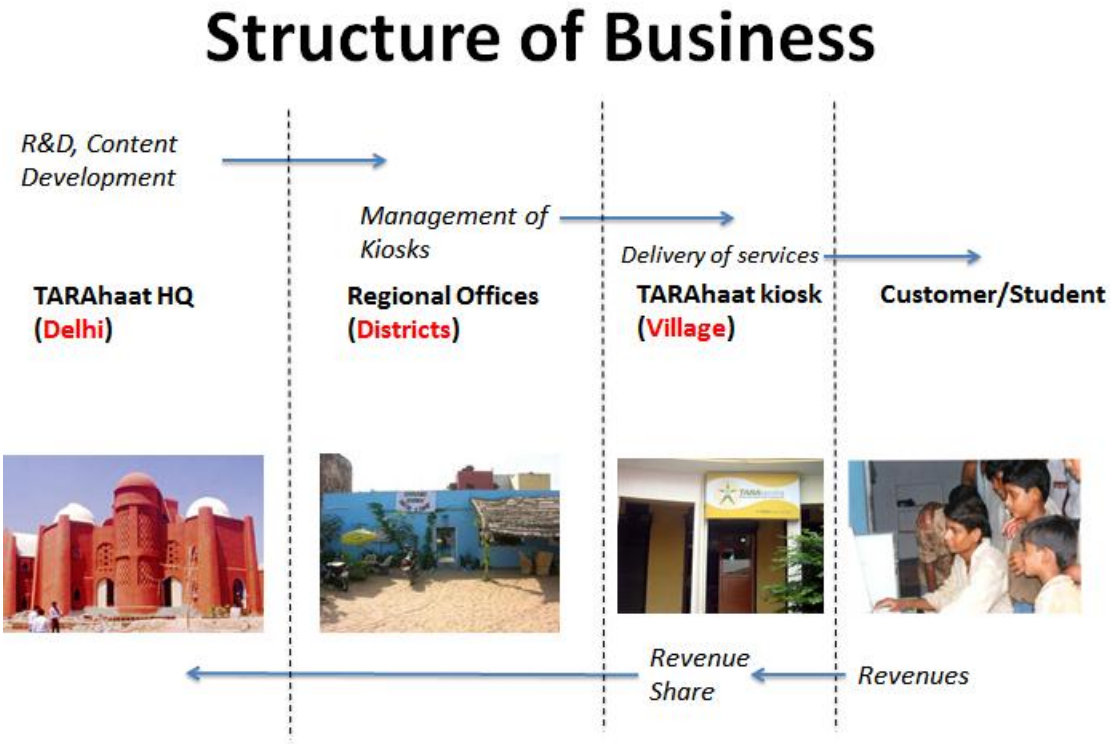


Students being trained at a TARAhaat kiosk; an artist's impression of ideal kiosk; the website interface: http//:www.tarahaat.com

TARAhaat is India's leading social enterprise; it aims to create livelihoods and jobs for India's 500 million unemployed by training people in skills, from basic literacy and computer operation to enterprise management and entrepreneurship development.

The organization operates a network of franchised Internet kiosks that deliver a variety of products and services to clients in remote parts of the country. A large part of the revenue of the kiosks and franchising fees for the company is earned through the

delivery of vocational training services[1]. The head office, in New Delhi, is responsible for business, course and content development and quality control through regional offices. Each regional office manages/supports a cluster of around 30 kiosks; the kiosks are set up and owned by local entrepreneurs in the village, often young graduates with access to some capital. These franchises are responsible for attracting and training students – thereby generating revenue.



Over the course of a decade, TARAhaat has trained over **50** thousand students through some 400 kiosks across northern and central India. In early 2011, in recognition of TARAhaat's success in creating jobs in remote areas, particularly in remote communities and under difficult financial circumstances, the Government of India offered to fund the scale-up of TARAhaat Kiosks across the country provided it could identify a winning strategy forward.

Some of the drawbacks of the existing strategy modeling exercises for TARAhaat have been:

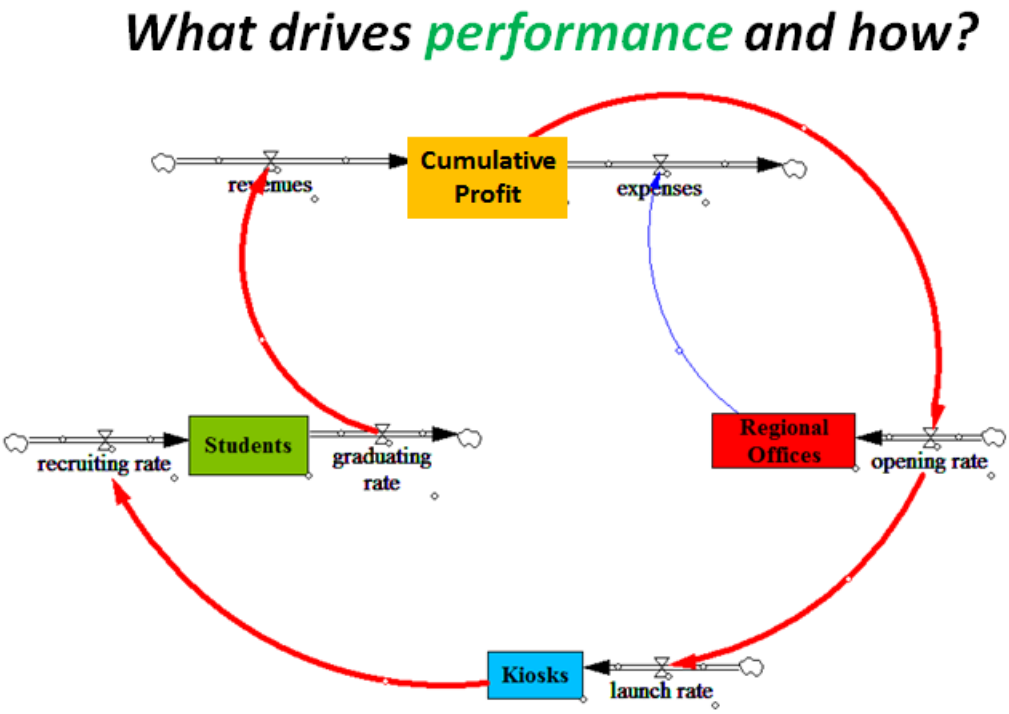
1. Creation of highly intricate and complex spreadsheets, whose results and assumptions are only understood by the person/persons who designed them

[1] Vocational skill programmes include basic literacy, call center training, mini "MBAs", hospitality training etc; Entrepreneurship skill programmes include: cell phone repair, handicrafts production etc

    a. This has resulted in blind faith in the finance team and a habit of “black box” modeling.
2. Such plans are highly detailed and often “hard coded”, making it very difficult to change and challenge assumptions. Iterations in the model can take days to prepare and share.
    a. *Much of the “dynamic” nature of the spreadsheets, e.g. shown by the expansion of regional offices, staff, etc., is not model-driven – it is, in fact, keyed in manually.*
3. A large part of the strategy planning is, in fact, financial planning; this involves working out amortization and depreciation schedules, forecasting IRRs etc.; very little attention is paid to understand what really drives performance.
    a. This way of working can be extremely technical and often excludes many people from actively, engaging in strategy discussions.
4. Most of these plans have almost no behavior over time graphs, or diagrams to explain where the organization stands.
5. There is very little “institutional understanding” of what drives performance in the organization:
    a. Spreadsheet planners do not differentiate between stocks and flows in a systematic manner, therefore it is not easy to see what resources really drive a business plan;
    b. There are dimensional inconsistencies in the formulation of key assumptions, which go unchecked;
    c. It is very difficult to trace feedback mechanisms and identify important managerial decision rules.

The TARAhaat Management Flight Simulator

The author was hired to assist in the development of a new strategy, using system dynamics to complement the conventional financial spreadsheet-based strategy exercise.



High level diagram of TARAhaat's business process

By working back from the profit and loss statement of the spreadsheet, it is clear that, ***Operating Revenues*** are driven essentially by student training and placement services, ***Operating Costs*** are driven by Regional Offices, Teacher Training Centers and the Headquarters. The time horizon of the business plan, over which it was to transform the business was the 10 year period from 2011-2021.

The SD model was built in phases by trying to capture essential processes and validate them against the experiences of the operations team and the existing model built by the finance team. The first major version of the model was completed over the course of 5 "strategy sessions" – in an intense, one month period.

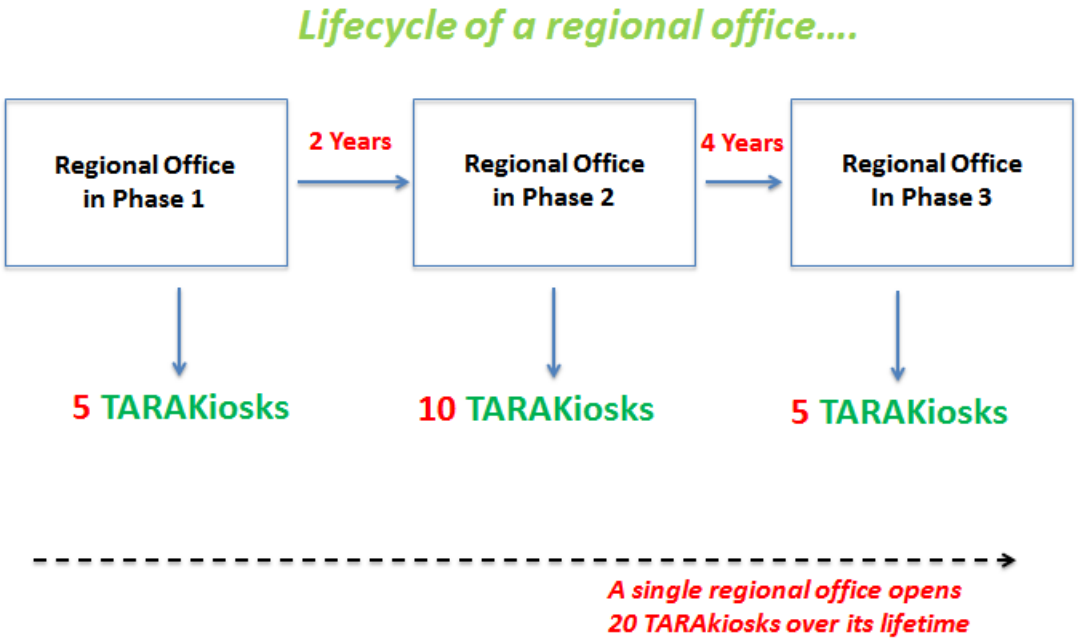
Most of these essential processes identified, were of the form of "progression pathways" with important delays[2] - which have significant impact on the performance of the system.

[2] A linked, stock-flow structure used to model the change of an attribute (or capability) of an entity as it progresses in quality; it differs from an aging chain, in that aging is inevitable, whereas progression is dependent on a variety of innate and environmental factors. This definition is the result of a Skype conversation between James P. Thompson, Bob Eberlein and the author: a more detailed explanation will be available shortly.

Progression Pathways and Operating Costs

The main structure driving business costs is the expansion of the Regional Offices (ROs). Regional offices are company owned and operated; they are usually located in small towns and are responsible for recruiting and managing TARAhaat Kiosks in nearby villages.

Associated with each regional office, is a network of TARAhaat Kiosks (TKs), that are sequentially opened as that regional office matures. The number of staff associated with a regional office also increases as it matures.



Above: Lifecycle of a regional office, "progression" times vary and are subject to many internal and external factors; in fact, many regional offices do not progress. TARAkiosks, themselves, follow a similar lifecycle and are able to attract more students as they progress in competence and marketing.

Grass root experience indicated, that many Regional Offices (ROs) have three phases over which, they open 20 kiosks[3]. This process was not captured in the spreadsheet model and there was little clarity about the impact of the transition times between "phases" and its impact on revenue.

In the system dynamics model, a "progression pathway" was used to capture this process. Due to the long transition times between the phases of the regional office (a

[3] *As mentioned above, this progression is not certain – many regional offices do not move to the next phase. The factors influencing the "progression times" are under investigation and are not included in this model.*

result of the time it takes to create networks and build trust on the ground), the SD model clearly shows that the "accepted" strategy[4] for opening regional offices was inadequate, as the delays in the pathway cause kiosks to enter the system later (and hence students *and* revenue). The revenue potentially lost by not incorporating the delays in the progression pathway amount to USD **5.5 Million**[5] (*end of simulation values for "Cumulative Earnings/EBITDA" over a 10 year model-run*)

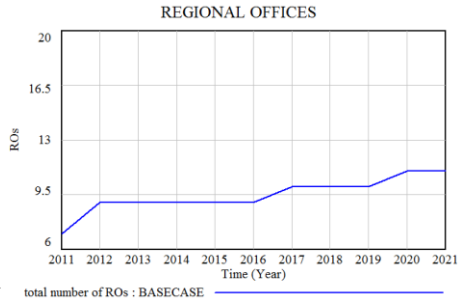
On the other hand, this structure also demonstrates the advantage of progression pathways; that keeping the absolute number of Regional Offices the same, yet simply opening them up earlier can create significant and sustainable gains for the company into the future without increasing costs - amounting to nearly **USD 6 Million** (*end of simulation values for "Cumulative Earnings/EBITDA" over a 10 year model-run*)

Once the value of the progression pathway was identified, it was necessary to "reverse-engineer" this process into spreadsheet plan. This was done as follows:

Regional Office Lifecycle in Excel….

			FY12E	FY13E	FY14E	FY15E	FY16E	FY17E	FY18E	FY19E	FY20E	FY21E
Expansion Calculations												
	TARAKiosks managed by an RO		5	5	15	15	15	15	20	20	20	20
	New ROs	Total ROs	Kiosks									
2012		7	35	35	105	105	105	105	140	140	140	140
2013	1	8	5	5	15	15	15	15	20	20	20	20
2014	-	8	-	-	-	-	-	-	-	-	-	-
2015	-	8	-	-	-	-	-	-	-	-	-	-
2016	-	8	-	-	-	-	-	-	-	-	-	-
2017	-	8	-	-	-	-	-	-	-	-	-	-
2018	1	9	-	-	-	-	-	5	-	5	15	15
2019	-	9	-	-	-	-	-	-	-	-	-	-
2020	-	9	-	-	-	-	-	-	-	-	-	-
2021	1	10	-	-	-	-	-	-	-	-	5	5
2022	-	10	-	-	-	-	-	-	-	-	-	-
TOTAL TARAKiosks			40	40	120	120	120	125	165	175	180	180

Unlike the system dynamics model, the lifecycle of a regional office needs to be "hard coded" into the spreadsheet matrix, and the modeler has to input by hand, when and how the progression takes place. Furthermore, tracking attributes of the regional offices (such as employees or TARAhaat Kiosks, which



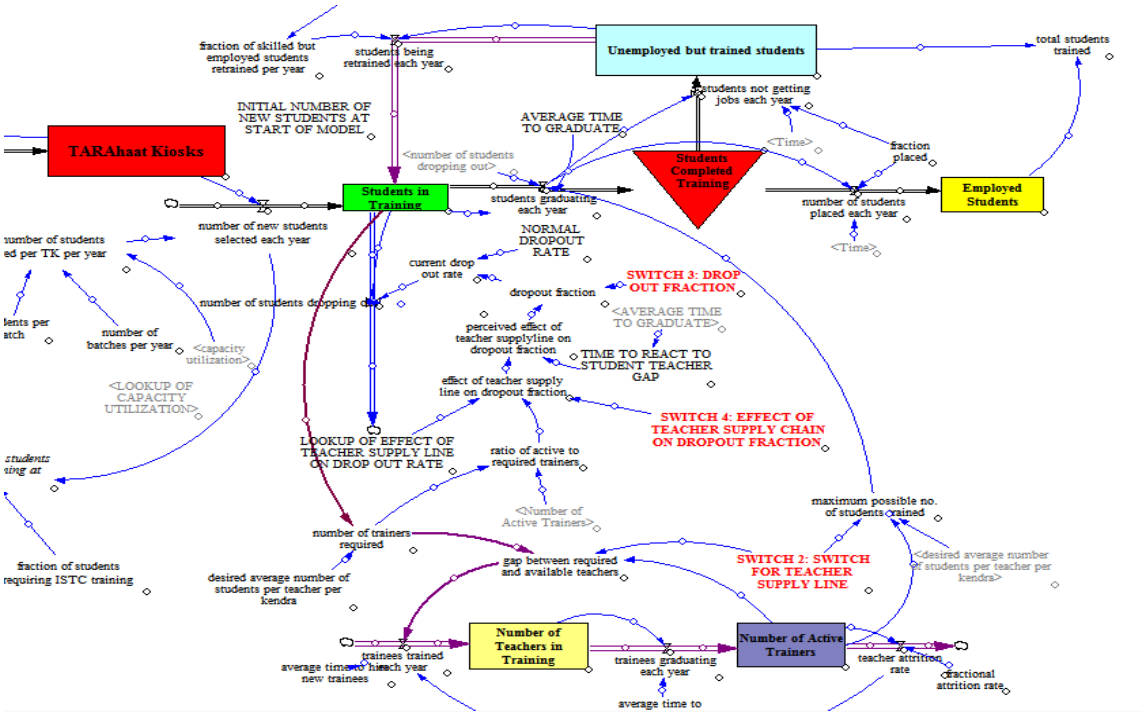
[4] - The accepted expansion strategy of the organization, in keeping with realistic financing options, was to open gradually, a maximum of three regional offices over the course of a 10 year period.

[5] To put things in perspective, the cumulative turnover of the company over the past ten years has been around USD **2 million**.

progress themselves) is almost impossible to include in this matrix without making it incomprehensibly complex.

Progression Pathways and Operating Revenue

Progression pathways are also useful in analyzing the movement of revenue; TARAhaat kiosks attract potential students through marketing, they train them and then "place" them with appropriate jobs – revenue is earned once a student graduates, and/or when they are placed through TARAhaat's assistance.



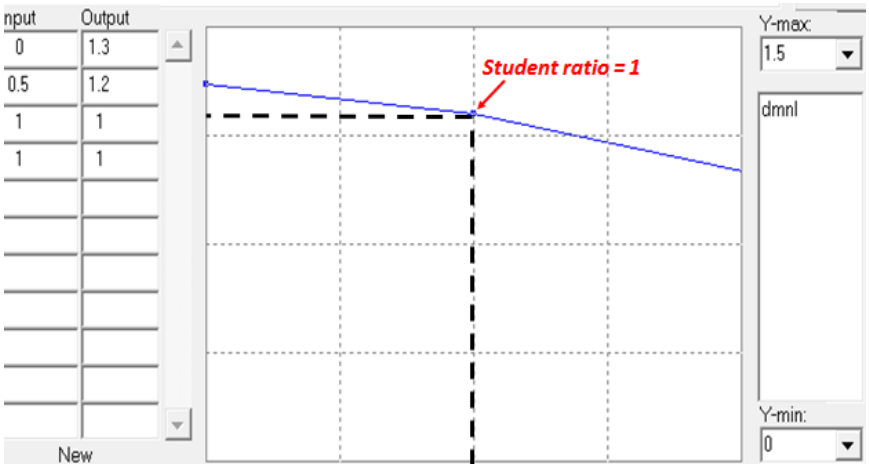
Progression Pathways which Constrain growth: Teacher Supply Line

Based on discussions with field staff, it became apparent that the supply of teachers was critical to the success of the business – previously, this had not been modeled. From historical data it was possible to estimate the average training time for teachers in the system[6]. Reliable information about student dropouts was not available. Dropout rates are can be high at times, given the unpredictable socio-economic circumstances, ranging from an unexpected health problem, to a marriage, to a death in the family. Anecdotal data from various Kiosk owners in villages was used to estimate the elasticity of the "effect of student-teacher ratio on dropout fraction". It was assumed that if the student teacher ratio was less than 0.5 (and this lasted for more than a few months), the dropout fraction would increase by about 20%; and would probably saturate at about 30% above normal. An interesting note is that Kiosk owners would probably not allow

[6] Depending on the level of literacy in the region and the availability of potential teachers, teacher training times/delay can vary from 3-9 months.

the dropout rate to spiral out of control and might take fewer students to relieve the training load – this effect will be modeled in a revision.

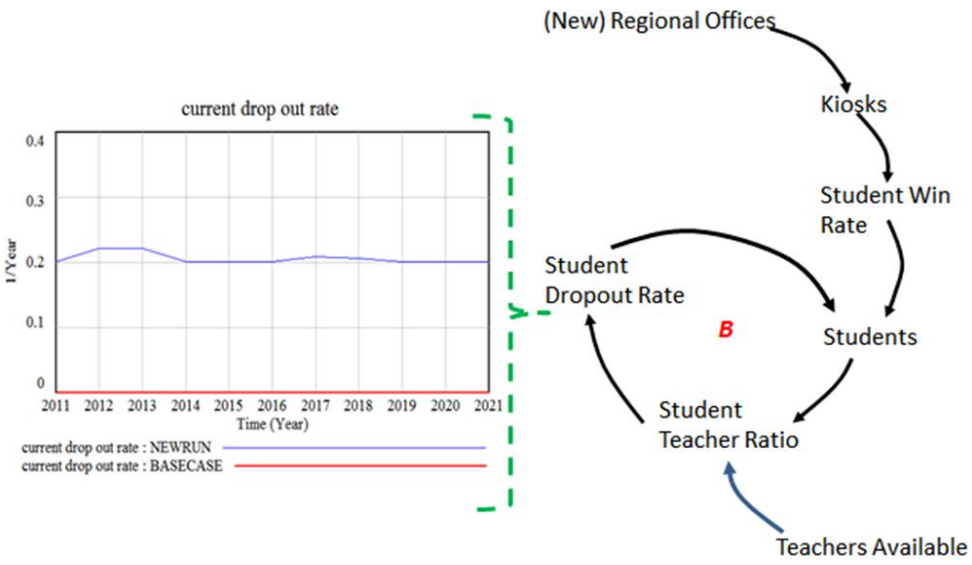
Effect of Student-Teacher Ratio on "Dropout Fraction"[7]



The "dropout fraction" has a strong "balancing" effect on the system as seen in the graph below - initial pressure from a *low* student-teacher ratio, *increases* the dropout fraction, *reducing* the stock of students in training; this, in turn, further *reduces* the teacher requirement and ultimately *increases* the student-teacher ratio in the long run.

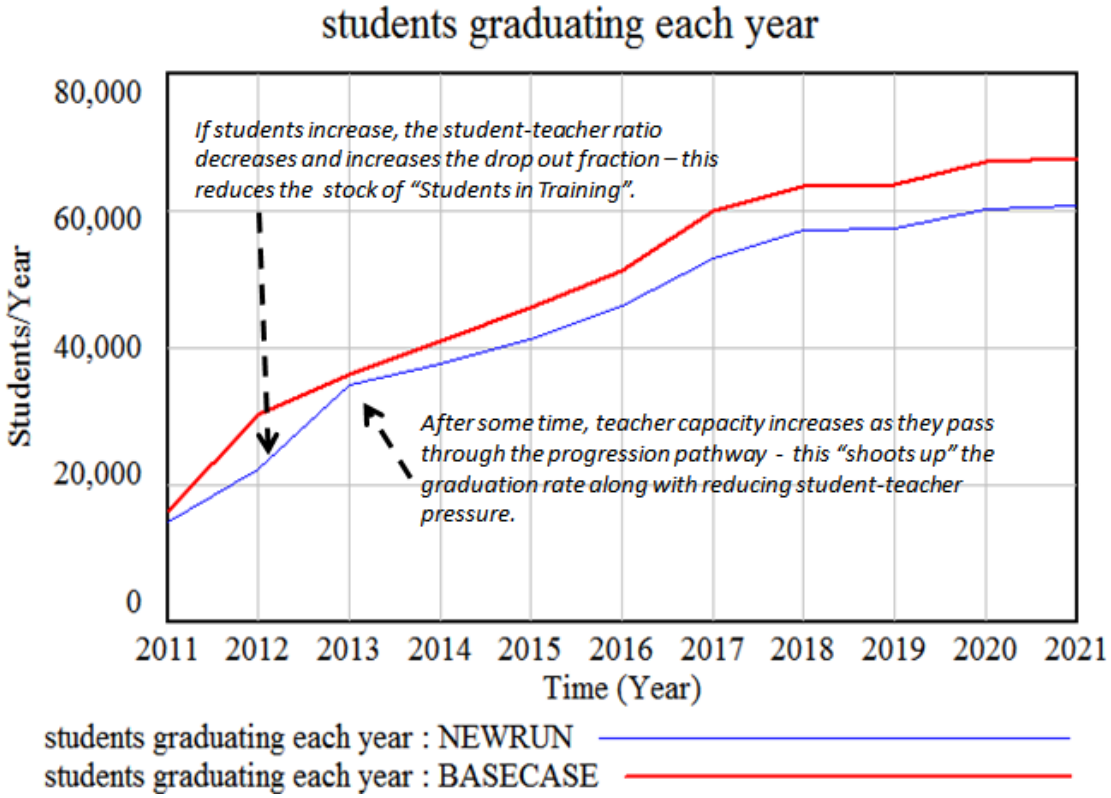
[7] Dropout Rate = Normal Dropout Rate * perceived effect of student teacher ratio on dropout fraction

[Students/year] = [Students/Year] * [Dmnl]



"Balancing" effect of student-teacher ratio on dropout fraction.

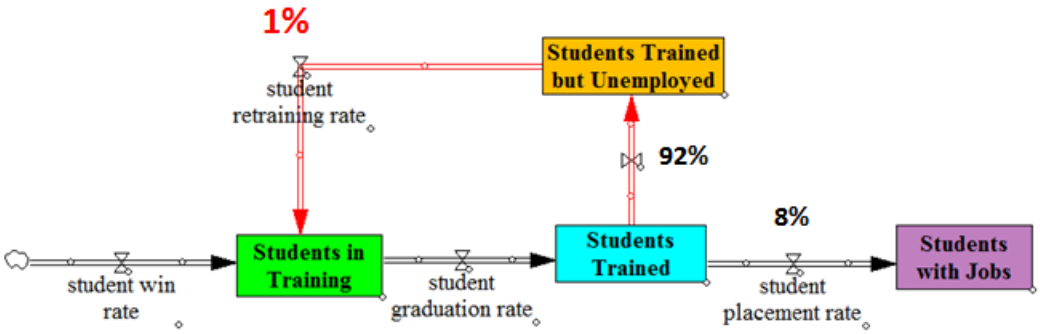
By modeling the supply-line of teachers as a progression pathway, it was hence possible to link the stock of "Qualified Teachers" to the "graduation rate" of students as well as the student "drop out" rate.



The graph above shows the combined impact of including the effects of the Teacher Supply Line (blue line) on the Graduation Rate and the Student Dropout Fraction.

Over the course of a 10 year model run, the cumulative effects of this progression pathway amount to a potential loss of USD **3.6 Million** to the cumulative earnings (*end of simulation values for "Cumulative EBITDA"*) - serious consideration has since then been given to outsource the HR management and recruitment services of the headquarters and regional offices.

Furthermore, it was estimated from TARAhaat's data, that only 8% of the total students trained each year, find jobs or turn to self-employment; the remaining 92% usually enter the day-labour workforce or remain unemployed. As a result of this inactivity, many usually forget the skills they learnt during the TARAhaat training programme. Therefore a logical strategy under consideration was to consider "retraining" students who had graduated but not found jobs.



High level diagram of student training-progression pathway: the red "flow" line indicates the flow of students via a newly identified structure.

The SD model shows that despite constraints caused by the teacher supply line, the retraining effect can add USD [**500,000 to 1 Million**) to the cumulative earnings (*end of simulation values for "Cumulative Earnings/EBITDA" over a 10 year model-run*).

Summary of Strategies

The table below describes six strategies to which the SD model was subject. *The values for "Students Trained" and "Cumulative Retained Earnings" reflect end of simulation values:*

Scenario	STRATEGY "SWITCH" NAME AND VALUE IN VENSIM	Description	**Impact on Students Trained** *(End of Simulation values, 10 Year Period)*	**Effect on Retained Earnings in USD** *(End of Simulation values, 10 Year Period)*
BASECASE	ALL "SWITCHES" = 0	*No Capacity Constraints, Delays, or Feedbacks*	**500,000**	**43,840,000**
NEWRUN 1	"SWITCH 1"=1	*Introduce Delays in Regional Office Progression Pathway*	**455,960**	**38,260,000**
NEWRUN 2	"SWITCHES 1, 2"=1	*Introduce Progression Pathway of Teacher Supply Line*	**455,922**	**38,320,000**[8]
NEWRUN 3	"SWITCHES 1,2,3" = 1	*Introduce the effect of "Dropout Rate"*	**408,145**	**34,960,000**
NEWRUN 4	"SWITCHES 1,2,3,4" = 1	*Link Teacher Supply Line to "Dropout Rate" via student-teacher ratio*	**406,678**	**34,860,000**
NEWRUN 5	"SWITCHES 1,2,3,4, 5" = 1	*Introduce "re-training" feedback effect i.e., students from stock of "Unemployed but Trained" to "Students in Training"*	**404,657**[9]	**35,420,000**
NEWRUN 6	"SWITCHES 1,2,3,4, 6" = 1	*Take advantage of the Regional Office Progression Pathway; instead of staggering their introduction to the system over 10 years, open the same planned number in the first two years*	**478,907**	**46,400,000**[10]

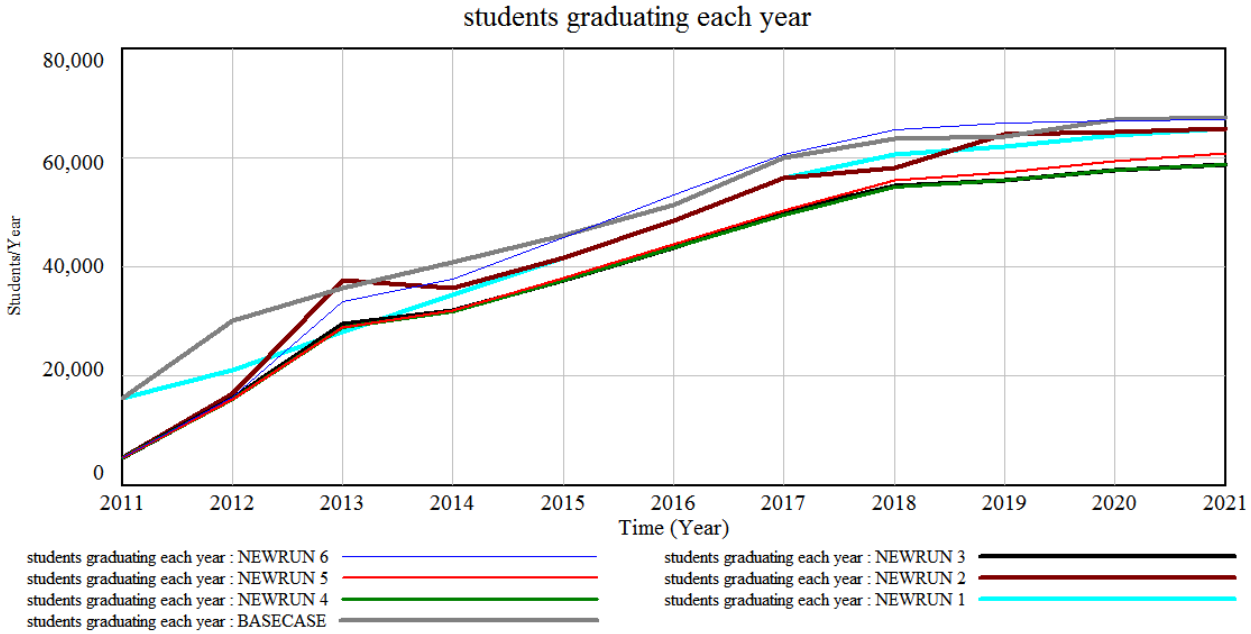
Red *Values indicated that this variable has **decreased** in comparison with the previous run;* **Green** *Values indicate that the variable has **increased** compared to the previous run*

[8] As compared to "Newrun 1", we expect end-values for both "Total Students Trained" and cumulative "Retained Earnings" to reduce due to delays in building up the stock of qualified teachers. However, the reduction in students (as fewer students can be trained at any time) also reduces associated "student costs" thereby ***increasing*** cumulative retained earnings compared to Newrun 1.

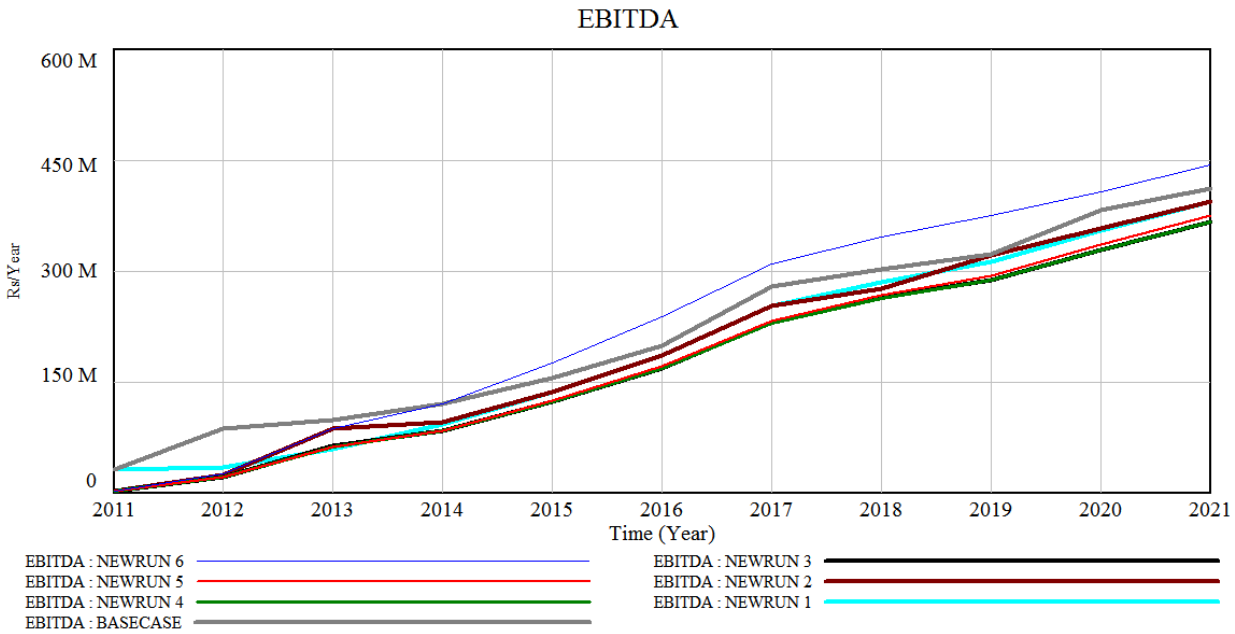
[9] The "total number of students" is the sum of the stocks, "Students Employed" + "Students Trained, but Unemployed" – this number is slightly lower because when the retraining effect comes into play, students leave the stock of "Students Trained, but Unemployed and enter the stock of "Students in Training" – which is unaccounted for in the variable "total number of students".

[10] Despite capacity constraints posed by the teacher supply line, opening regional offices earlier on makes it possible for them to mature earlier on, bringing in kiosks, students and revenue into the system much faster - at the same cost!

Graphs of System Performance



Graph of "Students Graduating each Year"



Graph of "EBITDA" (Earnings before, Interest, Tax, Depreciation and Amortization)

[- NOT CUMULATIVE VALUES, Graphs in Indian Rupees.

Validation and Calibration

An initial spreadsheet strategy had already been developed prior to the SD exercise carried out by the author. One of the most essential parts of the buy-in process was to create a BASECASE run for the SD model by "calibrating" SD structures to the existing spreadsheet plan by:

- reducing the delays in the progression pathways to make the model "discrete"
- removing progression pathways that constrain growth i.e., "teacher supply line"
- retain exogenous inputs to model, many of which were "gut instinct" assumptions; for example, rate of introducing new regional offices was not dependent on a more realistic feedback loop which links cumulative retained earnings (cumulative EBITDA) to the expansion policy.

The model is still currently in multiple-stages of revision and development, though the current version, on which this paper is based, passes tests of structure, extreme value and dimensional consistency.

Some Conclusions

Ultimately, given that the conventional language of the business community is that of spreadsheets, the insights from a system dynamics model or exercise must find their way into to the conventional method. This strategy exercise using system dynamics has helped the organization aggregate the strategy to its bare essentials and create a complementary and systematic "living document" for any manager at any level. Many involved in this process have said that it was both "instructive" and "constructive" for them to participate in the building and testing of the SD model - and this gave them a greater sense of ownership in the strategy process.

From a modeler's perspective it was good to that the strategy discussion moved from a complicated financial exercise, to a discussion that was more about strategically and optimally, building and maintaining revenue creating resources.

It was also clear from feedback, that the modeling software, i.e. Vensim had a large role to play in getting the strategy group to work together by testing alternative strategies in real time, with clear, neat graphs and tables generated at the press of a button.

Though the methodology of SD almost always finds merit, it is clear from industry experience that it will have a tough time replacing the "tried-and tested" spreadsheet modeling approach – in fact, at some level, the openness and discipline of analysis in the SD process is, perhaps, intimidating. Furthermore, finance planners usually feel that a high level of detail is necessary, as it legitimizes the "rigorous" thinking of a

strategy plan for potential investors; whereas the SD process is a little “gimmicky”. That being said however, many spreadsheet modelers are fascinated by how SD can easily define and differentiate between revenues and costs that come from stocks and those that come from flows; more importantly, how feedbacks and delays can counter-intuitively influence the performance of the organization – concepts that are not immediately clear in conventional financial modeling.

List of References:

1) **TARAhaat:** for more information on the activities of this social enterprise**,** check out: **http://www.tarahaat.com**

2) **Business Dynamics, John D. Sterman**:
   - **a.** Chapter 11 for details on the impacts of delays in various systems
   - **b.** Chapter 14, for more information on forming non-linear relationships,
   - **c.** Chapter 21 for information on validating models.

3) **Strategy Dynamics, Kim Warren:** for more information on understanding the strategic architecture of organizations using system dynamics.