Information Systems Planning: Indian Railways Experience

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ABSTRACT

The focus of this study is information systems development in the Indian Railroads performing in the ambit of the government sector and the concomitant pressures. It tries to address the relationships among work systems and Information Systems in order to understand the priorities of work systems where Information Systems can be developed with minimum inputs.

Keywords: Indian Railroad, work systems, information systems

1. Introduction

An efficient railway system is essential for the economic health of the nation. The railways weld the different parts of the country together, transporting its armed forces, providing postal services, and is therefore instrumental in the industrial development of India, carrying the raw materials like petroleum, coal, fertilizers, cement, steel and food grains. Railways are the main mode of communication for the citizens and goods of this vast country, which is 3,287,590 square kilometers in area with a population that is in excess of one billion. Indian Railways is an organization with a history of 150 years.

At its peak the share of Railways in the freight segment was a high of 88 per cent, which has decreased to less than 33 per cent now. The market share of the Railways in the passenger traffic has also fallen sharply, from 72 per cent in 1950-51 to 16 per cent by 1998-99. Currently the market share of Railways in the passenger traffic is 72 percent in and freight traffic is 33 percent. The Railways has not been able to stand its ground and is losing out to the road sector, in the main segment and to air in the premium segment.

Industrialization and further post industrialization there have been major changes in the freight movement pattern of bulk commodities like coal, cement, fertilizers, and steel, POL (petrol, oil & lubricants). The average lead of these commodities is reducing. Further there is a lateral shift of this reduced lead is to the road. Another result of the deregulation of the road and air segment is the improvement in the efficiencies of the road and air sector vis-à-vis the Railways and further erosion of its market share. Improvements in technology have had another outcome albeit an indirect one. It has rendered large workforce redundant in the organizations .A mechanism that has been effectively used by organizations to respond to the change in their environments worldwide has been utilization of Information Technology.

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The Information systems (IS) development in the Indian Railways started in the early 1960's. This was much ahead of its contemporaries. However the development of IS in IR has not kept pace with the developments in the field of IT over time. It is, a general observation that technology deployment does not keep pace with technology development. The same holds true for 'Information Technology.

Indian Railways has implemented two enterprise wide information systems. The online passenger reservation system – Country Wide Network for Computerized Enhanced Reservation and Ticketing (CONCERT) and the Freight Operation Information System – (FOIS), that is geared, to track the entire freight rolling stock of the Indian Railways. But for an organization the size of Indian Railways, the level of IT use is minimal. Rudimentary applications like payroll, inventory and accounts are the only ones that have been computerised.

The two enterprises wide Information Systems do not even scratch the shell of the organism - Indian Railways. The online passenger reservation system, CONCERT deals with the customer interface of providing reserved accommodation to passengers of Indian Railways. The FOIS is an information system that manages the various operational aspects of freight movement across the organisation. A further evaluation of the above information systems would reveal that none of the information systems tackles the core organisational areas of concern for Indian Railways, like line capacity, maintenance of the assets of IR, the maintenance schedules of the assets, fuel and energy efficiency, material procurement, project management, production units, human resources development. The IS also does not tackle areas that are of crucial importance to IR - like employee productivity, skills and training. In view of above, there is a scope for, a larger, more comprehensive and a strong case for implementation of Information Systems across the Indian Railways that include the above aspects.

The relationship between Organizations and Information Systems needs to be explored in the Indian context. Specifically, the Indian Railways, which is a large, government, service organization. Although the external threats are important the greatest threats to the Railways are internal. The Railways operate under a centralized command system with minimal responsibility to managers and imposes little commercial accountability.

The main threat facing Indian Railways is an outdated production led organizational structure. In addition the railways have a very weak system of keeping track of interdepartmental organizational events. The management information systems, cost accounting practices and business planning systems are also gray areas, which need to be tackled. The Railways is one of the most efficient arms of a largely bureaucratic government. The Indian Railways is one of the nation's oldest institutions and has a high component of 'public service obligation' in its goal. In addition the it has the largest single unionised work force in the nation. The information systems development in Indian Railways needs to be studied in such a milieu.

2. Data Collection and Analysis
Indian Railways has a large assets base and a large workforce. Both are dispersed across a big geographical area. Hence large resources are required to develop and implement information systems in such an organisation. This requires a clear focus and a sustained effort without which the resources allocated for information systems development can easily be lost in organisational inertia because of thin spread of the resources over many information system development initiatives. Therefore there is a need to conserve the resources – monetary, infrastructure and manpower of the organisation allocated for information system development and sustenance and use them efficiently. Situation analysis is an important stage in information systems planning. In situation analysis the current environment of the organization can be analyzed using any of the following methods: - (i) Analyzing current business systems (ii) Analyzing current organizational systems and (iii) Analyzing current information systems (Newkirk and Lederer,

2006). The aim of this study is to identify work systems in which information systems can be developed in such large organisations.

According to Alter (1999) the work system – a term used by him in IS literature, offers a better vantage point for studying an information system (Figure 1). The work system is defined as a system in which human participants and/or machines perform a business process using information, technology, and other resources to produce products and/or services for internal or external customers. Organizations would typically contain multiple work systems and operate through them.

Twenty-two work systems were studied in the survey questionnaire. The selection of work systems was based on the recommendations of the Work Study Group (1977) that was formed to advise a methodology for EDP development in the Indian Railways. Responses were elicited on a three-point scale as to the necessity of information systems in these work systems. The responses were analysed using factor analysis using Principal Component Analysis followed by Promax rotation. This methodology is useful in categorization of the work systems into various groups to provide better insight for development of information systems as per the grouping.
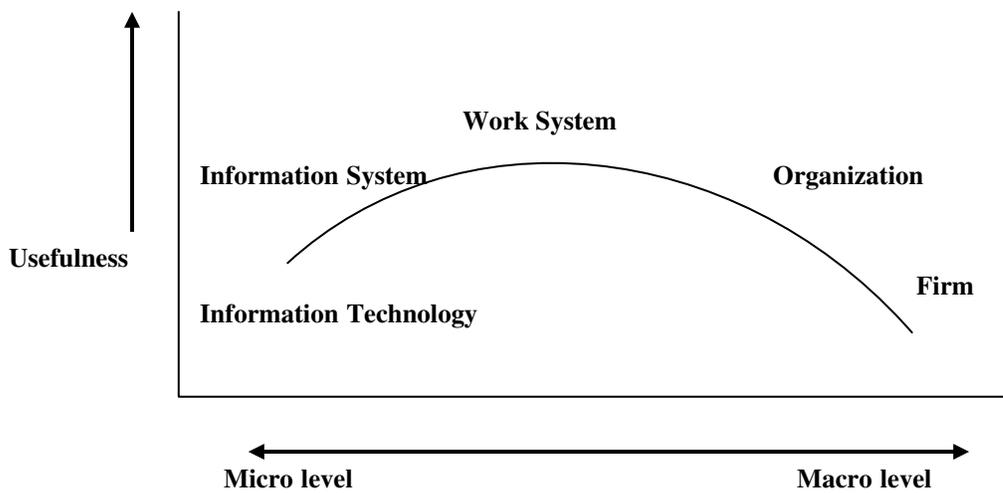
(Source: Steven Alter, 1999)

Figure 1: Relationship of Work Systems To Information Systems

Out of 22 work systems (WS) 17 WS have a mean score greater than 2 (On a scale of 1 to 3). The above indicates that the organisation is favourably disposed for IS development. Five categories of work systems emerged after a factor analysis of the above data. The five most important work systems in the study highlight the concern in the organisation for development of information systems in work systems that have a direct bearing on the operations function of the organisation like punctuality, control room applications, customer service requirements and safety.

The data was subjected to factor analysis. Eigenvalues of the components were plotted on a Scree plot (Figure 2). Five components with eigenvalues greater than one were extracted as factors. As per the above analysis five factors emerge. The loading of the components on the five factors is depicted in the structure matrix (Table 2).

Table 1: Ranking Of Work Systems for Development of Information Systems

S No	Work Systems	Mean	S No	Work Systems	Mean
1	Material Procurement	2.36	12	Fuel Efficiency	2.15
2	Punctual Operations	2.36	13	Manpower Productivity	2.11
3	Material Planning	2.34	14	Costing Procedure	2.09
4	Control Room Applications	2.29	15	Efficiency Of Assets	2.08
5	Customer Service Requirements	2.28	16	Reliability Of Assets	2.04
6	Safe Operation	2.26	17	Quality Of Products In Intermediate Stages	2.02
7	Training Of Employee	2.24	18	Office Collaborative Working	2.01
8	Support Activities	2.24	19	Business Process Reengineering	1.99
9	Servicing Employee Requirements	2.23	20	Creation Of Assets	1.91
10	Accounting Procedures	2.20	21	Financial Approval Procedures	1.89
11	Material Distribution	2.16	22	Creation Of Posts	1.85

The factors have been classified as Work Systems (i) (For) Operations, (ii) Directly supporting Operations (iii) Not directly supporting Operations (iv) (For) Planning and (v) Material Planning and Procurement
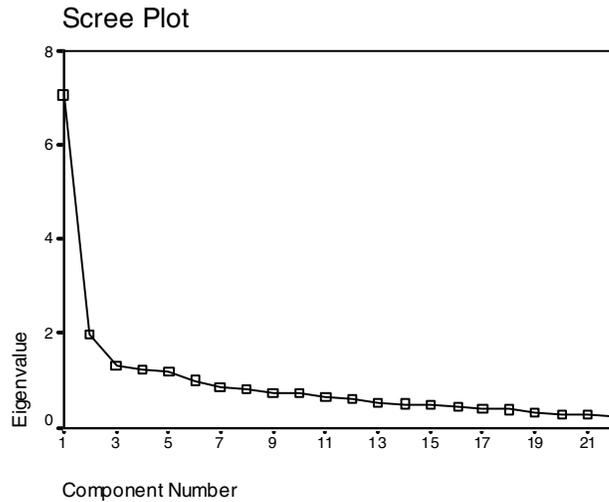

Figure 2: Extraction of Factors: Work Systems and Information Systems

(Table 2). Operation is the core function of the Indian Railways. Therefore as expected the work systems that are in the ambit of operations emerge as a factor in the factor analysis. Thus work systems for operation are crucial for implementation as per the survey.

Another category of IS that have emerged as critical to the Indian Railways are those pertaining to material planning and procurement. The above highlights the concern in the organisation for availability of material inputs for running of operations as also the fact that material inputs for the Indian Railways have a direct bearing on the safety and punctuality for running of trains. This category of information systems has the highest priority for development in the organisation (Table 3).

The work systems directly supporting operations are next in priority for development of information systems. These are material distribution, servicing employee requirements, accounting procedures and training of employee. The group of work systems that do not directly support operations are next in the priority for development of information systems. These include office collaborative working, financial approval procedures, efficiency of assets, manpower productivity, reliability of assets, quality of products in intermediate stages, business process reengineering. Work systems pertaining to planning which are creation of posts and creation of assets are lowest in the priority.

Table 4: Structure Matrix- Factor Analysis of Work System

S No	Work Systems	Comp 1	Comp 2	Comp 3	Comp 4	Comp 5	Mean	Overall Component Average
WS Indirectly Supporting Operations								
6	Business Process Reengineering	0.72	0.37	0.21	0.36	0.26	1.99	
5	Manpower Productivity	0.66	0.38	0.10	0.25	0.12	2.11	
1	Costing procedure	0.65	0.39	-0.02	0.08	0.54	2.09	
12	Efficiency of Assets	0.64	0.57	0.16	0.47	0.35	2.08	
7	Financial Approval Procedures	0.64	0.06	0.43	0.32	0.15	1.89	
17	Reliability of Assets	0.60	0.61	0.00	0.49	0.40	2.04	
22	Quality of Products in Intermediate Stages	0.58	0.16	0.31	0.47	0.48	2.02	
18	Office Collaborative Working	0.53	0.36	0.45	0.26	0.28	2.01	
								2.03

Table 3: Classification of Work systems and Priority of IS

Work Systems Classification (Factors)	Work systems	Overall Factor Average
Material Planning & Procurement WS	Material Procurement, Material planning, Vendor Support Activities	2.31
Operations WS	Punctual Operations, Safe Operation, Fuel Efficiency Customer	2.27

	Operations WS							
15	Punctual Operations	0.45	0.71	0.32	0.44	0.39	2.36	
11	Safe Operation	0.55	0.66	0.35	0.45	0.38	2.26	
16	Fuel Efficiency	0.55	0.65	0.14	0.42	0.49	2.15	
14	Customer Service Requirements	0.19	0.62	0.18	0.06	0.11	2.28	
3	Control Room Applications	0.32	0.62	0.43	0.08	0.47	2.29	
								2.27
	WS Directly Supporting Operations							
10	Training Of Employee	0.10	0.34	0.72	0.28	0.17	2.24	
13	Accounting Procedures	0.41	0.37	0.66	0.27	0.33	2.20	
4	Servicing Employee requirements	0.30	0.31	0.61	0.01	0.44	2.23	
21	Material Distribution	0.31	0.03	0.54	0.23	0.42	2.16	
								2.21
	Planning WS							
8	Creation of Assets	0.42	0.23	0.19	0.82	0.21	1.91	
9	Creation Of Posts	0.32	0.29	0.19	0.81	0.17	1.85	
								1.88
	Material Planning & Procurement WS							
2	Material planning	0.21	0.25	0.19	0.14	0.78	2.34	
19	Material Procurement	0.19	0.22	0.50	0.19	0.67	2.36	
20	Vendor Support Activities	0.31	0.42	0.49	-0.06	0.61	2.24	
								2.31

	Planning WS	Creation Of Posts, Creation of Assets	1.88
		Service Requirements and Control Room Applications	
WS Directly Supporting Operations		Material Distribution, Servicing Employee requirements Accounting Procedures, Training Of Employee	2.21
WS Indirectly Supporting Operations		Office Collaborative Working, Financial Approval Procedures, Efficiency of Assets, Manpower Productivity, Reliability of Assets, Quality of Products in Intermediate Stages, Business Process Reengineering	2.03

3. Concluding Remarks

An alternative method for situation analysis is used in the study based on analysis of work systems in the organisation. The results of the study are in consonance with the development of information systems in the Indian Railways in the present context and other organizations can also use the work systems approach to select information systems for development in their organizations.

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