Modelling and Analysis of Indian Outsourcing Industry: A System Dynamics Approach

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Abstract

India is emerging as one of the biggest markets for offshore services. Business process outsourcing (BPO) is the delegation of one or more information technology (IT) intensive business processes to an external provider that, in turn, owns, administrates and manages the selected processes based upon defined and measurable performance metrics. Offshore outsourcing is an umbrella term covering a range of IT and business services delivered to companies in developed countries by personnel based in developing countries. Though Indian outsourcing industry is growing, the attrition rate is also rising in this sector. So is the backlash against outsourcing. In order to survive and grow in this scenario, Indian firms must ensure that their services are not only cost-effective but also qualitatively superior. The present study probes into these issues. The study aims to explore the structure of Indian outsourcing industry through the methodology of system dynamics. A system dynamics model has been developed, validated and simulated over time to understand the trends that characterize this industrial segment. The implications of the results of the study are discussed.

Keywords: Business process outsourcing, information technology enabled services, system dynamics models, simulation, validation.

INTRODUCTION

Offshore outsourcing is an umbrella term covering a range of information technology and business services delivered to companies in developed countries by personnel based in developing countries. The offshore outsourcing market, initially developed as software development, has expanded well into an area one calls information technology enabled services (ITES) that is fast emerging as the major part of the IT industry. Business Process outsourcing (BPO) can be defined as the transfer of an organization's entire non-core but critical business process/function to an external vendor who uses IT based service delivery. With the current focus on core business capabilities, many firms are outsourcing select business functions to expert partners as the basic impetus for outsourcing remains leaving the non-core business processes to specialized service providers that not only minimizes costs but also improves the chances of the processes being handled by experts. It aims to raise a parent firm's shareholder value because it is about delivering outcomes - that is, higher performing business processes. BPO forms an important part of the ITES industry, and is all set to grow substantially in the years ahead.

Firms essentially have three kinds of processes: core processes (which give strategic advantage); critical, non-core processes (which are important but are not competitive differentiators); and non-core, non-critical processes (which are needed to make the environment work). Firms invest in core processes but prefer to outsource critical, non-core processes to providers who specialize in those processes because they will invest in them and aim to make them world-class. Generally, outsourcing means turning over to a BPO provider the 'how' aspects of a process - the systems, infrastructure, administration, execution, and some of the design of non-core processes but retain the 'what' aspects of the process - the governance, policy-setting, decision making, and strategy of these processes. The intent is to outsource the work while retaining the direction-setting part.

Outsourcing is not a one-time event; it is continuous. Firms that outsource one process later outsource another, then another - as their strategies change and new outsourcing options open up. Initially growth in the Indian BPO market was characterized by the setting up of joint ventures between local partners and western counterparts, usually to serve the needs of the western partner. Over time, many of these have expanded to address the broader market opportunity and have been added to local start-ups encouraged by the success of the first wave of service providers and by the availability of venture capital. The first level of BPO services in India comprised customer interaction services but it has expanded in many directions over time and now there are also new avenues in science oriented products like design, engineering and research.

A BOP/ITES provider has to work in close association with the clients. While non-core processes are outsourced thus freeing the firm's time and resources for core competencies, the process creates an extended form of the organization. This also demands appropriate control mechanisms and management practices. According to Ramachandran and Voleti (2004), the two capabilities critical for success in the IT space are the following: capabilities to understand customer needs in specific domains and acquiring business, and capabilities to execute them efficiently.

The global BPO market is worth about US$ 130-140bn (Dange and Vajpayee, 2003). The authors have observed that the growth of business process outsourcing is the highest among any component of IT spending. The key segments are business administration (69% of total), supply-chain management (20%), customer-relationship management, CRM (11%). Currently, Indian presence is primarily in CRM, payment, and administration and emerging Indian presence lies in the areas of human resources, and finance.

The Economic Times (27 October 2004[B]), quoting the results of a study by an analyst firm International Data Corporation (IDC), has reported that global investments in offshore IT services are estimated to grow from US$ 7 billion in 2003 to US$ 17 billion by 2008 and India is among the select group of countries which are poised to gain from this spurt in outsourcing apart from Philippines and China, joined by central and eastern Europe. According to the study, spending by US customers on offshore IT services will continue to concentrate heavily on applications, with most activity in the areas of custom application development, application management, and systems integration.

According to a survey carried out by McKinsey (The Economic Times, 28 October 2004) of 5500 senior corporate leaders, one-third of European companies with revenues higher than US$ 1 billion prefer India to China as an R&D destination. Around 71 per cent of the European business leaders considered India as a key source of talent as against the figure of 58 per cent for the world as a whole.

Further, according to India Infoline News (28 October 2004), the ITES-BPO sector has emerged as a key driver of growth for the Indian software and services industry. This sector is estimated to have grown by about 54% with export revenue of US$ 3.6 billion during 2003-04 indicating that the sector is showing upward spiral growth on service lines like customer care, finance, HR, administration, billing and payment services, etc. It has reported an estimate from the Annual Report of the Department of Information Technology (DIT), Government of India for the year 2003-04 that nearly 245, 500 professionals were employed in ITES-BPO sector by March, 2004. It has been further estimated in the report that exports from Indian ITES-BPO sector are likely to reach US$ 21-24 billion by 2008.

In the background of the above, the present study attempts to explore the structure of the Indian outsourcing industry, identify the primary drivers and their interrelationships and linkages, and subsequently develop a system dynamics model to analyse the industry behaviour over time.

WHY OUTSOURCE?

Globalization, competitive markets, and mergers and acquisitions are the primary stimuli for business-process outsourcing. The global market for business process outsourcing is one that is substantial and growing. From transaction processing to call centres to application development, there is a wide range of business processes that can be

outsourced to third parties promising either reduced costs, greater flexibility or improved functionality on in-house teams.

BPO/ITES includes services that can be outsourced using the powers of IT. The extent to which outsourcing is possible depends on the industry, location, time, costs, and managerial perceptions of the risks involved. Outsourcing draws upon both transaction cost and production cost efficiencies (Ramachandran and Voleti, 2004). According to Antonucci and Tucker (1998), the key reasons for outsourcing are the following: cost reduction, care competent focus, flexibility while retaining control, and competitive advantage through strategic outsourcing. In this connection, it may be pointed out that Baxendale (2004) has carried out a quantitative analysis that sets to help out small firms determine the costs that are relevant in various outsourcing decision situations.

Employing BPO/ITES provides several advantages to the parent corporations. Some of these are:

- Achieve cost reductions made possible through process improvements, reengineering, and use of technologies.
- Key in on company's main business.
- Obtain outside expertise.
- Meet constantly changing customer demands.
- Achieve revenue increases by outsourcing non-core processes.

According to the results of a study carried out by the Boston Consulting Group as reported in the Washington Post, 2 July 2004 (Blustein, 2 July 2004), American firms risk extinction if they hesitate in shifting facilities to countries with low costs. It has further pointed out that the largest competitive advantage will lie with those companies that move soonest. It has further provided reason after reason why US firms should locate operations offshore, and has rebutted arguments why the trend is likely to slacken.

BPO-ITES SECTOR IN INDIA

India has one of the largest higher education systems in the world and offers a range of world class professionally skilled manpower especially in the new economy sectors. The most important new economy sector is that of the Information, Communication and Telecommunications (ICT) sector. The importance of this sector stems from the fact that the Indian IT industry has grown impressively in the last 10 years from a US$ 150 million in 1991 to US$ 17.6 billion in 2002-03 (*www.embassyofindia.com/IndiaNewsJuly2003*). India is the fourth largest telecom market in Asia after China, Japan and South Korea.

BPO includes primarily the following:

- Customer service interaction including call centres. Call centres are expected to maintain a 45% growth rate for the next few years (Singh, 2002).
- Back office operations/banking/revenue/accounting/data conversion/HR etc. Transcription services.

- Content development/animation etc. With the animation industry slated to be to the tune of US$ 70 billion by 2005 (Singh, 2002), much of the work will be outsourced to countries like India.
- Data research, market survey, consultancy, management etc.

According to a study carried out by the National Association of Software and Service Companies, NASSCOM (*www. nasscom.org,* Table 2.4, 2003), the employment and revenue growth of Indian ITES/BPO companies over the last few years have been most phenomenal in key BPO sub-sectors like customer-interaction services including call centres and back office operations like revenue accounting, data entry, data conversion including financial accounting. Sub-sectors like content development and transcription services have remained more or less static (Roy and Sharma, 2003).

Focusing specifically on the call centre landscape, the '2004 Asian Call Centre Industry Benchmark Study – Dynamic Asian Markets' sponsored by Kelly Services (Hindustan Times, New Delhi Edition, 22 February 2005) has predicted that the call centre sector in India is expected to grow at a rate of 64% followed by the Philippines at 53% and China at 50%. The growth in India is being fuelled by the growth of the economy, and, in particular, the growing availability of telephone services. The study has further pointed out that the BPO/ITES firms have realised the importance of retention (with India facing a level of turnover at 31%) and the firms have started paying special attention to career planning and on-going training of their staff.

The problem of attrition as mentioned above is compounded by other factors. A study carried out by Hill and Associates (Offshore Outsourcing World[1], 2005) on the challenge of keeping people in the Indian outsourcing sector (with a respondent base of 1000), has pointed out that more than 50% attributed this to the lack of growth opportunities, mismatched expectations, dissatisfaction with company policies, and the never-ending quest for career fulfilment. This stands to correct notions that salary, incentives and lifestyle ranked as the highest reason for joining the outsourcing sector, since only 35% cited these. The report has quoted the Country Manager, Hill and Associates as having said, 'Attrition not only pushes up costs incurred on the training of employees but also affects productivity along with the ideal level of "knowledge maturity" of the organization and the employees'.

According to a study carried out by PricewaterhouseCoopers (The Economic Times, 25 October 2004), the contribution of ITES-BPO sector to India's Gross Domestic Product (GDP) is expected to increase to 7 per cent by 2008 from its current value of 1.4 per cent. Another significant indicator of the growing confidence in the Indian IT market is the rise in venture capital funding in this sector. Venture finding in Indian IT sector grow from US$ 20 million in 1996-97 to US$ 1.1 billion in 2001-02 and by 2007-08, this figure is expected to be US$ 10 billion, according to the results of the study.

It has been observed that more and more Indian companies are exploring opportunities in the BPO/ITES space. A report jointly brought out by benchmark-it.co.uk Ltd. and Netscribes (India) Pvt. Ltd. entitled 'benchmark-it performance' (2003) on the trend to

outsource a range of business processes and the role that India could play in this global market, has highlighted the following reasons:

- Large talent pool of English speaking skilled graduates.
- Low cost and high education levels of staff.
- Lower attrition rate.
- Relatively well developed software and call centre industry.
- Strong existing customer base of blue-chip companies.
- Powerful venture capital interest in investing in growth opportunity.
- Developing track record of proven delivery and systems/processes.

The Times of India (15 September 2004), quoting 'The Economist', has predicted that infrastructure management services (IMS) could be the 'next big wave' of Indian outsourcing deals. Remote IMS work could be divided into three categories: monitoring global network operation; providing helpdesk support and maintenance; and administering databases. The Economic Times (27 October 2004[A]) has reported, from a study carried out by McKinsey and NASSCOM, that IT services exports from India is expected to touch US$ 55 billion by 2012 and ITES exports is expected to touch US$ 64 billion. About 9, 72, 000 professionals would be employed by the former sector and 2, 23, 000 by the latter sector.

In an interview published in the Independent (Offshore Outsourcing World[2], 2005), Wipro Chairman, Azim Premji has been quoted as having said, 'Areas such as China, Eastern Europe, and the Philippines are becoming major players in IT offshoring but India still has an overwhelming advantage because of the support of the Government and the country's huge talent pool'.

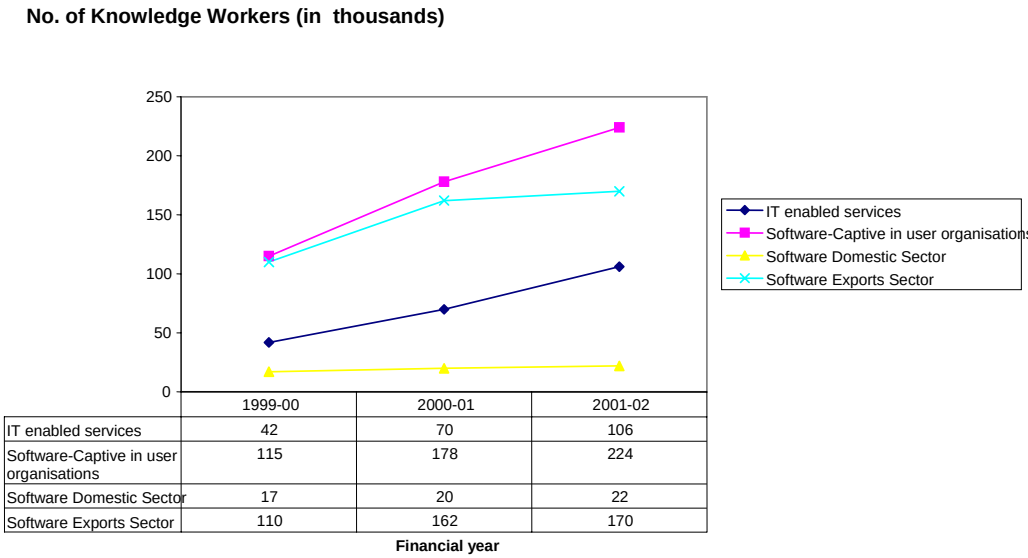
If one defines knowledge professionals as a combination of manpower from Software Exports sector, Software Domestic sector, Software-captive in user organisations and IT enabled services, then Figure 1 gives a segment wise break up of the knowledge professionals In India for three years (up to the year 2001-02). It is apparent from the graph that the software captive in-user business, IT enabled services and software export segments have been growing steadily. There has been a very negligible growth in the Software Domestic Sector.

India: A Favourite BPO/ITES Hub

Various factors have contributed to the emergence of BPO/ITES as a key area of focus in India. Some of these are the following:

- Significant development in communication technology infrastructure: internet backbone.
- BPO substantially expands the addressable technology services market.
- BPO improves efficiency and substantial cost savings.
- Attractive economics and competitive landscape for service providers.
- Technology enablers like ERP etc., eliminates some of the major obstacles to BPO.

India's BPO prominence is based on several factors that includes India's client relationship with its Y2K conversion work with North American and European vendors and global organizations and the fact that India benefited from the marketing buzz of favourable reports by NASSCOM, Gartner Group, International Data Corporation ((IDC), McKinsey & Company, and PricewaterhouseCoopers (Vales, 2003).



	1999-00	2000-01	2001-02
IT enabled services	42	70	106
Software-Captive in user organisations	115	178	224
Software Domestic Sector	17	20	22
Software Exports Sector	110	162	170

Figure 1: Break-up of Indian knowledge professionals

According to another study carried out by Dossani (2003), India's capabilities in software outsourcing industry are in no small measure due to the following reasons:

- Low labour costs (US$ 300-500/m) for high quality technical manpower.
- Adequate supply of English speaking programmers and systems analysts in urban areas.
- Availability of project management skills.
- Good communication systems and other infrastructure.
- Strong flow of global venture capital, and technological sophistication.
- All-in costs of US$ 10-25/hour, compared with US costs of US$ 40-120/hour.
- Strong focus on applications development for banking and telecom.

BPO penetration in Indian cities

Table 1 presents the extent to which the activities of BPO firms have penetrated in various Indian cities (data source: *www.nasscom.org*). It is apparent that the penetration of this industry is highest in the national capital region, NCR (Delhi and its surrounding areas including Gurgaon, Faridabad, Ghaziabad, and Bhiwadi). In NCR, students and graduates from the north-eastern states are preferred as workforce in the voice based communication sector owing to their fluency and accent in English. Mumbai is the next

big destination with a large pool of English speaking crowd. The southern zone which was earlier a big hub of technical education is now a cluster of offshore centres.

Table 3: Extent of BPO Penetration in Indian Cities

Region	No. of Companies
National Capital Region, NCR (including Gurgaon, Ghaziabad, Faridabad, NOIDA)	53
Mumbai	45
Bangalore	35
Chennai	35
Kolkata	29
Hyderabad	24
Kochi	10
Ahmedabad	9
Pune	6
Others	32

THE STUDY METHODOLOGY

System dynamics (Forrester, 1961; Wolstenholme, 1990; Coyle 1979, 1996; Mohapatra *et al*., 1994; Maani and Cavana, 2000) has been adopted as the methodology for structural and policy analysis of the Indian outsourcing industry as it provides a paradigm with which complex, dynamic and non-linear interactions in social systems can be understood and analysed and new structures and policies can be developed to obtain desired improved behaviour of systems. It allows one to use a systems approach in visualizing and solving a problem holistically. It possesses many desirable characteristics such as generality, ease of communication, ability to explicitly represent physical flows and inherent capability to model nonlinearities and produce model behaviour in time. This methodology is particularly suitable for analysing such an industry structure like the outsourcing industry as this methodology, by its very nature, 'causes the researcher to identify the pertinent factors and variables in the referent system and to specify the relationship amongst those factors and variables' (McCray and Clark, Jr., 1999, p. 350).

Why is System Dynamics a Preferred Methodology?

The Outsourcing Industry in India is dependent on many variables, some of which can only be defined qualitatively (soft variables) and not quantitatively. We found that these factors interact simultaneously with one another and bring about changes in the Cumulative Average Growth Rate (CAGR) of the Outsourcing Industry each year. Therefore, a mathematical model based on the constant CAGR concept fails to capture the true growth trends and features of the outsourcing industry and also fails to justify the effect of the soft variables that can only be defined qualitatively.

Statistical forecasting models using time series analysis has been adopted by the authors in their earlier studies on the Indian outsourcing industry (Roy and Sharma, 2003, 2004; Roy, Sharma and Bhushan, 2004). However, the use of statistical models for providing market forecasts has been critically commented upon in the literature. Lyneis (2000) has argued that in time series forecasts, based on averaging and/or trends in the data, '*there is no attempt to understand the underlying structure of the industry that created the data stream*' (Lyneis, 2000, p. 13, emphasis original). Further, limitations with factors such as the availability of data, estimation techniques, measurement error, etc. and the over-dependency on macro-economic factors affect the accuracy of regression/econometric models. Therefore, the benefits of using system dynamics models for forecasting, according to Lyneis (2000), are the following:

- System dynamics models can provide more reliable forecasts of short-to-mid-term trends than statistical models and thus lead to better decisions.
- System dynamics models provide a means of understanding the causes of industry behaviour, and thereby changes in industry structure, as part of an early-warning or on-going learning system.
- System dynamics models allow the determination of reasonable scenarios as inputs to decisions and policies.

Previous System Dynamics Studies on Service Sector Industries

The methodology of system dynamics has been used widely to study non-linear behaviour of dynamic systems in different fields. For instance, Roy, Jain and Mohapatra (2001) have carried out a study on the forecasting and simulation of scientific manpower under various policy regimes taking the case study of an R&D laboratory in India. Regarding service sector industries, one finds that system dynamics has been adopted to study process structure in a wide variety of application areas. Powell, Schwaninger and Trimble (2001) have attempted to identify general principles for the measurement and control of business processes. To this aim, they have presented a system dynamics model of a typical service sector business process, for instance, administrative paperwork in insurance. Dutta (2001) has carried out a system dynamics study of online service provision. Dutta and Sridhar (2002) have modelled the growth of cellular services in India using this methodology.

There has not been any reported study on the adoption of this methodology to study and analyze the specifically the outsourcing industry in India. However, similar studies have been carried out in other countries, notably the USA. McCray and Clark, Jr. (1999) have presented a system dynamics model that was developed to anticipate the organizational impacts of outsourcing for the parent firm. According to them, system dynamics proves a particularly appropriate methodology with which to address the inherent complexity of this decision situation. The findings indicate that while outsourcing offers potential cost savings, it is accompanied by a decreased ability to respond to unexpected changes in the competitive market place.

SYSTEM DYNAMICS MODEL OF THE INDIAN OUTSOURCING INDUSTRY

Model Description

Variables used in system dynamics model
The variables used in our model are the following:

Global Market – It is the total revenue generated in the BPO sector at global level *i.e.* sum of all revenue generated in BPO markets all over the world.
This variable is measured in US dollars ($).
India's BPO Share – It is the projected share of Indian BPO sector in the Global BPO Market. The projection is based on the CAGR of India's BPO share that has been calculated using past data and other factors affecting BPO growth. This is measured as a percentage value. Increase in India's BPO share means that either more multinational companies are outsourcing their jobs to India or more BPO service providers are entering the sector or both.
Desired Revenue – It is the revenue that will be generated by the Indian BPO sector based on growth of India's BPO share and the Global Market. This is measured in US dollars ($).
Desired Manpower – It is the total manpower required by the Indian BPO sector to generate the Desired Revenue. This is expressed as a number. In the system dynamics model(s) this is measured as manpower unit (mp).
Revenue Generated – This is the revenue generated by India's BPO sector based on its present revenue generation potential. This is measured in US dollars ($).
Present Manpower – It is the total manpower present in the Indian BPO sector which is constituted by both the total number of *Trainees* present and total number of working manpower present. This is expressed as a number. In the system dynamics model(s) this is measured as manpower unit (mp).
Working Manpower – It is that part of the present manpower which contributes to revenue generation. For our calculation purpose, it is assumed that the total manpower contributes to the revenue generation. Since the training period is estimated as of two months duration, the number of trainees at any given time is just an instantaneous value. This is expressed as a number. In the system dynamics model(s) this is measured as manpower unit (mp).
Trainees – This variable is that part of present manpower which is trained first and then on completion of training period it becomes a part of the working manpower. This is expressed as a number. In the system dynamics models this is measured as manpower unit (mp).
Hiring Rate – It is the rate at which the trainees are hired. This is measured in terms of manpower per month (mp/mo) in the system dynamics model.
Training Rate – It is the rate at which the trainees are trained into working manpower. This is measured in terms of manpower per month (mp/mo) in the system dynamics model.
Attrition Rate – It is the rate at which working manpower quits job due to various factors. This is measured in terms of manpower per month (mp/mo) in the system dynamics model

Trainees Required due to Attrition – This is the number of extra trainees required to compensate for the loss due to attrition. This is expressed as a number. In the system dynamics model(s) this is measured as manpower unit (mp).
Attrition Percent – It is that per cent of the present working manpower that quits job for various reasons. This is measured as a percentage value.
Cost of Manpower Ratio – It is the ratio of the Cost of employing Manpower in India and the Cost of employing Manpower in the United States for the same job (this is because majority clients of Indian BPO sector are from the USA). This is a dimensionless quantity with its value varying from 0 to 1.
Service Quality – Here, it is the ratio of the service quality offered by the Indian BPO sector at any future period and the service quality offered by the Indian BPO sector during the period 2002-2003. This is a dimensionless quantity with its value varying from 1 to 3.
Productivity – This is the ratio of the productivity offered by the Indian BPO sector at any future period and the productivity offered by Indian BPO sector during the period 2002-2003. This is a dimensionless quantity with its value varying from 1 to 3.
Technical Innovations – It explains those innovations which help BPO service providers to improve their service quality and productivity; this would give them an edge over other service providers and help them compete in the international market by attracting companies interested in outsourcing. This is a dimensionless quantity with its value varying from 0 to 1.
Skills Availability – This is the ratio of total manpower present in the Indian BPO sector and manpower required to sustain the present growth rate. This is a dimensionless quantity with its value varying from 0 to 1.
Manpower Value – It is the amount of revenue generated by one unit manpower *i.e.* one person. This is measured in US dollars per manpower ($/mp).
Attrition Ratio – It is the ratio of the present attrition level in the Indian BPO sector and the average acceptable attrition level. This is a dimensionless quantity with its value varying from 0 to 4.
Poaching of Employees – This variable expresses the fraction of the attrition growth rate occurring due to competitors “poaching” employees within the Indian BPO sector. One probable reason is the increase in India’s BPO share in the global market. This is a dimensionless quantity with its value varying from 0 to 0.5.
Stress Factors – These constitute that fraction of attrition rate which occurs due to the high stress environment and ‘burnouts’ at the work place. High level of burnout is caused by a number of reasons like peculiar working hours, working days/holidays determined by geographic considerations, assuming pseudo identities, learning foreign accents, operating in alien business environment and altered social and family life. This is a dimensionless quantity with a constant value.
Compensation – It is that fraction of Manpower cost which the BPO service providers give to their employees in the form of perks or allowances in addition to the salary to keep them attracted towards their job. This is practiced mostly as a method to reduce the high attrition rate the Indian BPO sector is facing. This is a dimensionless quantity with its value varying from 1 to 1.2.

The Model Assumptions

- The Global Market is growing at a constant Compound Annual Growth Rate of 11% which is the annual growth rate of Global Market for the period 2001-2002.
- India's BPO share growth is affected by changing skills availability in the BPO sector, cost of employing manpower in this sector, service quality and productivity and effect due to other factors are constant.
- The change in foreign exchange rates is assumed to be insignificant throughout the simulation period and therefore is not considered here.
- The Manpower Value is growing at a Compound Annual Growth Rate which changes due to change in productivity. Effect of other factors on which the Manpower Value depends is constant.
- The Manpower planning is based on revenue projections and attrition percent.
- Attrition in this industry is mainly caused due to 'Stress Factors' and 'poaching of Employees' as mentioned earlier and effects of all other factors are not considered.

The Causal Loop Diagram

A Causal Loop diagram is a graphical tool to qualitatively capture the mental models of the system as understood by the model makers. The Causal Loop Diagram based on our study of the Indian Outsourcing Industry is illustrated in the Figure 2. Desired Revenue defines the size of demand for services of the Indian Outsourcing Industry in Global Outsourcing Market and is the driving force for whole model. It increases with growth in Global Outsourcing Market and India's share in this market. In our model, the manpower planning for Indian Outsourcing Industry is done on the basis of this desired revenue value. An increase in Manpower Value implies that as manpower efficiency increases, more revenue is generated per manpower and hence lesser manpower is required to achieve the desired revenue. Increase in desired revenue calls for more manpower which in turn scales up the desired manpower. The Hiring Rate of trainees not only depends on the difference between the Desired Manpower and the Present Manpower but it also considers it the number of trainees required to compensate the shortage due to the attrition rate in this industry. The Trainees become a part of the Working Manpower once their training period is over. The Indian BPO sector is facing a heavy attrition rate due to various reasons which decimates the strength of the Working Manpower. The strength of Trainees and Working manpower constitute the Present Manpower which along with Manpower Value is responsible for increase in Revenue Generated.

The increase in India's share in Global Market shows that the number of overseas clients outsourcing to India is increasing and so is the number of BPO service providers in India. This pushes up the competition within the Indian BPO sector. BPO service providers try to attract employees from other companies in the same sector by offering better employment packages. This is called Poaching of employees and this brings the attrition rates to a higher scale. The employees in BPO sector face high stress environment and 'burnouts' at their work place. High level of burnout is caused due to various reasons like peculiar working hours, working days/holidays determined by geographic considerations, assuming pseudo identities, learning foreign accents, operating in alien business

environment and altered social and family life. All these factors cause increase in attrition rate and are represented through Stress factors in the causal loop diagram in Figure 2.

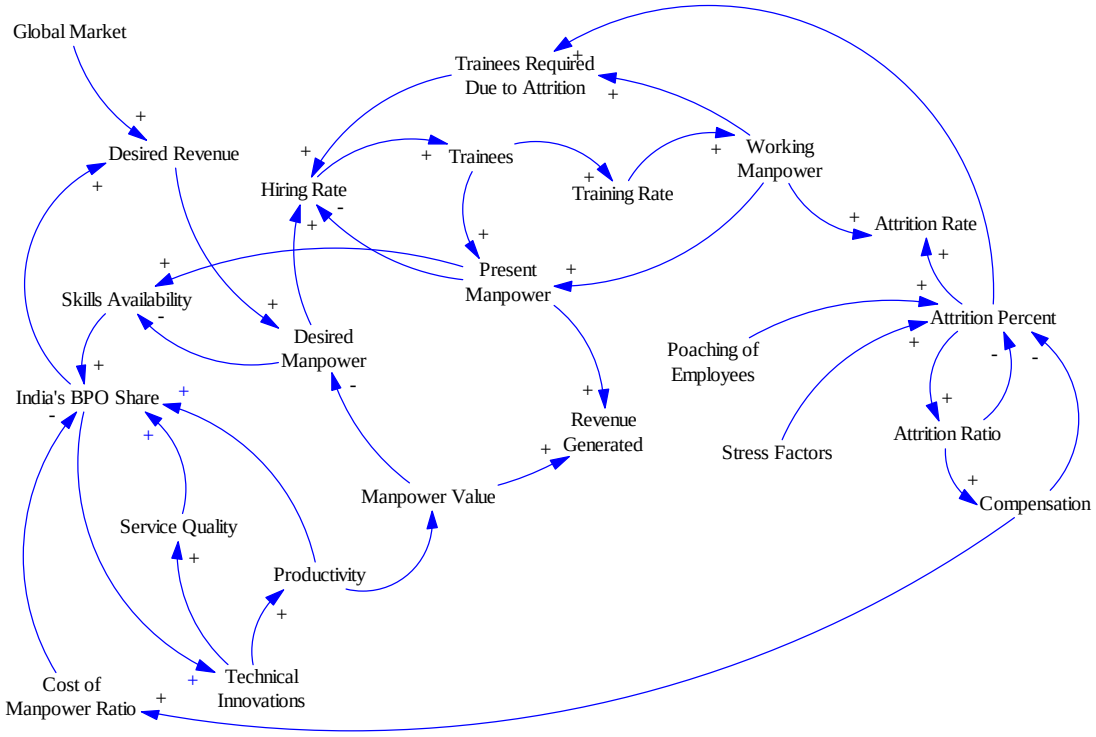


Figure 2: Causal Loop Diagram for Indian Outsourcing Industry

With increase in Attrition percent, Attrition Ratio increases and companies are forced to adopt policies to check the attrition level. One such policy considered here is giving perks and other allowances to employees in form of compensation to retain them. Increasing the compensation reduces attrition percent. But increasing compensation also increases the cost of manpower which in turn has a negative effect on the growth of BPO share. This causes a dilemma in deciding whether or not the compensation should be increased to control the attrition percent as it also increases the operating cost of manpower for the company. Another factor which may be a hindrance to the desired growth of Indian BPO share in Global Market is Skills Availability. If the industry fails to meet the continuously increasing demand of Global BPO Market owing to shortage of necessary skilled manpower, the desired growth is not attained and the growth of Indian BPO sector slows down.

Increase in Indian BPO share increases the competition as explained above; to retain the present clients and to attract more clients who would outsource, there will be a pressure on the service providers to improve their service quality and productivity through

Technical Innovations. This improvement will attract more companies to outsource to India with expectations of better service quality and productivity on their outsourced services. It will also encourage entry of new players in this industry segment, thus increasing the growth rate of the Indian BPO share.

The Stock Flow Diagram

The Stock Flow diagram is a translation of the Causal Loop Diagram illustrated earlier. The Stock Flow diagram for system dynamics model of Indian outsourcing Industry is shown in Figure 3. Here, the size of Global Market and India's BPO Share are modelled as stock. While the Global Market grows at a constant rate of 'GM CAGR' the growth of India's BPO share is a function of 'IM CAGR', 'Manpower Cost Multiplier', 'Service Quality', 'Productivity' and 'Skills Availability'. 'IM CAGR' is the growth rate of Indian Outsourcing Industry for the period 2001-2002 and is a constant. 'Manpower Cost Multiplier' is function of 'Cost of Manpower Ratio' defined as:

$$Manpower\ Cost\ Multiplier = 0.25 \times \left(\frac{1}{Cost\ of\ Manpower\ Ratio} - 1\right)$$

The Cost of Manpower Ratio at any time t is the product of Cost of Manpower at time (t-dt) and Compensation.

Desired Revenue, the driving force of the model, is the product of Global Market and India's BPO share. It is multiplied with manpower value to get Desired Manpower. Manpower Value is modelled as a stock with growth rate as a function of Manpower Value CAGR and Productivity. Manpower Value CAGR is a constant derived from past values of Manpower value. The difference of Desired Manpower and Present Manpower is the shortage in manpower. This shortage has to be reduced in order to achieve the targeted desired revenue.

New Trainees are hired at a (hiring) rate which is the sum of shortage in manpower divided by hiring time and the shortage created due to the attrition of working manpower each year. The trainees are trained at a defined (training) rate upon completion of which they are incepted by the company as the working manpower. A certain (Attrition) Percentage of the Working Manpower quits the job within an average (Attrition) time. The Present Manpower is a sum of the Trainees and the Working Manpower.

The Attrition Percent is modelled as a stock with 'increase rate' as a function of Attrition Percent and Net fractional increase and 'decrease rate' as a product of Net fractional Decrease and Attrition Percent. Net fractional increase is the ratio of product of Poaching of Employees and Stress factors and Attrition Ratio. Poaching of Employees is a function of India's BPO share, graphically defined as shown in Figure 4. There is an increase in poaching because of increase in competition within the sector. While India's BPO share increases, poaching rate is very slow initially but after the share has grown to 70% the poaching rate becomes very high. Poaching of Manpower's value varies in the range of 0 to 0.5. Stress factor is kept constant assuming its value would not change for next 10

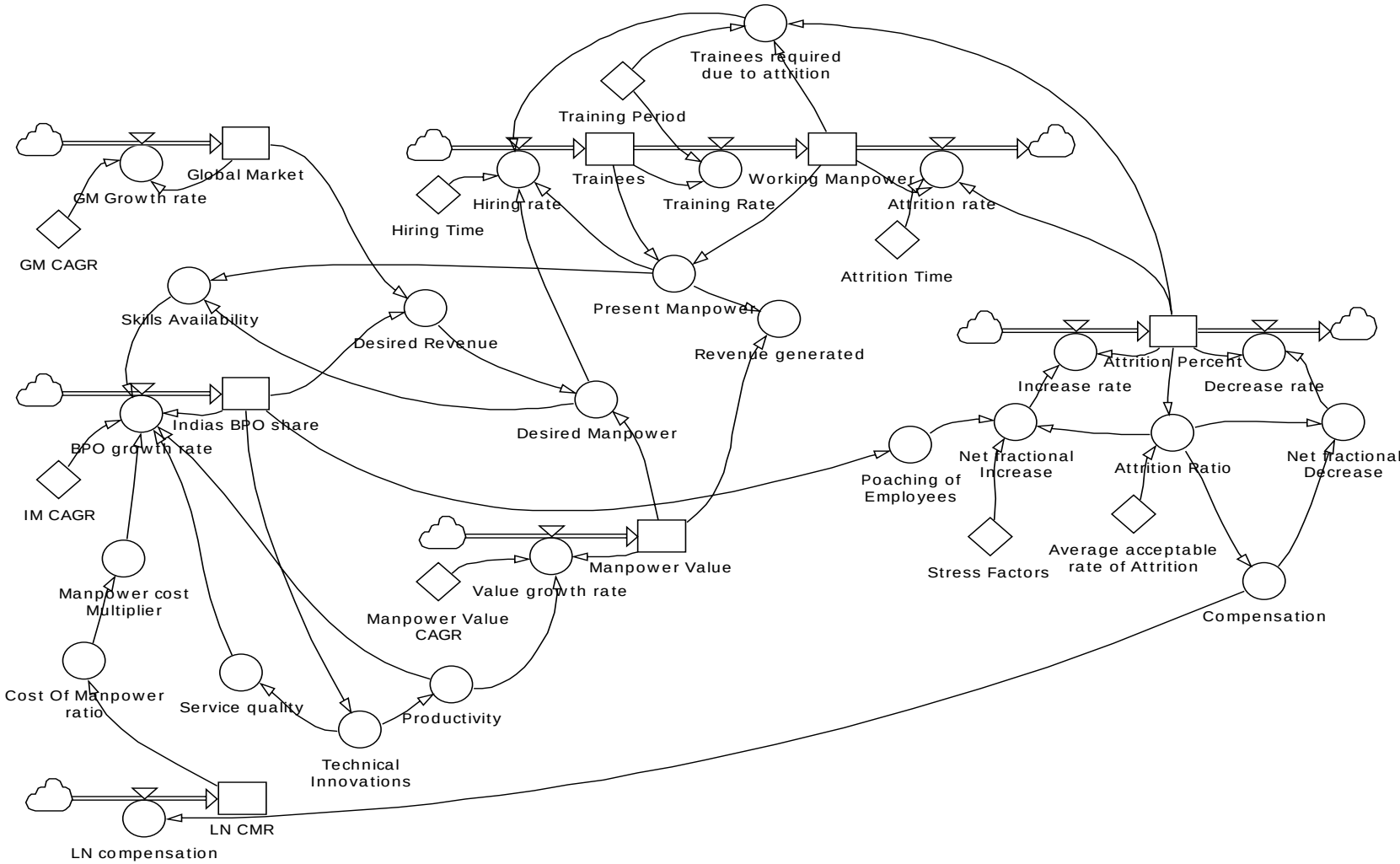


Figure 3: Stock Flow diagram for Indian Outsourcing Industry

years. Attrition Ratio is the ratio of Attrition Percent and Normal rate of Attrition which is a constant with value of 25%.

Net fractional decrease is defined graphically as a function of product of Compensation and Attrition Ratio as shown in Figure 5. The product of Attrition ratio and Compensation varies in the range of 1 to 6 and Net Fractional Decrease in the range of 0 to 0.5. Initially the growth of Net Fraction Decrease is slow but for high values of the product the growth rate is very high. Compensation is also defined graphically as a function of Attrition Ratio as shown in the Figure 6. The Attrition Ratio varies in the range of 1 to 4 and Compensation varies in the range 1 to 1.2. The Compensation value denotes how much will the cost of manpower grow as a function of Attrition Ratio. The Normal rate of Attrition is the rate at which there is no compensation for employees but at very high value of attrition the compensation can grow as large as 20 % of cost of manpower.

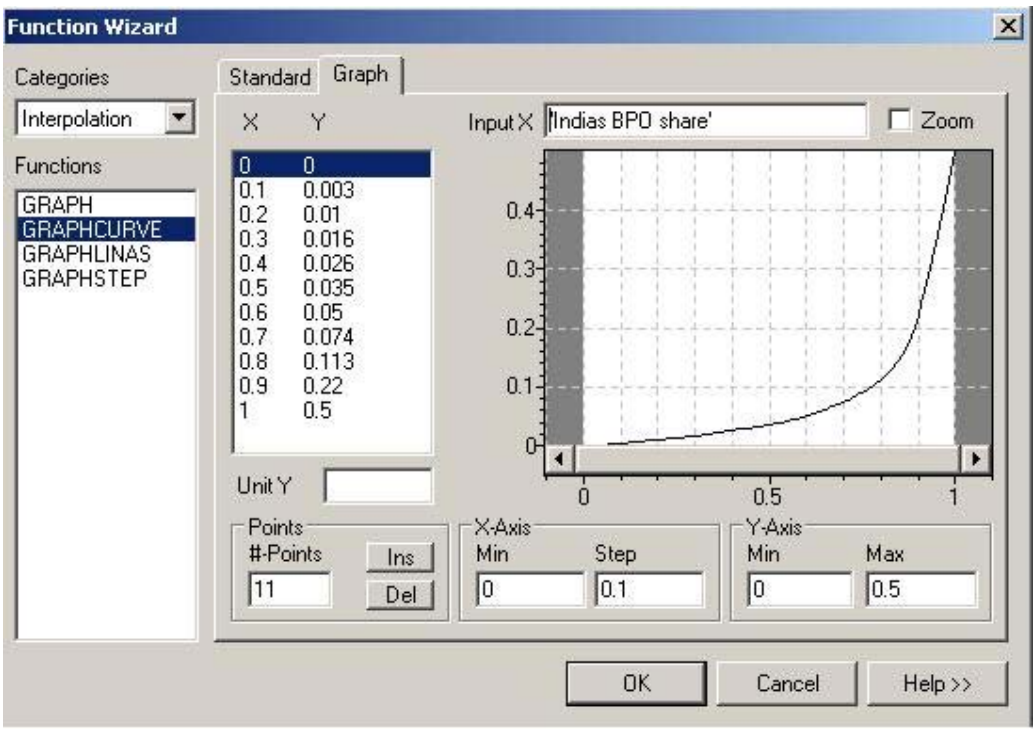


Figure 4: Poaching of Manpower as a function of India's BPO Share

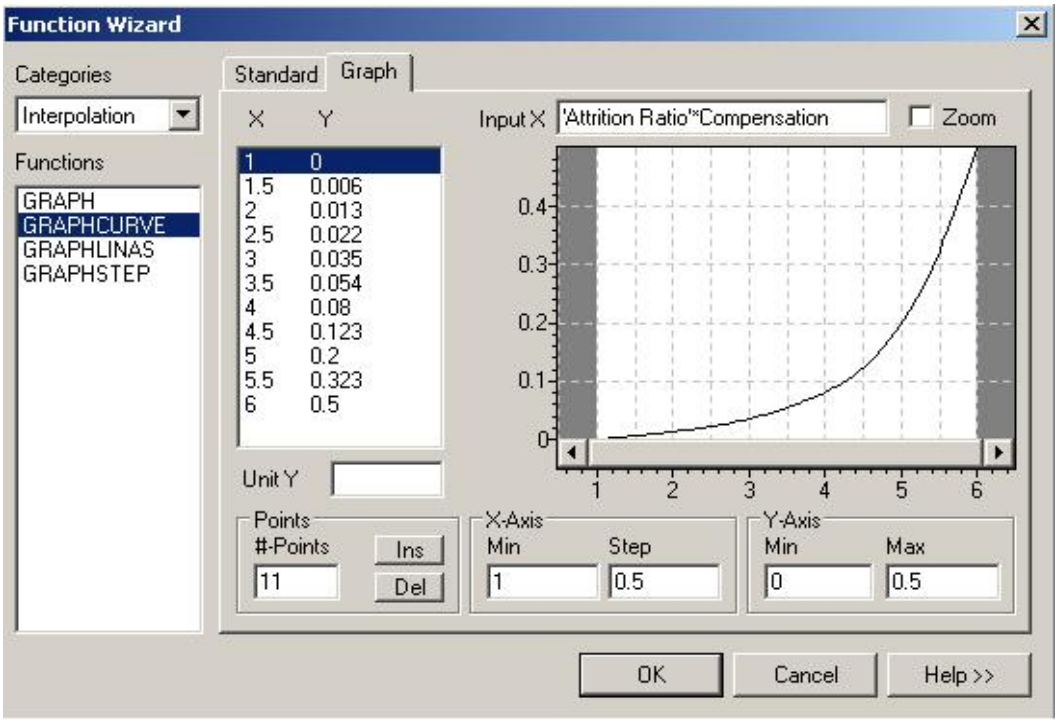


Figure 5: Net fractional decrease as function 'Attrition Ratio'*Compensation

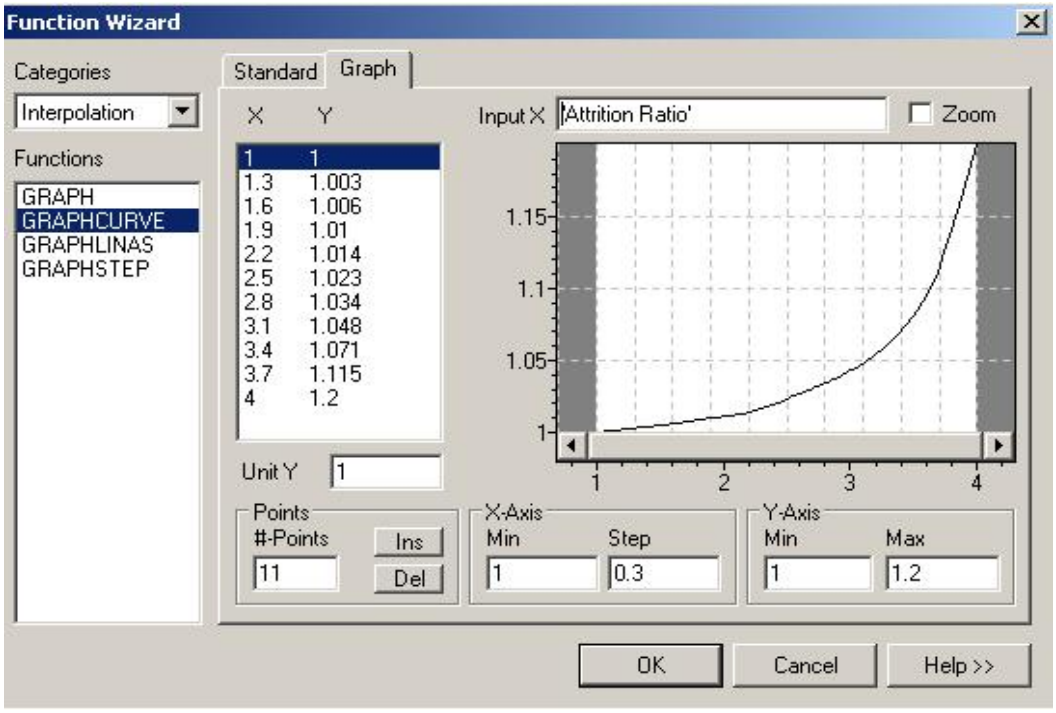


Figure 6: Compensation as a function of Attrition Ratio

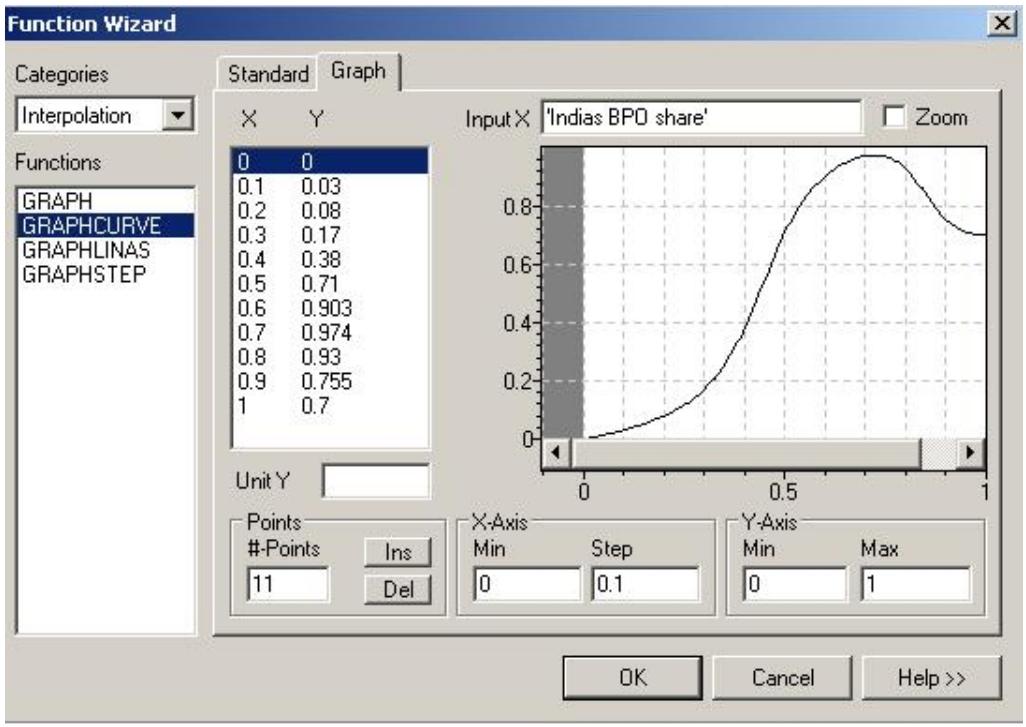


Figure 7: Technical Innovation as a function of India's BPO share

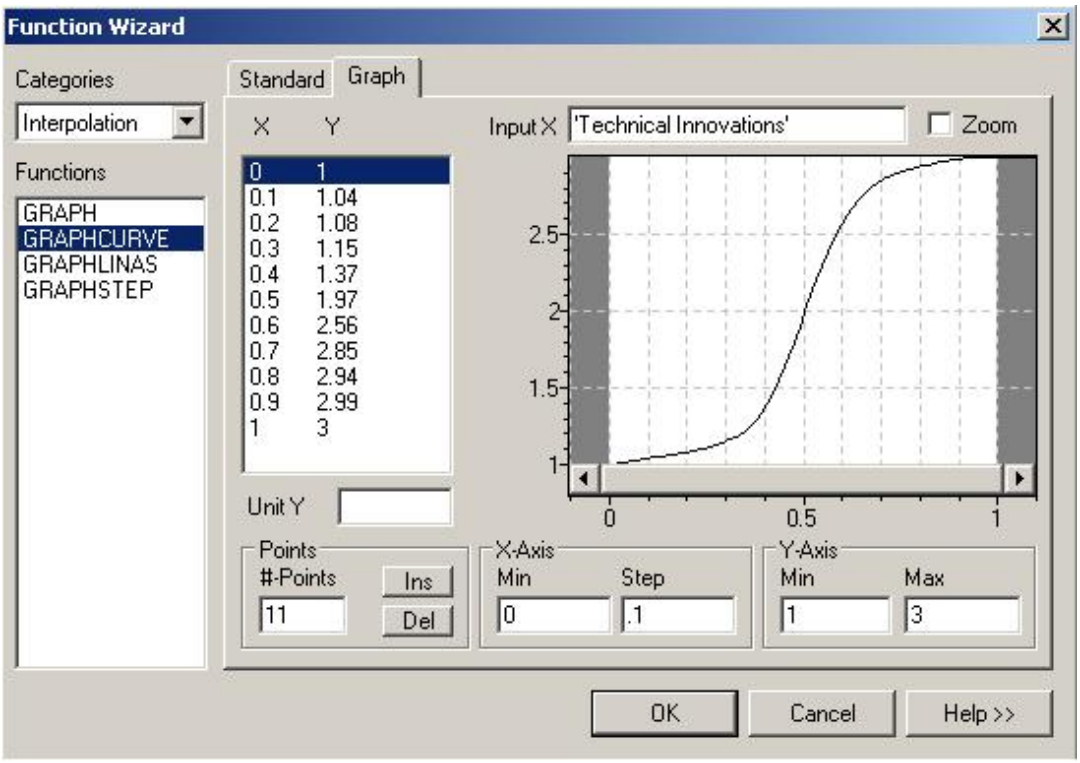


Figure 8: Productivity as a function of Technical Innovations

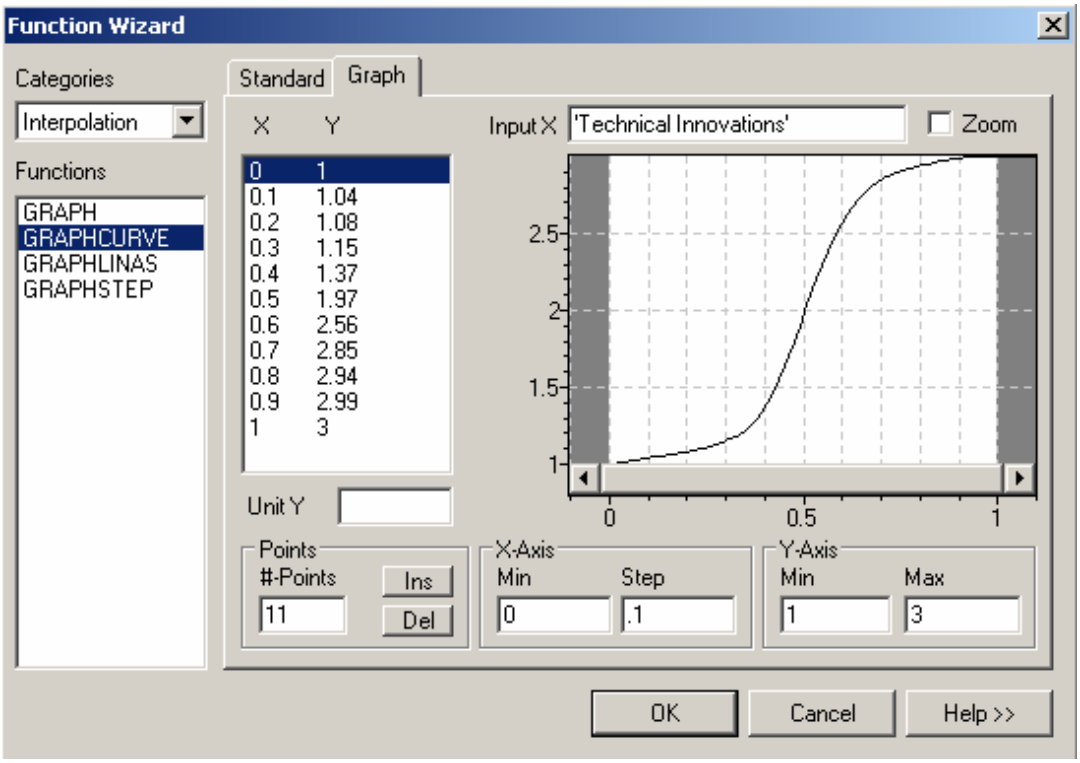


Figure 9: Service Quality as a function of Productivity

Technical Innovations is graphically defined as a function of India's BPO share as shown in the Figure 7. Technical Innovation varies on a scale of range 0 to 1 against India's BPO share which also varies on a scale of range 0 to 1. The Technical Innovation curve is similar to industrial growth curve and it shows increase in technical innovations with increase in BPO share but once it reaches the maximum level, the technical innovation decreases as India's BPO share increases. However, we have considered here, for the simulation runs in the model, only the growth phase of the Technical Innovation curve (before it reaches its maximum value). Productivity and Service Quality are also graphically defined as a function of Technological Innovation as shown in the Figure 8 and Figure 9. Both these factors follow similar S-shaped growth function. The two factors vary on a scale of range 1 to 3 and the Technical Innovations vary on a scale of range 0 to 1. The Service Quality and Productivity have been defined as functions of Technical Innovation such that they represent their degree of improvement in their respective values.

The Model Validation

The system dynamics model for this study has been simulated for the period from January 1, 2002 to January 2, 2012. Simulations for first three periods (2002, 2003 and 2004) were used to validate the model. In the validation phase, the model was tuned to get maximum simulation fit with the actual values for these three years. The results for these three years are compared with the true values in Table 2. It is observed from Table 2 that the actual and simulated values for the variables, for each of the three years under consideration, are very close providing an evidence for the validation of the given system dynamics model.

Table 2: Comparison of Actual and Simulated values for Validation Period

	2002		2003		2004	
	Actual	Simulated	Actual	Simulated	Actual	Simulated
India's BPO share (%)	0.2	0.2	0.3	0.3	0.5	0.5
Revenue Generated (million US Dollars)	1478	1478	2550	2596	4650	4648
Present Manpower	106,500	106,500	179,100	179,940	310,000	309,618
Global Market (million US Dollars)	792,000	792,000	881,000	879,120	978,000	975,823

The Model Simulation Runs

Table 3 presents the simulated revenue estimates and India's BPO share values obtained from the simulation run of the System Dynamics model. The plots of the results can be seen in Figure 10 and Figure 11. The growth curve of the Desired Revenue, Revenue Generated and India's BPO share is closely exponential. The CAGR for these parameters is changing every year due to the change in the values of the factors on which they depend. The growth gets sharper every year. Table 4 presents the simulated manpower estimates obtained from the simulation run of the System Dynamic Model. The nature of growth in case of Desired Manpower, Present Manpower, Working Manpower and Trainees is almost similar to an exponential curve. Figure 12 illustrates the plot of Manpower Value against the simulation period. Figure13 is the plot of skills availability against the simulated time period. It can be seen that the skills availability curve is almost stable for all periods but at the end of 2011, it shows some sign of decline which is a common phenomenon for all industry segments. It suggests that the Indian BPO sector might attain maturity around this period.

Table 3: Simulation results for Revenue and India's BPO Share

Time	Global Market (USD)	Desired Revenue (USD)	Revenue generated (USD)	Indias BPO share (%)
Jan 01, 2002	792,000,000,000.00	1,584,000,000.00	1,478,302,005.00	0.20
Jan 01, 2003	879,120,000,000.00	2,838,890,106.58	2,597,635,884.27	0.32
Jan 01, 2004	975,823,200,000.00	5,079,236,285.71	4,648,574,578.82	0.52
Jan 01, 2005	1,083,163,752,000.00	9,080,051,336.54	8,311,740,590.44	0.84
Jan 01, 2006	1,202,311,764,720.00	16,221,016,823.84	14,851,019,618.23	1.35
Jan 01, 2007	1,334,566,058,839.20	28,964,121,620.15	26,521,710,902.15	2.17
Jan 01, 2008	1,481,368,325,311.52	51,711,078,579.05	47,355,402,614.73	3.49
Jan 01, 2009	1,644,318,841,095.78	92,363,495,513.46	84,586,232,199.32	5.62
Jan 01, 2010	1,825,193,913,616.32	165,231,121,167.00	151,300,946,384.10	9.05
Jan 01, 2011	2,025,965,244,114.12	296,803,463,105.53	271,651,578,314.14	14.65
Jan 01, 2012	2,248,821,420,966.67	539,118,914,797.28	492,674,297,777.72	23.97

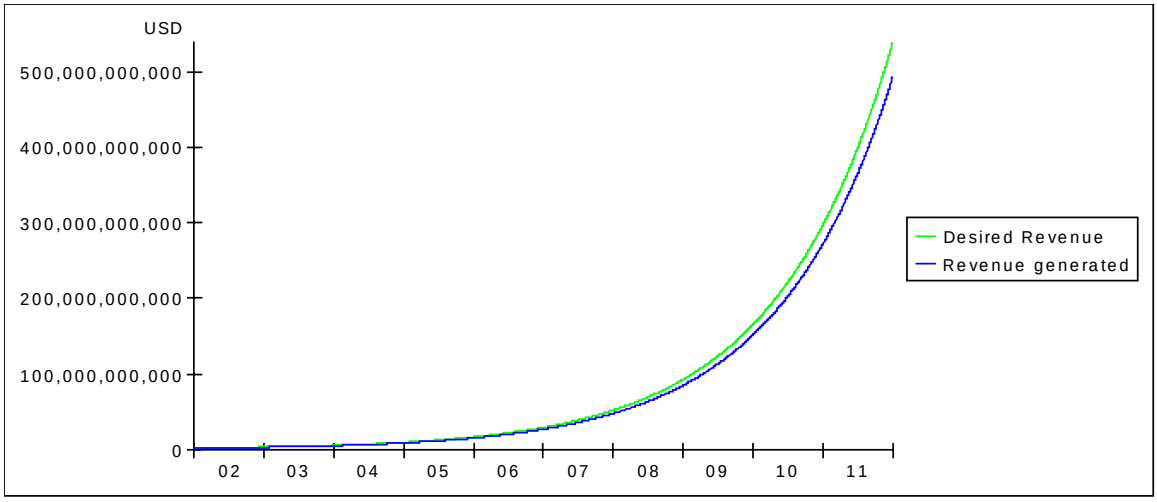


Figure 10: Plot of Desired Revenue and Revenue Generated

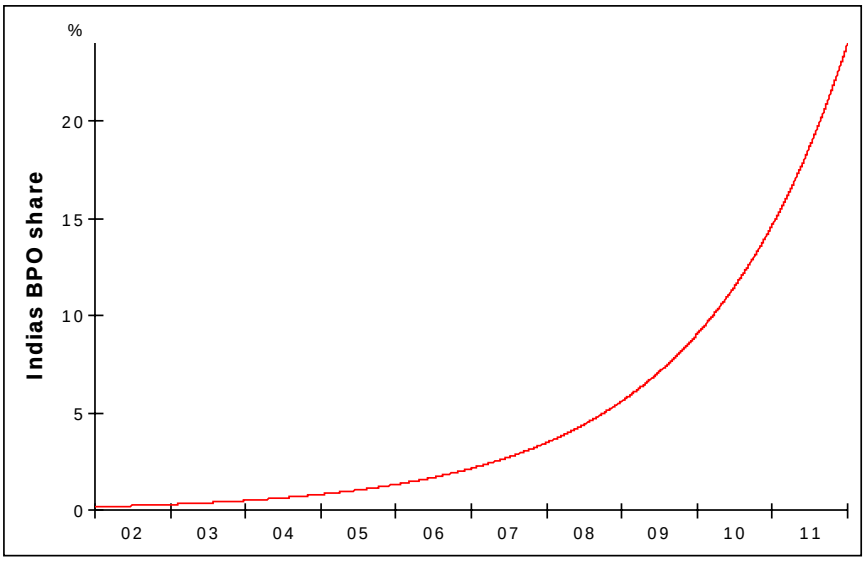


Figure 11: Plot of India's BPO share

Table 4: Simulation Results for Manpower

(mp)

Time	Desired Manpower	Present Manpower	Working Manpower	Trainees
Jan 01, 2002	114,114.71	106,500.00	100,630.00	5,870.00
Jan 01, 2003	196,651.39	179,939.58	156,668.66	23,270.92
Jan 01, 2004	338,303.09	309,618.82	269,640.24	39,978.59
Jan 01, 2005	581,500.87	532,297.03	463,719.16	68,577.87
Jan 01, 2006	998,819.97	914,461.48	796,891.47	117,570.01
Jan 01, 2007	1,714,764.83	1,570,166.62	1,368,662.86	201,503.77
Jan 01, 2008	2,943,359.08	2,695,437.00	2,350,025.31	345,411.69
Jan 01, 2009	5,054,086.55	4,628,518.40	4,035,867.75	592,650.65
Jan 01, 2010	8,690,781.83	7,958,086.26	6,938,652.24	1,019,434.03
Jan 01, 2011	15,001,882.95	13,730,585.01	11,965,546.07	1,765,038.94
Jan 01, 2012	26,170,772.43	23,916,183.57	20,804,539.54	3,111,644.03

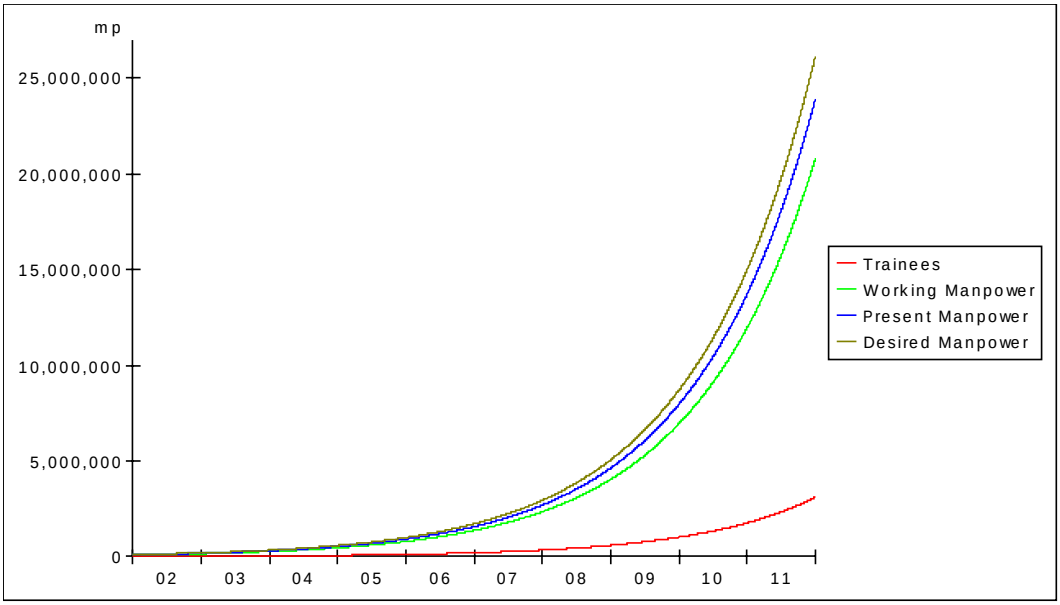


Figure 12: Plot of Manpower

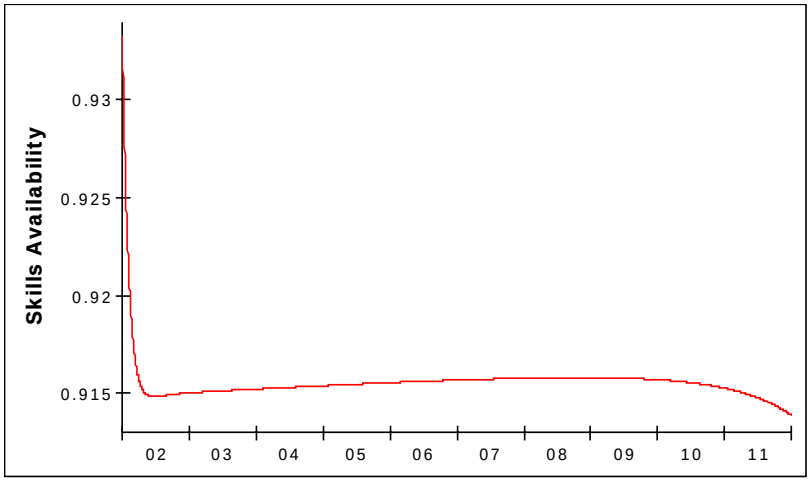


Figure 13: Plot of Skills Availability

Table 5: Simulation results for Attrition and Hiring Rates

Time	Hiring rate (mp/wk)	Attrition rate (mp/yr)	Attrition Percent (%)
Jan 01, 2002	1,383.26	35,220.50	35.00
Jan 01, 2003	2,962.23	54,595.66	34.85
Jan 01, 2004	5,083.92	93,562.15	34.70
Jan 01, 2005	8,719.90	160,228.46	34.55
Jan 01, 2006	14,948.39	274,207.89	34.41
Jan 01, 2007	25,619.69	469,026.05	34.27
Jan 01, 2008	43,919.65	802,069.99	34.13
Jan 01, 2009	75,374.11	1,371,935.26	33.99
Jan 01, 2010	129,729.81	2,349,427.57	33.86
Jan 01, 2011	224,965.30	4,036,826.27	33.74
Jan 01, 2012	398,447.10	6,999,106.90	33.64

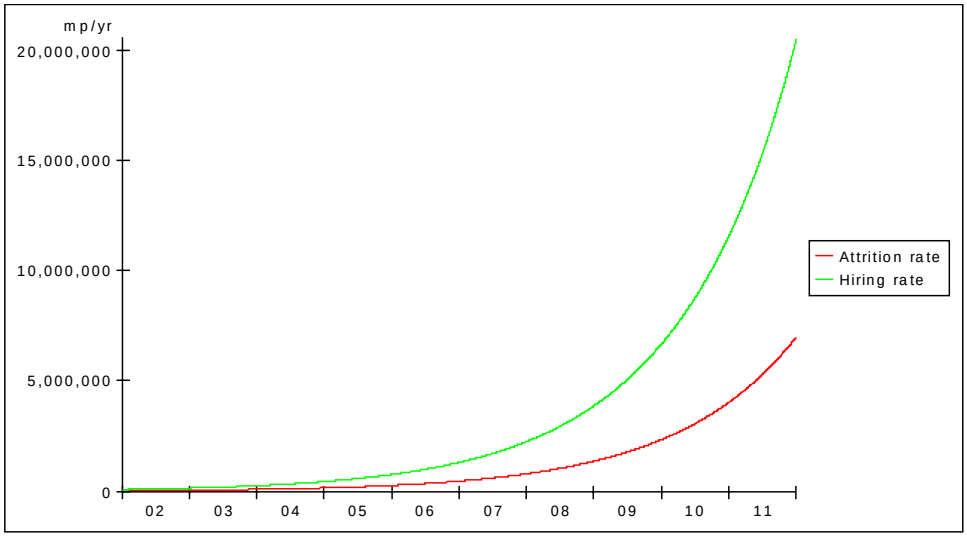


Figure 14: Plot of Attrition and Hiring Rate

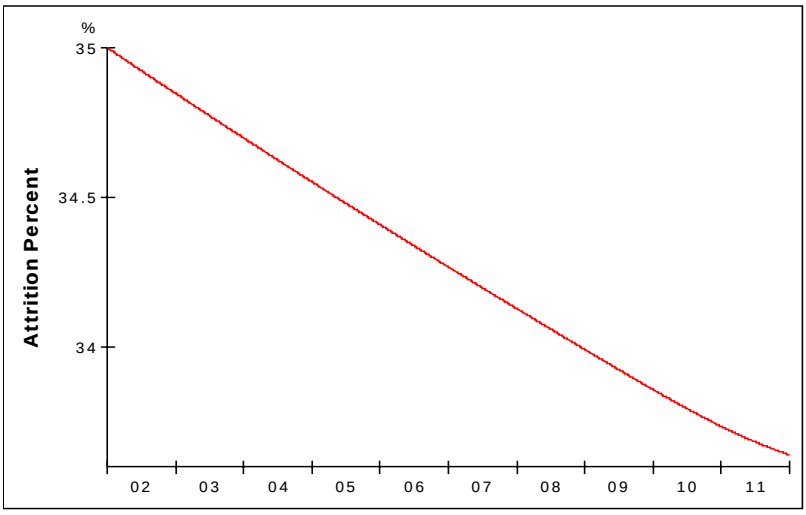


Figure 15: Plot of Attrition Percent

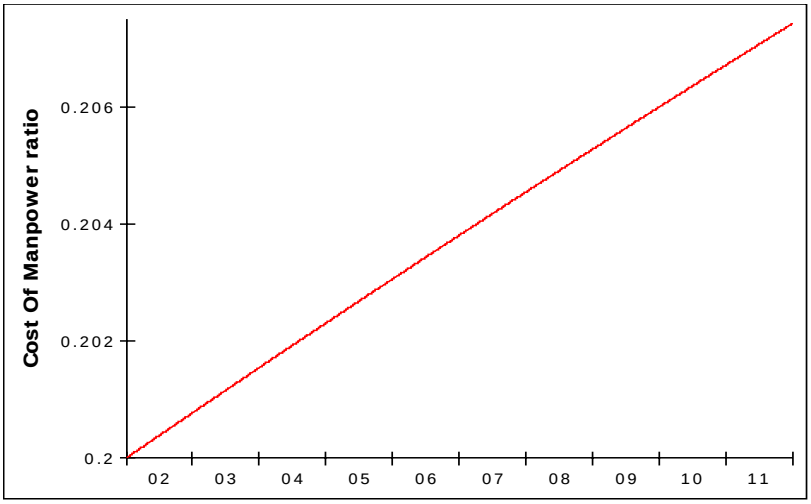


Figure 16: Plot of Cost of Manpower ratio

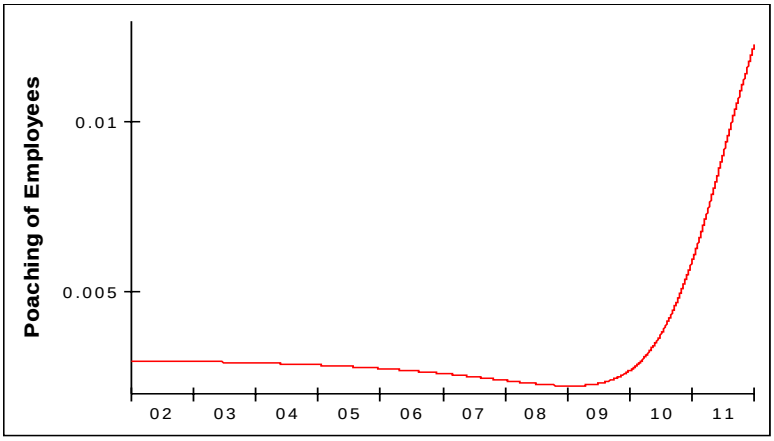


Figure 17: Plot of Poaching of Employees

Table 5 presents the simulated attrition and hiring rate estimates. The nature of curves for attrition and hiring rate are plotted in Figure 14. The attrition rate is higher than hiring rate (which is normally observed in almost all industries) due to the hiring time lag in filling up the manpower shortage that is caused by attrition in the industry. Figure 15 shows the plot of Attrition percent against simulation period. Figure 16 shows the plot of Cost of Manpower ratio against the simulation period. Figure 17 shows the Plot of Poaching of Employees against the simulation time period. The poaching rate decreases with time at a slow rate till the year 2009 but after 2010 there is a very sharp rise in the poaching curve. This might be due to the sharp rise in BPO growth rate and India's BPO share in Global Market that will bring a rise in the competition within the industry.

Figure 18 and Figure 19 show the plots of Service Quality and Productivity respectively against the simulated time period. The growth in levels of Service Quality and Productivity are similar; by the end of 2011, there will not be any significant increase in the service quality and productivity level offered by Indian BPO sector.

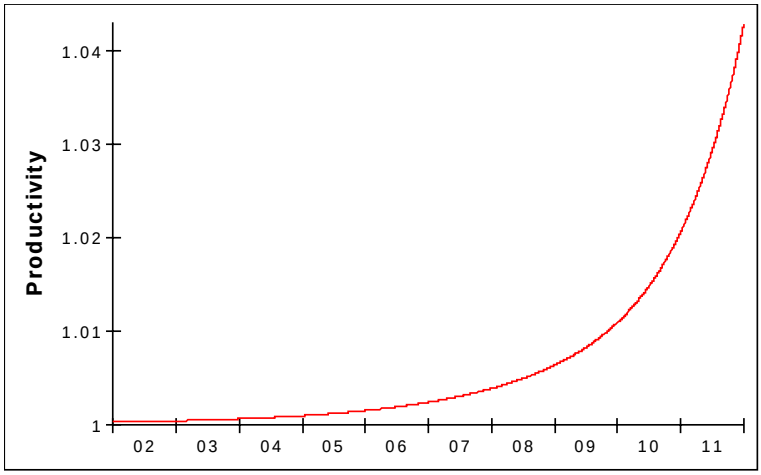


Figure 18: Plot of Productivity

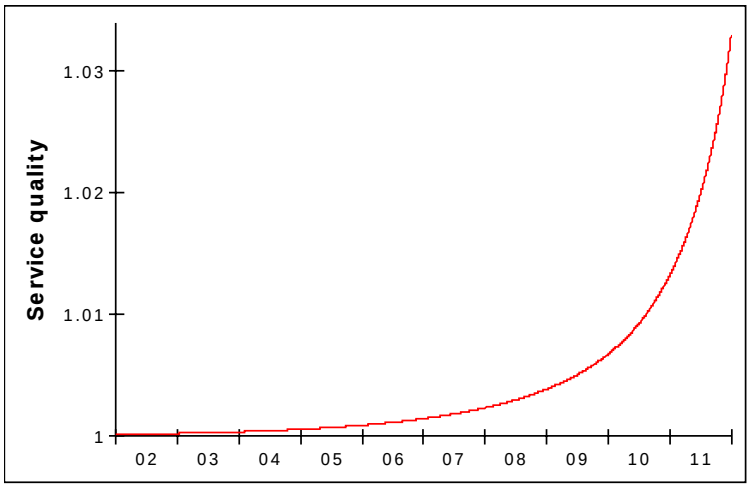


Figure 19: Plot of Service Quality

CONCLUSIONS

Offshore outsourcing is here to stay despite all the political heat it has generated, and for a country like India which has been one of the primary beneficiaries of this trend due to several crucial advantages that she enjoys as mentioned elsewhere in the text, the importance of this sector in the emerging knowledge economy cannot be underestimated. This is a trend that has benefited both the developed as well as the developing world, as has been pointed out by Bruce Meyerson of the New York Times (Offshore Outsourcing World[3], 2005). According to him, a weak dollar and outsourcing has helped the international software superpower IBM's finances in no small measure. It is reported that revenues from computer support services sold to businesses, including consulting, outsourcing and maintenance, grew by 10 per cent to a figure of USD 12.6 billion in the past year.

A study commissioned by the UK National Outsourcing Association (NOA) and carried out by NelsonHall on the use and perception of offshoring by British companies today (Offshore Outsourcing World[4], 2004) has observed that:

- 80% of companies claimed that the use of offshore services has increased their competitiveness.
- 87% of companies believe that the use of offshore services has increased the quality of their internal processes.
- 77% of companies believe that the use of offshore services has decreased their process cost.

In view of the above, it, therefore, becomes all the more imperative for a researcher to analyse the structure and the behaviour of Indian outsourcing industry and what it holds for the future.

The study reported in the paper has attempted to model the Indian outsourcing industry using a system dynamics framework. Both the causal lop diagram and the stock flow diagram of the model have helped us understand the various factors and drivers at play in this emerging and critical sector of the Indian economy. These variables have been explained in detail (including their measurement characteristics) and the model assumptions have been clearly delineated. The model has been validated for a time period of three consecutive years. The outsourcing industry, by its very nature, is of recent origin, and therefore, we could not get the luxury of a longer data period for validation purposes. The different simulation runs of the model illustrate the way the various parameters of the Indian outsourcing industry would behave over a period of time.

The model is limited by the choice and selection of the variables that are included, and those that have been left out. Crucial to the modelling exercise is the fact that the scenario in this industrial sector is constantly varying, and it is almost impossible to keep pace with the changing environment. For instance, in India, an entrance examination will soon be a mandatory requirement for BPO candidates (Offshore Outsourcing World[4], 2005). This is a product of the team up of the National Association of Software and Service Companies (NASSCOM) and the IT industry. It is expected to cut recruitment costs by as much as 40 to 50 per cent. Inclusion of a larger number of variables like those related to the government policies that impact outsourcing decisions and economies, that have currently been left out of the model considerations would have perhaps further complicated the model structure, and consequently, making the understanding of the model behaviour more obscure. There are other important factors that have been left out, and also some of the interrelations among the variables in the present model might not have been captured properly. Keeping these limitations in mind, the study has made a first hand attempt to model Indian outsourcing industry in a system dynamics framework and has discussed the various simulation runs while the scope for further research and improvement of the model remains.

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