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MULTIPLE PERSPECTIVE THROUGH MULTIPLE ANALOGY

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Abstract

This paper proposes a new method for developing multiple perspectives through use of multiple analogies . Majority of the challenges /opportunities in Railways cannot be categorized into disciplinary boxes, developing the capacity to synthesize knowledge from multiple perspectives, to capitalize on distributed expertise, integrating insights becomes essential for optimal solutions . The method and its practice is described in paper .The technique has led to a number of ideas in the areas of challenges and opportunities facing Indian Railways . The paper concludes with a exploration of possibilities of application of the method to other areas like road mapping , scenario building , technology forecasting and business environment analysis.

1.Introduction

Railways are a multidisciplinary organization requiring specialized inputs from many disciplines such as Mechanical Engineering , Electrical Engineering , Communication Engineering , Civil Engineering , Finance , HR ,Safety ,Marketing etc . Majority of the challenges /opportunities in Railways cannot be categorized into disciplinary boxes, developing the capacity to synthesize knowledge from multiple perspectives, to capitalize on distributed expertise, integrating insights becomes essential for optimal solutions . This paper proposes **a new method for developing multiple perspectives through use of multiple analogies** . Application of the method for generation of ideas for areas of concerns to Indian railways is detailed and the results are discussed . The paper concludes with a exploration of possibilities of application of the method to other areas like road mapping , scenario building , technology forecasting and business environment analysis .

1.1.Contents

- Railway industry at inflexion point
- Training is the critical tool for performance enhancement
- Objectives of programme on innovation through creativity
- Multiple perspective
- Need for multi perspective

- Advantages of the multiple perspectives approach
- Enhancing mental models
- Multi- and interdisciplinary and interdisciplinary Perspective through analogy Forced analogy
- Methodology for generating multiple perspective through multiple analogy
- Application of the technique at railway staff college for generating perspectives and ideas.
- Outputs
- Applications

2. Railway industry at inflexion point

Railway industry at inflexion point and is poised for revival due to its frugality in utilization of important resources like energy and land , growing concerns about environmental issues. Future railways to be different from past as it responds to major technological developments , economic and social challenges . Number of stakeholders is getting wider and larger necessitating inputs from varied stakeholders . To bring about transformational changes railways need to become innovative taking into consideration concerns of Multiple stakeholders

2.1.Vision 2020 of Indian Railways

As per Vision 2020 Gross Revenue of the Indian Railways has remained at a level of around 1.2% of India's GDP over the last 10 years this has to be increased to 3% by 2020 .[1] The next decade is

going to be characterized by technological change , economic growth , manpower constraints and increasing   customer   expectations . Emerging paradigms in training and learning like E-Learning . Gaming   based Learning customized learning offer opportunities to increase impact of training to meet the managerial   and technological challenges. It is imperative that the managerial resources of Indian railways perform at their best through potential enhancement and realization . Only   Training can enable the managerial cadre to accomplish the challenging tasks . [2]

2.2.Training For Performance Enhancement

Training is the critical tool for performance enhancement through up gradation of knowledge and skills . Railway Staff College offers training courses for officers of all disciplines and all grades right from Probationers to prospective General Managers. Around 2500 officers   are   trained annually.   In addition to Officers of Indian Railways officers of many Afro-Asian countries , Public Sector Undertakings ,Probationers   and other   officers   of Central Services like Indian Revenue Services Indian Police Service also undergo training here. [3]
Sessions on innovation and creativity are integral part of management programmes conducted at Railway Staff College [4]

2.3.Programme   on   Innovation   Through Creativity

The   purpose   of program on INNOVATION THROUGH   CREATIVITY   is to enhance the innovative   capability of senior managers of Indian Railways. The   programme takes   an outside in approach to develop   multiple perspective on challenges   and   identify ideas for conversion to innovations to meet major challenges.

2.4. Need for Multiple perspectives

Railways   is   a multidisciplinary organization requiring   specialized inputs   from many disciplines such as Mechanical Engineering , Electrical   Engineering   ,   Communication Engineering , Civil Engineering , Finance , HR ,Safety ,Marketing etc . Majority   of   the challenges /opportunities in Railways cannot be categorized   into disciplinary boxes, developing the capacity to   synthesize knowledge from multiple perspectives, to capitalize on distributed expertise, integrating insights becomes essential for optimal solutions .

2.5.From Single   to Multiple   Perspective Approach

A single perspective image represents the spatial relationships of objects in a scene as they appear from a single viewpoint. A multi-perspective image combines several viewpoints into a single context [5]   The Multiple Perspectives approach to problem solving was   introduced by Mitroff and

Linstone [6] It was based on what they call unbounded systems thinking, integrating   as many perspectives as possible on a situation when analysing it. The multiple thinking process creates a powerful platform for divergent perspectives to come together. The result is an expansion of an organization's   peripheral vision **.**

2.6.Outside-In Thinking

In today's world of accelerating change what's born on the edge can transform the core with breathtaking speed . Organizations ignoring   the edge will find their core markets and capabilities under attack from edge players who can deliver more value at lower cost.[7] .Most individuals   and   organizations   are   surprised   by discontinuous events because they   spend their time thinking about what they are most familiar with: their own field or organization. They think from the inside—the things they can control—out to the world   they would like to shape. For an   organization   responding to needs as they emerge, the realm of control is very narrow, as is the organization's peripheral   vision—making it highly vulnerable to blindsiding. Conversely, thinking from the outside-in begins with cognizance of external changes /trends that might have   profound affect work i.e a geopolitical shift that could introduce unforeseen social needs. Outside-in thinking can help organizations anticipate and prepare for surprising eventualities. Outside-in thinking can inspire more open and imaginative thoughts about a range of potential changes and strategies that may not have been visible otherwise. Outside-in thinking is so important because it takes   one out of one's immediate reality.

3. Analogy

Analogy   acts as an provocation for starting a new stream of thoughts and generation of new ideas .The anecdotal   reports   of   creative   scientists   and mathematicians suggest that the development of a new theory frequently depends on noticing and applying an analogy drawn from a different domain of knowledge. [8]. Analogy acts as a stimulus to generate new concepts and solve design problems. It can trigger breakthrough ideas [9]

The technique of Analogy consists of transferring of insights /essence from a source domain to a target domain by a process of mapping between source to target. The modeling of a source domain abstracts its structure and relationships .In the field of design during the idea generation phase the   design team get inspirational products to focus on. They analyze the product and translate aspects of the product in their own context. The name 'product crossing' is inspired by the term 'plant crossing'. Plant crossing is the art and science of combining properties of two plant species to create a new variety. In 'product crossing' designers combine aspects from the inspirational product to their own design and create a 'new' product .

Sr. No.	Source domain	Target domain
1		
2		
3		
4		
5		

Table 1 Mapping source to target domain

3.1.Multiple Perspective From Multiple Analogies

Mapping of single source domain to a target domain has been extensively used for idea generation however there is little information available on generating more than one inference from a single analog or on the use of multiple analogs. [10]. Multiple analogies mapping onto a common target is the technique developed and practiced by the author . A source domain model is chosen and represented by its key determinants. During the mapping features of structure and relationships are transferred from source domain to target domain. The uncommon elements and structural relationships uncover many hitherto unknown aspects of target domain and illuminate new perspectives .Analogies are special models which externalize the relationships and processes embodied in the actual phenomenon leading to generalized relationships and processes. The process is repeated for multiple source domains. Superposition of multiple analogies from fields of economics , art, sports, politics , warfare culture ,media , industry , sociology , cultural anthropology, psychology ,mathematics, physics, computer science, engineering, biology etc, leads to multidisciplinary model having multiple perspectives.

The method takes forward the technique of analogy by using several source domains instead of one overcoming the limitations of any one source . Different model for same phenomenon shows new interconnections and dynamics by removing the constraints under which the phenomenon was being studied encouraging flexibility In aircraft development, the project engineer, the aeronautical engineer, the electronic engineer, the engine builder, the interior designer, and the market analyst all look at the same aircraft using distinct perspectives. Representing different disciplines, they use different models and data.

Functional fixedness, involves restricting source domains to contiguous or related phenomenon inhibiting creative processes and leading to ideas with lesser chance of originality and novelty . [11] Analogies used to facilitate multiple perspectives range from familiar to strange .The potential for creative insights seems highest when the source domain is very distant to target domain Research by Chan shows positive effects of analogical distance on novelty and n quality of solutions. Classic accounts of

creative discoveries and inventions often highlight the potential of far-field analogies for creative insights, including George Mestral's invention of Velcro via analogy to burdock root seeds, and Niels Bohr's discovery of the structure of atoms via analogy to the solar system. [12] Empirical work has also supported a link between far-field analogies and innovative outcomes. For instance, it has been shown that the number of far-field analogies used by designers during ideation is positively related to the originality of proposed solutions, as rated by a sample of potential customers . Distant analogies promote outside in thinking considered essential for environmental mapping and strategy making process of any organization . [13]

The original source domains are therefore encouraged to be distant provoking originality and outside the box thinking . The technique proposed by the author combines the advantage of novelty and originality of ideas provided by distant analogies while simultaneously ensuring convergence through the artifact of intermediate domain .

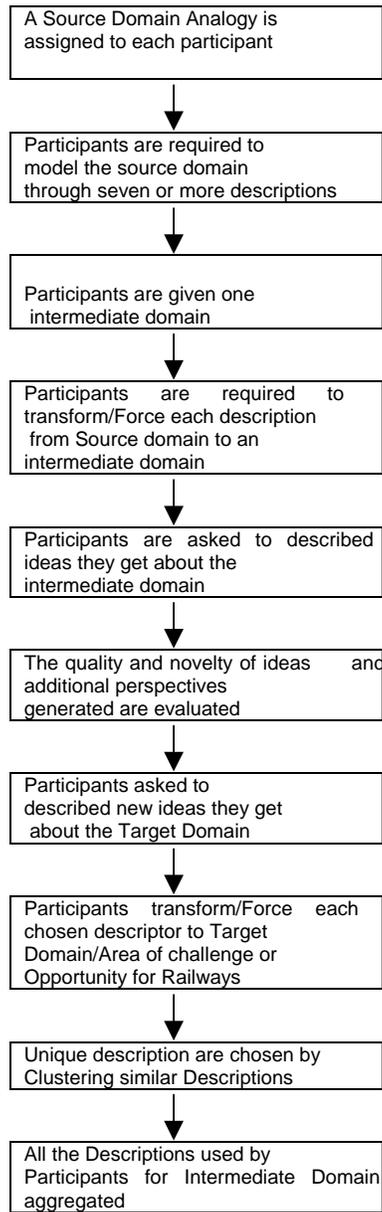| 1	Solar System
2	Google
3	IPL
4	Diwali
5	Antakshari
6	Civil Disobedience movement
7	Monsoon
8	Tsunami
9	United Nations
10	Global Warming
11	Nano
12	I Phone
13	Facebook
14	Ganga Yamuna
15	Mother Teresa
16	Surgery
17	3 idiots
18	Lage raho Munna Bai
19	Camera
20	Diamond

Table 2 Multiple Source Domains

4.METHODOLOGY OF MPMA TECHNIQUE

The participants first transfer determinants of source domain to intermediate domains which is similar to the challenges faced by Indian Railways . In this step the process of mapping of determinants is externalized and a model is created for process of

mapping and transferring of essence while mapping elements from   source domain to intermediate domain .A   model is created for near analogies which have relevance to the target domain . Thus the intermediate   analogy plays the role of facilitator of   structure and relationship mapping

 Fig-1-Methodolody   for   Multiple   perspectives Through Multiple Analogies

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┌─────────────────────────────┐
│ A Source Domain Analogy is   │
│ assigned to each participant │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│ Participants are required to │
│ model the source domain      │
│ through seven or more descriptions │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│ Participants are given one   │
│  intermediate domain         │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│ Participants   are   required   to │
│ transform/Force each description │
│  from Source domain to an    │
│ intermediate domain          │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│ Participants  are  asked  to  described │
│ ideas they get about the     │
│ intermediate domain          │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│ The quality and novelty of ideas   and │
│ additional perspectives      │
│ generated are evaluated      │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│ Participants asked to        │
│ described new ideas they get │
│  about the Target Domain     │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│ Participants   transform/Force   each │
│ chosen descriptor to Target  │
│ Domain/Area of challenge or  │
│ Opportunity for Railways     │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│ Unique description are chosen by │
│ Clustering similar Descriptions │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│ All the Descriptions used by │
│ Participants for Intermediate Domain │
│ aggregated                   │
└─────────────────────────────┘
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 .
 The participants are exposed to the concept of description of   source   domain   by   seven descriptors . The purpose of this step is to abstract a model of the source domain . This step decontextualizes the   source domain . The   participants are   unconstrained   and cognitively positioned outside the box. They are then required to   force   fit descriptors   to intermediate   domain   .   This   step

recontextualizes   the abstracted to   an intermediate domain . Many new insights are normally discovered at this stage.

	Intermediate domains
1	Increase speed of city traffic
2	Capacity enhancement in health delivery
3	Leapfrogging to a higher growth trajectory of wate transport
4	Value added services in mobile phone industry
5	Creating intellectual capital property from India's research organizations
6	Reduce energy consumption for lighting and cooling
7	Leveraging potential of it and communication technology in education
8	Encourage healthy life style
9	Making organized retail trade profitable
10	Leveraging India's demographic dividend

Table 3 The Intermediate Domains

 The next step is to transfer the descriptors to the target domain . The target domain is normally an area of concern or of value to the organization . Many new insights and attributes hitherto unknown are normally revealed /discovered at this stage.

5.Target Domain

Innovation opportunities in rail sector

 Spanning over 64,000 km, IR is one of the world's largest carrier of passenger and freight. Currently, over 35% of total freight traffic and about 20% of passenger traffic is transported by IR. The organization faces several challenges which need to be addressed on priority,challenges are   opportunities for innovation . Following are the key challenges being faced by IR.[14]

5.1. Capacity Constraint

 Major capacity constraints are: saturation of routes in areas where demand is fast growing; slow moving freight trains; lack of high capacity locomotives and (fixed) infrastructural constraints in hauling more freight; and passenger train speeds that are much lower in comparison to advanced countries. Indian Railways has to expand its network at a fast pace to connect far-flung areas of the country especially the hilly regions, in the

north east and areas totally isolated or inadequately connected to the railway network.

5.2.Reliability of Assets

Failures in track, signals and rolling stock affects the overall efficiency of railway system. The impact of such failures is particularly severe on high traffic density routes. So, improving the reliability of these critical assets is a continuing challenge.

5.3. Safety

Safety performance of IR has been showing a steady trend of improvement. But with the passage of time, tolerance of the nation towards railway accidents, particularly accidents leading to fatalities/ injuries is falling at a rapid rate.

5.4. Slow Speeds of Trains

The speeds of goods train as well as that of passenger trains on Indian Railways are not up to the levels on which railways of developed countries are working. One of the major constraints in train operation is the large differential of speed between freight and passenger trains which both move on the same track.

5.5 Door to Door Supply Chain Management System

IR have done very little to provide integrated transport solutions i.e. door to door service. This problem can be overcome by forging partnerships with private service providers and establishing large logistics hubs. Similarly, close attention to passenger services including the provision of information technology to provide passenger information and value-added services such as booking of taxis and hotel services prior to and after the railway journey, would greatly enhance the attractiveness of rail travel.

5.6 Enhancing Carrying Capacity

On IR, the passenger as well as freight traffic demand continues to rise. Optimal use of maximum moving dimensions will need to be examined.

5.7 Redevelopment of Railway Stations

The railway stations located in major metropolitan cities individually handle more passengers than the numbers handled by all airports of the country put together. But these stations are inadequately designed and ill equipped to handle such a large number of passengers. The stations do not provide easy access or comfortable experience prior to boarding or after disembarkation from trains. Street-level access is generally restricted to one or two end-platforms (except at terminal type of station layouts). Inter-platform connectivity is through foot over-bridges which are not passenger-friendly and often inadequate for large numbers of

passengers. Good-quality waiting space and modern shopping or retail outlets pertinent to passengers' needs are largely absent. Incoming and outgoing passengers are not segregated at platforms. Platforms are also used for parcels, so that floor space for passengers gets reduced. Similarly, catering stalls occupy part of the already limited space on platforms. This leads to severe congestion on platforms. In addition, lack of hygiene and cleanliness on part of the traveling public as well as absence of a sustainable waste management system means that our major stations are far off from being environmentally appealing places. Besides these functional inadequacies, most of the stations have not been built with any architectural or aesthetic consideration and as a result, these serve as a poor introduction to the cities they serve.

	Intermediate domain	Target Domain
1	Increase speed of city Traffic	Increase Speed of freight trains
2	Capacity enhancement in health delivery	Capacity enhancement in railways
3	Leapfrogging to a Higher growth trajectory of Water transport	Leapfrogging To a higher Growth Trajectory in railways
4	New and novel value Added services f for mobile	New and Novel value Added services for railways
5	Creating intellectual Capital property from India's research organization	Monetization Of assets
6	Reduce energy Consumption for Lighting and cooling	Optimizing Energy usage
7	Leveraging potential Of it and communication technology in education	Door to door Supply Chain Management System
8	Encourage healthy life Style	Safety in Train Operations
9	Making organized retail trade profitable	Redevelopment of railw stations
10	Exploiting demographic dividend	Leveraging human resources

Table 4-Relationship between intermediate and Target Domain

Average size of group	Number of Source domains	Number of Intermediate domains	Number Target domains	Average number of ideas Generated per Target domain
35	20	10	10	

Table 5 Application of the technique at railway staff college for generating perspectives and ideas

6. Notable Ideas generated through the application of the technique at Railway Staff College India

1) Value added services

2) Utilization of OD capacities through alternate routes and network
3) Multimodal hub-and-spoke multimodal transportation models for passengers as well as freight.
4) Enable seamless transfer, through strategic partnerships and alliances.
5) Leverage presence across the length and breadth of the country for delivery of additional services like banking , service centres .
6) Customer loyalty card(Optimizer) that offers additional benefits and bonuses (from Indian Railways as well as partners) to customers, and can serve as a debit or credit card.
7) Mobile based ticketing and validation systems for all sales, integrated with information database to optimize seat availability.
8) RO -RO , double stacking triple stacking
9) High speed freight trains
10) Device independent pervasive availability of Railway information Leveraging the full MMD.
11) Improving availability and utilization of maintenance block s through technological and managerial innovations .
12) Satellite based ticketing and hand held Devices.
13) Regenerative braking on passenger coaches
14) Utilization of rubber wheeled vehicles on sections having low traffic for reducing track
15) Use of hovercraft for movement of material to mid section for repair and maintenance .

7 Conclusion

The technique has been used with over five hundred managers of Indian Railways and around Two thousand Engineering and management students .The result of application of the technique suggest that it is a useful method for generating alternative solutions for problems not only in terms of quantity s but also quality , novelty and variety of ideas . The technique has been applied by authors in the area of management education.[15] The technique has multiple applications in other areas like Business Environment Analysis, Roadmapping and Scenario Building .

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