HUMAN RESOURCE DEVELOPMENT FOR AGRICULTURAL SECTOR IN INDIA: A DYNAMIC ANALYSIS

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ABSTRACT

The paper describes a system dynamics model developed for dynamic analysis of human resource for the agricultural sector in different sources of employment, viz., government, private (including corporate), academic, financial institutes, non-governmental organizations, self employment, and others in India. Besides projecting an overall scenario for continuation of current agricultural education policy and trends, the paper analyses simulated results from the model for the current curriculum with 80:20 proportion of technical to soft skills. The analysis shows that in the coming years the private sector will emerge as a major employer for the graduates of agriculture and allied sciences.

1. INTRODUCTION

Human resources constitute the most critical inputs relying on the use of science and technology for development. Agriculture being the backbone of Indian economy, the human resource needs to meet various activities related to agricultural development which is critical to attain country's goals towards rural development, employment generation and host of related activities leading to sustainable growth and development. The growth achieved in Indian agricultural sector has been attributed to the consorted efforts of available skilled human resource. But over the years the scenario has changed. The growth in agriculture sector slowed down and the job opportunities declined leading to increased unemployment. Compounding to this problem, the job requirement of other economic sectors of development has also undergone major transformation encouraging

stiff competition from graduates of other disciplines. The increasing unemployment led to serious debate to relook at agricultural education.

Education system is perceived to be orbiting along a vicious circle of unemployment – quality reduction – loss of job opportunity. To break this nexus, the complexity of human resource supply and demand process needs to be analyzed in detail to assess the impact of various contributing factors and policy options.

The graduates coming out of the agricultural education system in the country constitute the supply where as the demand stems from various employment avenues. Agencies employing trained agriculture human resource are grouped under seven sectors namely Government, Private (including corporate), Academic, Financial, Non-government organizations, Self-employment and Others (mostly not related to agriculture directly). The demand for trained agricultural human resource in each of these sectors depends on sectoral growth and attrition rate of the existing employed stock. As the demand increases, new colleges may come up or the intake strength in the existing colleges may increase leading to enhancement in the output of graduates. However, actual employment depends on the skill-set of the graduates coming out of the education system. Skill-set represents skill and knowledge in respect of both technical skills and soft skills (managerial, behavioral and communication). If the possessed skill-set does not match the expectations of the employer, a fraction of the employment may be lost to the persons from other competing disciplines, such as management or science graduates. The skill gap, through reduced job opportunity, aggravates existing unemployment problem, and increased unemployment in turn distracts students from opting for these courses affecting supply of quality-trained human resource. Thus, three major parameters - demand, supply and skill-set – are important dimensions for developing future scenario of trained agricultural human resource.

The human resource data was taken from secondary reports and largely from those published by the Institute of Applied Human resource Research (IAMR, 2001). The qualitative and influencing parameters were based on discussions with senior executives in academic, private and public sector organizations employing agri-graduates, professional associations, working professionals and students.

2. CAUSAL MODEL OF THE SYSTEM

The causal relationship among various parameters of the system is shown in Figure 1. This figure shows flow of graduates with interactive positive and negative loops operating through intake, output, stock, sector growth, skills, attrition, and recruitment in various employing sectors. The model has two positive loops emanating from growth driven demand. This is balanced by one negative loop influenced by skill-set, unemployment and outturn.

3. MODEL VALIDATION AND SIMULATION

To develop confidence in the model, it was validated following scheme proposed by Mohapatra et al, (1994). The structure of the model was validated through detailed discussion with the experts from university and employers. Simulation process requires defining initial values for the base year i.e.1991. The initial values of model parameters were compiled and computed from secondary sources or decided considering historical growth scenario. The base year data, various growth rates and table functions used in the model are given in Tables 1 and 2. Basic data for the model on stock, enrolment, intake, drop out, and growth rate of agri-education are given in Table 1. The additional employment generated is proportional to the sectoral capacity growth, i.e. agricultural GDP for government, annual sale for private, expenditure for academic and agricultural credit for finance institutes. For the remaining three sectors (NGOs, Self employment and Others) the number of employed agricultural human resource defined their capacity. The values for sector-specific parameters such as employed stock, initial capacity, growth rate, employment multiplier, recruitment rates were arrived through review of available published data (IAMR,2001; AFFC,2000; DST,1999; TCS,2000; DGET, 2002; and DES, 2004) and discussions with the executives / managers in various sectors. Desired skill-set for broad sectors are compiled from discussions with the Chief Executive Officers and curriculum composition is given in Table 3.

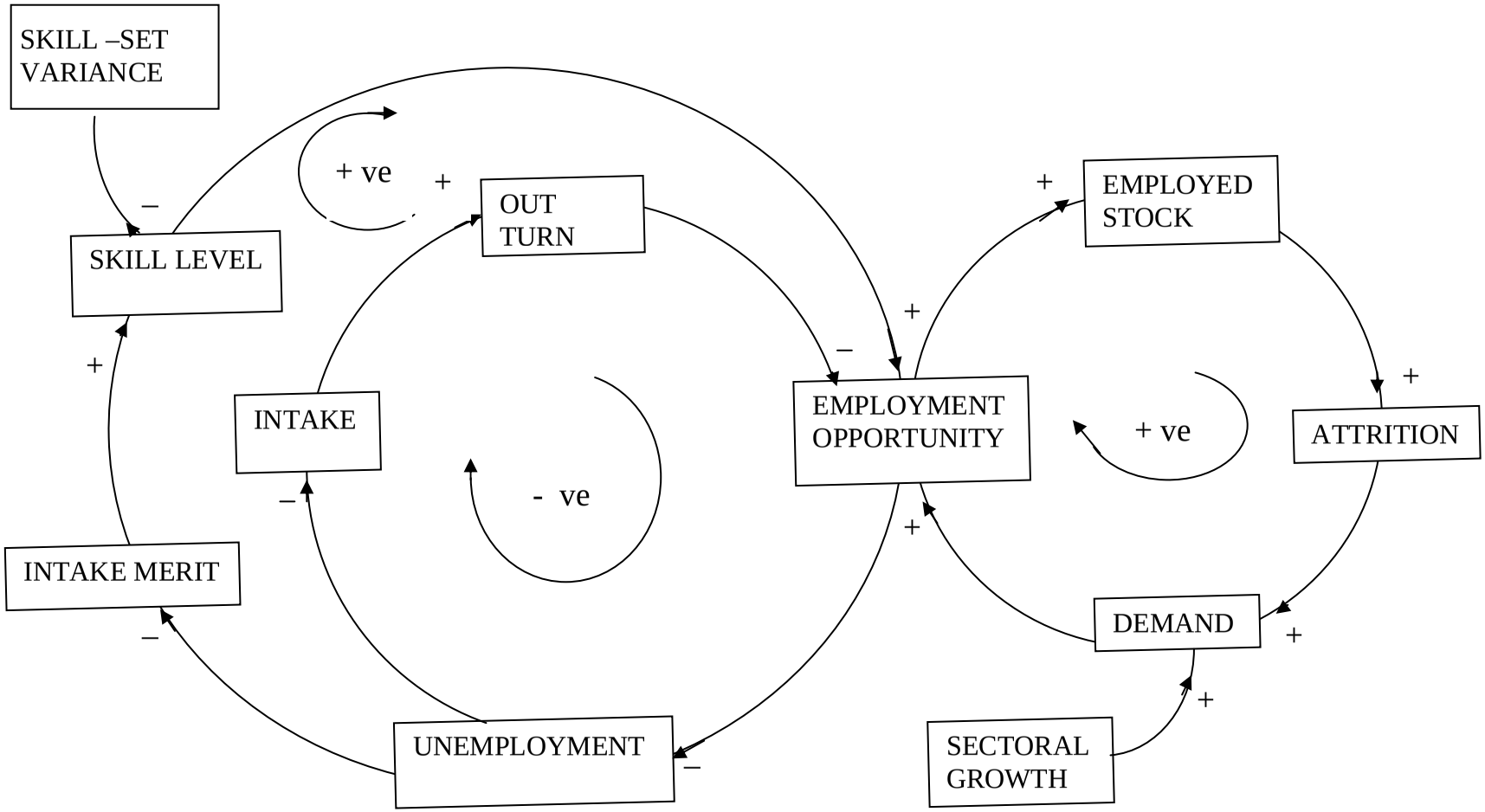

Figure 1 : The causal loop diagram

Table 1: Basic data for the base year: 1991

Sl No	Variable	Value
1	Total stock	202800
2	Enrolment	56000
3	Intake	15500
4	Dropout rate	30 per cent
5	Intake Growth Rate	2.0 per cent

Source: Compiled and computed from DST (2000) and Rao,D.R, and Muralidhar U, (1994)

Table 2: Sectoral parameters for base year 1991

Sl No	Sector	Employed stock	Initial capacity	Capacity growth rate (%)	
				1991	2020*
1	Government	80685	Rs.2044.21 billion	2.5	2
2	Private	32274	Rs.934.59 billion	10	5
3	Academic, R&D	19364	Rs.61.32 billion	3	2.5
4	Financial Institutes	9682	Rs.185.73 billion	15	5
5	NGOs	1614	1614 number	6	3.5
6	Self employed	1614	1614 number	6	3.5
7	Others	16137	16137 number	5	4

Source: Compiled and computed from DES – 2004, and CMIE , 2004 and feedback from CEOs.

* The growth rates for 2020 were arrived from the discussions with the executives.

Table 3: Desired Skill-set

Sl No	Sector	Desired Skill-set (%)	
		Technical Skill	Soft Skill
1	Government	70	30
2	Private	60	40
3	Academic, R&D	80	20
4	Financial Institutes	50	50
5	NGOs	40	60
6	Others	60	40
7	Non-agriculture	50	50

Source: Compiled from the discussions with CEOs of various sectors.

The model result is validated comparing simulated output with available data on total stock of agricultural human resource for the period 1991 to 2000 (DST, 2000) and shown in Figure 2. The variance in parameter estimation is found to be with in acceptable error limits (1.7 per cent). As the stock values match with the corresponding reported values, the model was considered to be reasonably good representation of reality. The validated model is used for developing future scenario and related parametric analysis.

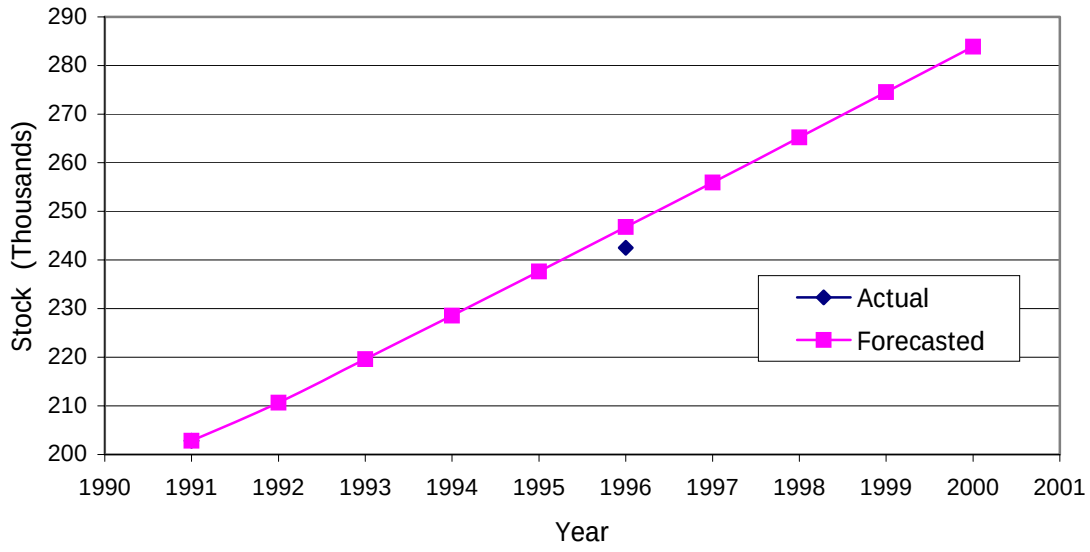

Figure 2 : Total stock of agricultural manpower

4. GENERATION OF FUTURE SCENARIO

The supply and demand scenario of trained agricultural human resource for the period 2001 – 2020 is developed. Model uses time lag of four years for graduating. The curriculum adopted by the agricultural universities was revised during 1995 keeping in view the employment opportunities at that point of time (ICAR 1995). Analysis of this representative syllabus suggests that about 80 per cent of the total credits are devoted to imparting technical (subject-specific) skills; where as about 20 per cent are marked for developing soft skill. The long-term impact of continuing with same syllabus is as under.

Supply and Demand

The forecasted annual supply and demand for agricultural human resource is shown in Figure . The supply of human resource is projected to be around 16000 in 2020 against a demand of nearly 15000. Though the growth in government sector is assumed to be modest at 2.5 per cent,

positive and healthy growth in other sectors drives the model to reduce demand supply gap with time.

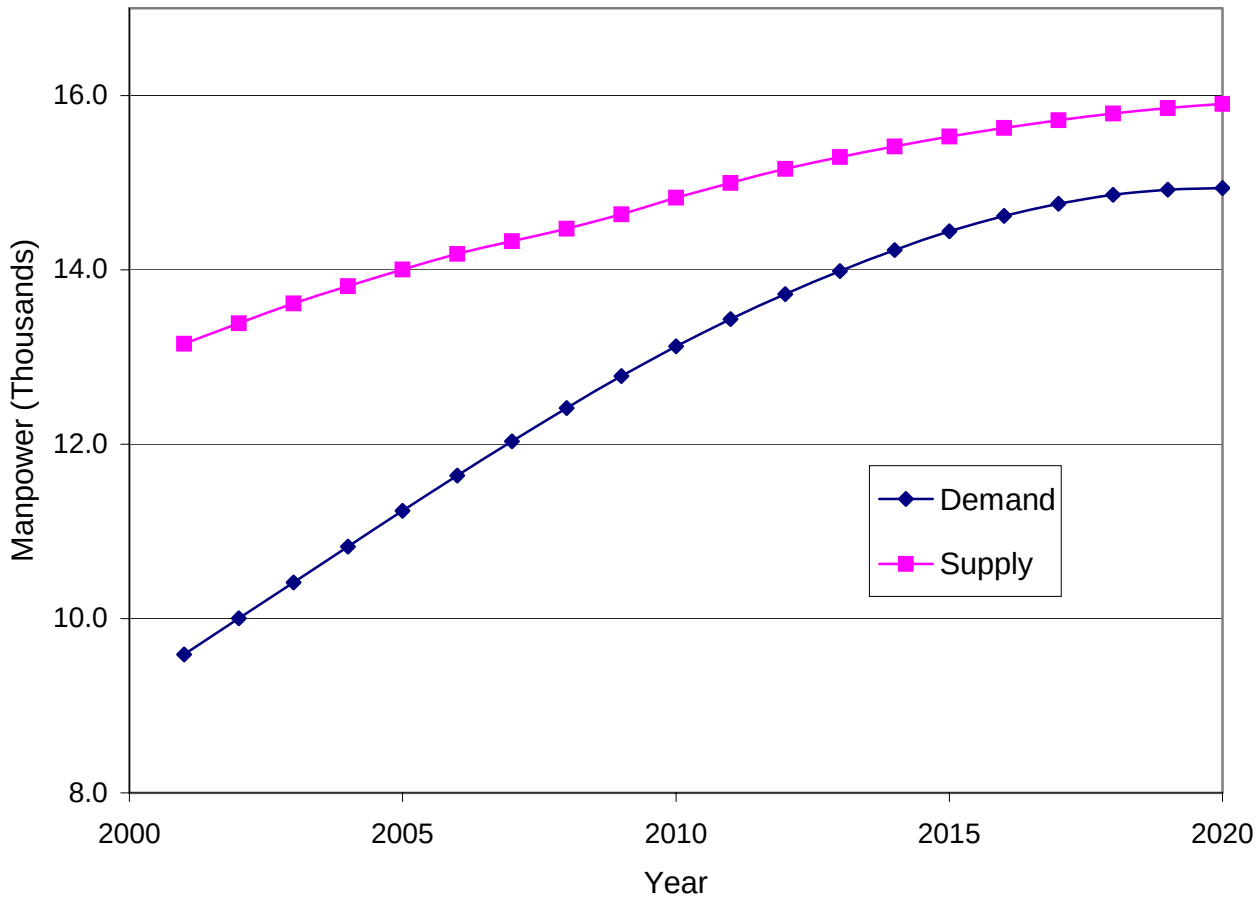

Figure 3: Supply and Demand of Manpower

The annual supply-demand gap, declines from 27.1 per cent in 2001 to A minimum of 5.93 per cent in 2019 and there after registers a slow growth to 6.1 per cent in 2020 (Figure 4). In absolute numbers the gap reduces from 3562 in 2001 to the minimum of 933 in 2018 and then increases to 966 in 2020. This increase in the supply-demand gap towards the tail end of the simulation period reflects the cyclic behaviour of the supply and demand sub-sectors, i.e., with increased demand (reduction of the gap) supply (intake) increases resulting in increased supply-demand gap in latter years i.e. during 2018-2020. During this period annual intake would go up by about 14 per cent, whereas the outturn will increase by 20 per cent. Correspondingly, the dropout rate reduces from 26 to 22 percent. This is because of increased interest in the courses due to improved employment opportunity.

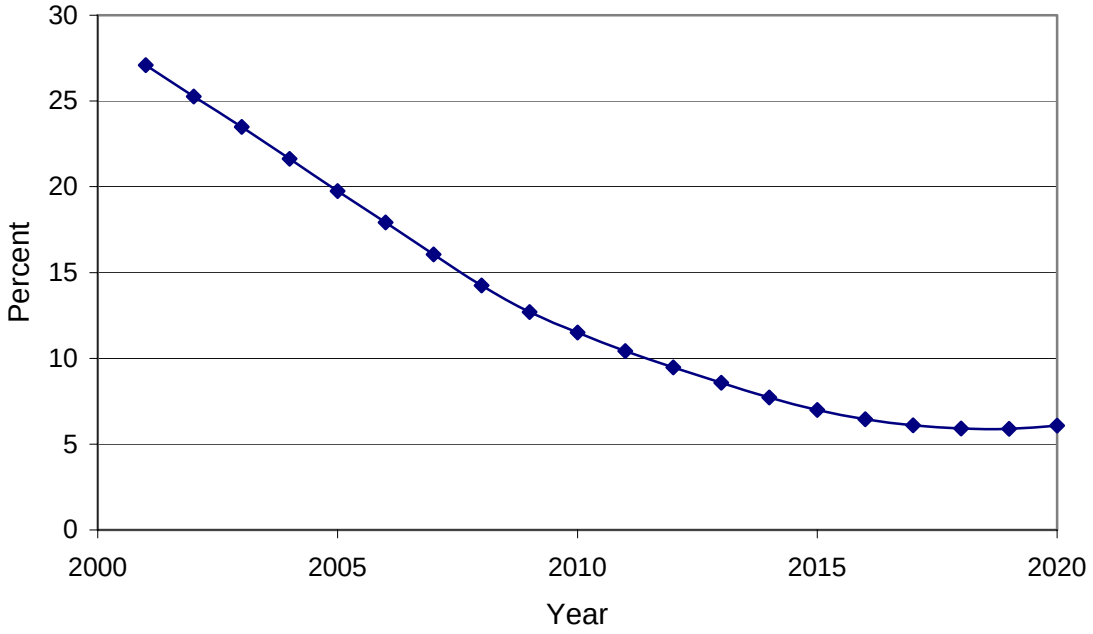

Figure 4 : Ratio of Annual Supply and demand gap to Supply

Stock of Agricultural Human resource

Both the total and the employed stock of agricultural human resource is shown in Figure 5. The total stock increase from 290 thousands in 2001 to about 474 thousands in 2020 out of this nearly 380 thousands will be employed, leaving about 20 per cent unemployed. These estimates are comparable with the projections made by other similar studies (Table 4).

Table 4: Projected Total stock of Agricultural Human resource

Sl No	Year	Total stock	
		Present study	IAMR
1	2001	289683	266716
2	2005	327484	313570
3	2010	376021	379755
4	2020	474307	--

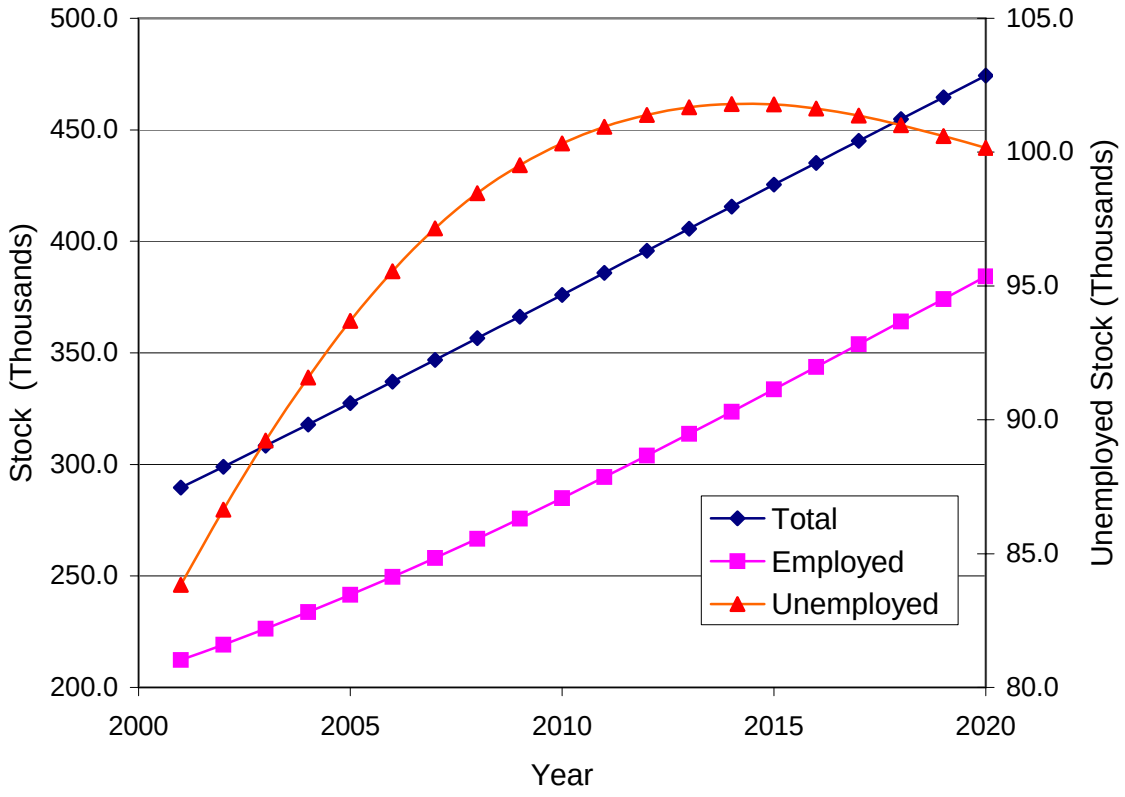

Figure 5: Stock of Agricultural Manpower

The unemployed stock accumulates to the maximum of 101.8 thousands in 2013 and declines gradually there after to a level of 100.2 thousands in 2020 (Figure 5). This variation follows the pattern of annual supply-demand gap reflecting level of annual unemployment. Even though the unemployment increases in absolute numbers till 2013, the overall unemployment ratio (ratio of unemployed to total stock) declines during this entire period from 28.9 per cent in 2001 to 20.6 per cent in 2020 (Figure 6). Figure 7 depicts the composition of employed stock in various sectors of employment. The Private sector comprising of fertilizer, pesticide, seeds, agricultural machinery and processing industries will take-over government sector as major employers of agricultural human resource by 2007, and this sector accounts for nearly 42.1 per cent of employment by 2020 as against 24.6 per cent in government sector. Financial institutes follow these two sectors in terms of providing employment to the agricultural human resource. With reducing job opportunities in government and academic sectors, graduates would opt for employment in other sectors.

Private sector would become major employment creation source and, hence, it would keep reducing unemployment at rather slow rate.

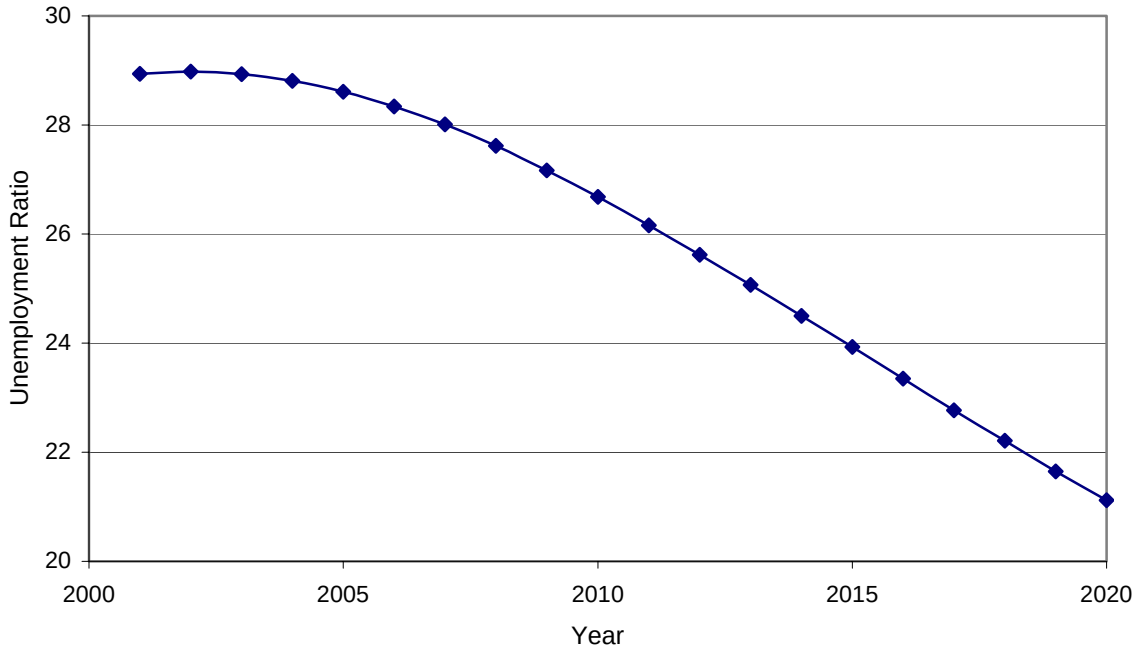

Figure 6 : Overall Unemploment Ratio

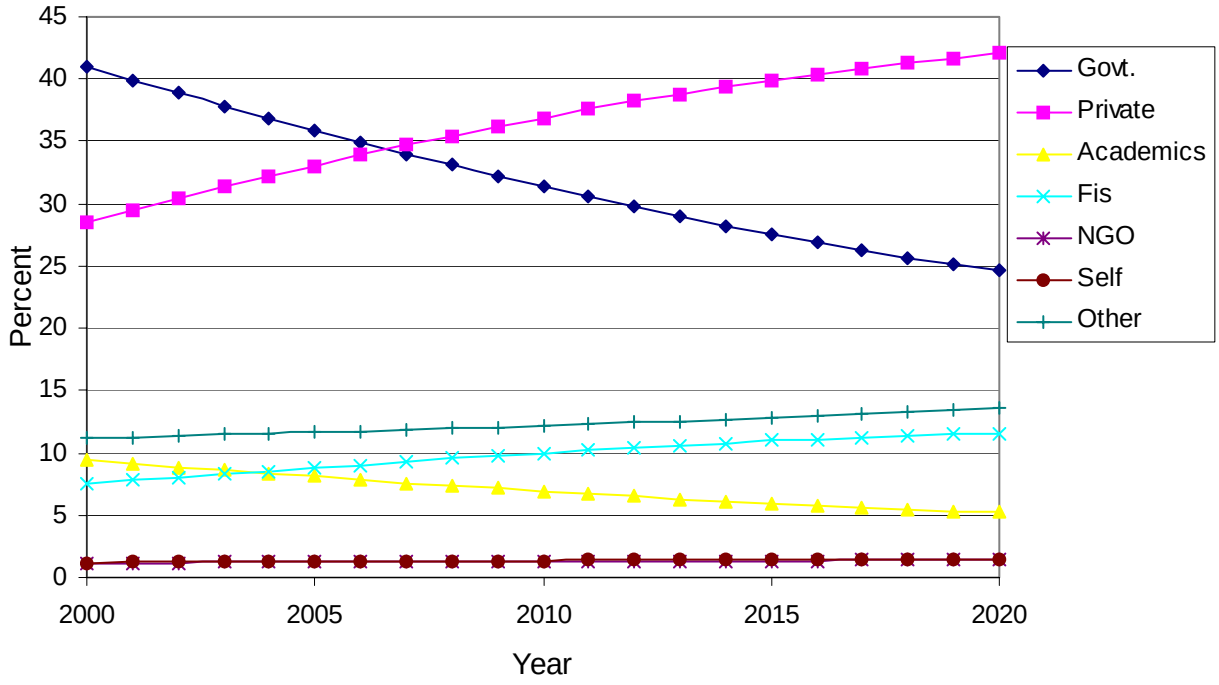

Figure 7: Composition of Employed Stock

CONCLUSION

A system dynamics model is developed to analyze the supply-demand scenario of human resource for agricultural sector. The model results were compared with the actual values and validate the efficacy and relevance of model simulation to depict the reality. The future scenarios on employment were generated. It is observed that non-government sector, private corporate sector in future will emerge as major employer for agricultural human resource. The boom in IT and Computer related fields is driving Companies to accept students with more soft skills. The industry is asking for a mix of 60:40 (technical:soft) skills as compare to the current 80:20 curiculum. They can be tested with this model.

The interpretation of education as a factor of production was well recognized by policy makers and human resource planners (Williems, 1996). The interventions in Education at specific levels and of specific types (like soft skills) can boost the quality of the human resource, inturn output of the various sectors employing them. This means that the educational level and composition of the labour force is a determinant of the economic growth and hence it is important to understand the relation between the educational structure of the workforce and the economic targets. The simulation models for educational or human resource planning have great potential in this type of enquiry.

The results show that a variety of future scenarios can be generated. This would be of interest to educational planners and deans working on new curriculum to improve the employment opportunities. Such simulation modeling can help in formulating educational strategy by designing various policies and analyzing their long-term effect.

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