



**Vision 2020:  
The Role and Scope of Operations Research Models**

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**W.P. No.2006-11-01**  
November 2006

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## Vision 2020: The Role and Scope of Operations Research Models

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### Introduction

In this theme article, we summarize the broad characteristics of Vision 2020 (a document which outlines the transformation process related to evolution of India as a developed nation by 2020) as envisaged by Dr. A.P.J. Abdul Kalam. We discuss the enabling role of our discipline related to this critical national (social) transformation process.

This theme article is organized in three segments. The first segment, which is drawn heavily based on the published work by Dr. A.P.J. Abdul Kalam introduces the salient features of Vision 2020 and a road map related to realizing this national dream. The second segment sketches the evolution of operations research as a scientific discipline in the international and Indian context. The third and final segment of the article relate OR tools and techniques that can facilitate the planning and implementation of several projects / activities / policies in the overall context of Vision 2020.

**Vision 2020: Goals:** In the developed India, every Indian citizen would have an enhanced quality of life. Developed India would have a 4% global GDP share from 1.67% (as of 2002). The population growth rate in developed India would reduce to 1.5% from 1.9% (as of 2002).

**Pre-requisites:** Achieving Vision 2020 would require unshakable commitment from the political leadership. It would require the active involvement and strong commitment of the general public, at a level compared to what was exhibited to achieve our independence. Vision 2020, planning and implementation should be integrated as a part of the national agenda and should be de-linked from the narrow political party objectives and considerations.

**Enablers:** Transformation of India to a developed country would require appropriate state of art technology interventions in all areas of Indian economy. The transformation process should create sustainable economic and social systems. It is possible to develop such systems only when social equity issues related to education, health and empowering rural India are completely and fully addressed. Developed India is possible only when the benefits of the development process percolate to all in India and in particular to the lower strata of the society.

**Operational Guidelines:** Rapid development of internal technological expertise, awakening the Indian psyche to stretch and motivate to achieve the development agenda, and a tenacious adherence to policy objectives are the key operational routes which would support this transformation.

Over a period of time, Indians have developed a mindset which inhibit them to accept new ideas (anywhere from the world), modify and/or develop them to suit our local requirements. This has evolved as a major handicap. Consequently Indians have developed a defeatist mindset. Anything foreign (product and services) is accepted as superior. This needs to change. If nations like USA, Europe, China, South Korea, Israel, Malaysia and Singapore can transform themselves as developed nations, why not India? What can we possibly learn from the experience of these countries?

We have abundant quantity of natural minerals and rich material. However, we lack the technology to convert them to value added products. We are dependent on international research and development to access innovative and / or new technology and its usage. The best solution to overcome this constraint is to connect industry, academia and the research laboratories. There is an urgent need to develop a funding framework which would generate funds, deploy them in this cooperative framework and monitor utilization with a focus on tangible outputs.

**Resources and Opportunities:** We have an appropriate mix and variety of chemical industries. We are endowed with a rich bio-diversity context. We need to take cognizance of these resources and use them efficiently to create wealth.

India has not taken full advantage of its manufacturing potential. There is a great opportunity to explore the home grown IT skills in specific manufacturing sectors. Service sector neglected so far would surely emerge as an important contributor to the wealth creation process in India by 2020. Growth in this sector would also accelerate the envisaged social transformation process. To respond to these opportunities, Indian society as a whole should need to unlearn a lot (past practices), learn rapidly new things, use new methods in learning, teach and share learnings among us etc.

**Business Model:** The Indian business model was export opportunity driven and import led technology based. Export led business activities reduced the realization. Import led technology added to the cost of technology. A combination of these two lead to low margin and slow growth rate. We need to break this business logic. We need to develop critical technologies internally. We need to pay attention to the huge domestic market, use this market access to create critical and viable volume. We need to prioritize and act on industrial sectors which are of critical importance to the Indian development process.

To support and accelerate the development process, we need to pay attention to social objectives as well. This would be in the areas of education and health. Health for all would be the primary social objective. We have developed an excellent health care infrastructure. However, our performance in health care delivery sector is highly skewed. The immediate need is to prevent infectious diseases, pre-natal care and disease based on mal-nutrition at younger age. Safe motherhood is an issue. Infant mortality is a major concern. To transform health care scenario in India, we need to aggressively explore public-private partnership for effective health care delivery. We also need to dramatically simplify the rules and procedures to support health care policy implementation. Broadly, the same analysis would apply to education. We produce the largest number of Engineers in the world. We also have highest primary school drop out rates. Illiteracy is the highest in India among developing nations. Quality of our primary and secondary education system has great potential for improvement.

## Vision 2020: A Road Map

The following broad steps may provide a road map to realize vision 2020.

- Improved administrative efficiency at all levels starting from Village Panchayat to Central Government. Administrative transparency and accountability would facilitate the progress towards efficiency.
- Convergence of technology and economic policy framework would facilitate the developmental process.
- The public sector units (based on technological competence and potential) should grow to ensure dominant global presence.
- Small and medium enterprises which contribute to 40% of industrial output and accounts for 18 million direct employment should be rejuvenated to support a developed nation.
- Activate and reenergize the Indian education system to play a pioneering and innovative role in the development process.
- Nationalistic pride should be renewed at all levels.
- The media and the teaching community should play a positive and important role.
- Concentrate effort on select core areas like agriculture, food processing, power generation, education, health, information technology and manufacturing industries in strategic sectors.

## Vision 2020: Implementation Stages

### Stage 1 –Enabling Social Infrastructure

At this stage, the following major social projects would be considered for implementation.

- Elimination and removal of poverty
- Basic health and hygiene for all (sanitation projects, safe motherhood, reduced infant mortality, reduced mal nutrition etc.)
- Increased access to primary and secondary education, enhanced primary and secondary education quality, combination of secondary education and skill based work, greater emphasis on vocational training and technical education

- Increased involvement of women in social and other developmental responsibilities

As a consequence of all these initiatives, Indian population would realize improved standards of living, increased life expectancy and enhanced quality of life.

### **Stage 2 – Infrastructure Creation**

- Road, Rail, Ports and Airports to be built, rebuilt, repaired, and enhanced.
- Construction and safe operation of mass rapid transport systems in 25 large cities.
- Construction of new power plants, capacity creation, reduced transmission losses, and managerial efforts to narrow the demand and supply gap.
- Safe drinking water and sanitation access to population in rural India
- Superior IT infrastructure to bridge the urban- rural divide
- Town planning, town building and housing for poor
- Creation of specialized industrial zones to realize efficiency due to economics of scale and scope
- Build large super speciality hospitals and clusters of medical facilities in select areas spread across the country

Each one of these activities is a major (social / industrial) project. Each intervention would call for heavy investment with long gestation period. Technological expertise would be critical. Managerial competence would be a necessity. Several of these projects should start simultaneously. They should be implemented with an aggressive time schedule. The impact of these projects would be felt at several levels. Once a critical number and related group of projects are implemented, India would be firmly on the path of the developmental process.

### **Stage 3 – Operational Efficiency**

- Manufacturing in select areas would lead the pack
- Agricultural and food processing sectors would have significant impact on GDP
- IT enabled services would provide us global visibility and the much needed **made in India** brand
- We need to enlarge the scope in service sectors like engineering, and outsourced R&D

- Large scale tourism (heritage, religious, adventurous and medical are potential opportunities) would provide visibility, economics of scale
- Education policy and its implementation needs to be dramatically improved. This would apply across the board (primary, secondary and university education)
- There is a tremendous scope in improving the systems and processes related to governance

As a consequence of these initiatives, India would be able to redefine the social model. Under the new dispensation, critical technology would be internally developed. There will be a huge domestic commercial opportunity. The ability needed to service this domestic commercial opportunity would be comparable to the best in the world. India will be able to seamlessly integrate with the rest of the world on technology, products and services, quality of life and social infrastructure.

The stages outlined here are indicative. They are not necessarily sequential. Several activities belonging to several stages can start simultaneously. However, in order to ensure optimum impact and contribution to the development process, we need to select a few at a time, evolve broad based political consensus to implement them, deploy world class technology and managerial resources and aggressively monitor the implementation schedule. In the absence of this, we will continue to discuss developed India with no or very little meaningful implementation.

### **Evolution of OR as an Academic Discipline**

Operations research has its origin in the operational support related to World War II. It was primarily used to ensure maximum damage to the opponents' infrastructure installation with minimum resource deployment. To a large extent conceptually, operational research and related mathematical modeling and optimization procedures were used to increase effectiveness in a competitive environment (what can be more competitive situation than a war!).

Because of this historical legacy, operational research was accepted as a legitimate management tool in defense research establishments and subsequently for efficient resource planning and allocation by Government departments. Business supported the

accelerated growth of this discipline by funding real and potential applications. Over a period of time, a symbiotic relationship between government, business and academia ensured the growth and expansion of the discipline for their mutual benefit. During the last 50 years, operational research has evolved as a multi-disciplinary function involving economics, mathematics, statistics, industrial engineering and management.

Broadly, operational research as a discipline can be classified into three distinct set of categories. They correspond to tools, models and methodology. Tools include ABC analysis, 80:20 rule, and break even analysis. Blending models, optimized distribution system, portfolio optimization of assets would broadly represent examples under the category of models. Operational research methodology would include project management systems, multi criteria optimization, game theory, simulation methodology, data envelopment analysis, enterprise resource planning systems and conflict resolution methods. The tools, models and methodology of operational research have found a variety of applications in different contexts. Also, several outstanding academicians have contributed to the development of this discipline.

Today, operational research is almost an industry on its own. There are several universities (all over the world) who offer rigorous masters and Ph.D. program in this area. The professional society related to this discipline is well represented by industry, academia and government in almost all countries. The societies usually hold an annual conference to further the discipline and facilitate networking among fellow professionals. Numerous applications have been reported in several professional journals. The practitioners of this discipline systematically contribute to the wealth creation process in various contexts.

### **Operational Research in India**

The Operational Research Society of India, established in 1957 is among the oldest societies in the world. It is affiliated to the International Federation of Operational Research Societies (IFORS) and the Asia Pacific Operational Research Societies (APORS). The society has approximately 500 members. The members of the society are predominately from the academic departments of mathematics, statistics, industrial engineering, computer science and management of universities and institutions of higher



learning. Several chapters of this society are active across the country. The society also publishes a well known academic journal OPSEARCH. Unfortunately, operational research in India is characterized by pockets of excellence. There is only one university department in the country which offers a post-graduate programme with a focus on operational research. There are several university departments in the country which offer operational research courses as a part of their engineering curriculum.

Some of the early noteworthy contributions to operational research discipline came from Indian Scientists. There are several outstanding OR professionals of Indian origin working in various parts of the world both in the academia and the industry. However, the development and growth of operational research in India and its applications in the Indian context has been somewhat limited. The following is the partial list of reasons for the lack of progressive use of OR tools and techniques in the Indian context.

- Planned Indian economy (until 1990) and hence lack of appreciation of competition and a global outlook by industry and society
- Several opportunities to improve the economic performance of India as a nation was ignored by policy planners
- The decision making machinery was predominantly driven by rationing and resource allocation
- Efficiency and effectiveness was not a consideration in decision making and resource allocation
- Political class was driven by often narrow party considerations rather than the society welfare
- Ruling class was never held accountable for its performance and the economic growth in the country
- Bureaucracy was only interested in maintaining status quo related to development
- Under these circumstances policy planning choices were based on effectiveness of the stated programme objectives. Consequently, efficiency took back seat.
- Resource consumption was routinely monitored in all social projects. However, the utility of resources and its productivity was never monitored.

## Operational Research Models and Vision 2020

So far in the Indian Economy, Agriculture sector has played a dominant and key role. This is in addition to the economic context where industrialization in the country has been timid. While agriculture would continue to play an important role in the years to come, the pace of industrialization has to be rapid to catch up with the rest of the world. India has already demonstrated that it can play a dominant role in global economy in the areas related to information technology and other associated services. When the world is moving towards knowledge based economy, to be a developed nation, India has to be globally competitive in its policy, planning and its execution. It also needs to find ways and means by which the imprisoned resources (bio-diversity, rich minerals, metals, globally competitive manpower) are effectively used. The resources needed are to be efficiently allocated without compromising on their effectiveness. This would demand a great deal of application of scientific procedures, processes and approaches. It is in this context that operational research would play a very significant role to help policy planners, managers and administrators to transform India as a competitive nation.

### Specific applications

In this section, we briefly outline the potential use of operational research models and methods in transforming India as a developed country. At a very basic level, India needs to evolve robust methods and procedures by which key projects can be well planned, executed and managed. PDCA (Plan, Do, Check, Act) should be routinely used at the implementation level. There are abundant opportunities to use resource level optimization models (Appendix 1).

Before discussing specific operations research models that may be used in various sectors of Indian Economy, we briefly present a sketch on the evolution and usage of these models in the context of the development process in India. We broadly identify this evolution into three stages. At stage 1, the applications would primarily focus on identifying feasible managerial options. This would be based on primarily the product / service providers perspective. Resource minimization would be the end objective. There would be attempts to enhance output maximization. Resource productivity and its optimal deployment may not be the explicit criteria. At the second stage, the efficient use

of technology and knowledge base would drive the managerial choice. This would translate into a judicious combination of efficiency and effectiveness in the context of a chosen objective. However, at this stage the choice would be influenced by the dominant partner who would usually be the service provider. At the last and final stage of this evolution, operations research models would guide decision making in the context of competitive environment. The situation would be characterized by a segmented approach to the market, optimized product offering customized to a given segment, multiple options to the user and products with a combination of several features etc. The user would make an appropriate trade off between efficiency and effectiveness in the context of the application.

To clarify, we develop a profile of application in all the three stages in the context of infrastructure development. Such an evolution of OR models is widely applicable to other areas as well.

Consider the context of developing roads and bridges, port and airports, building power plants, railway network etc. At the early stage, these applications would be driven by, given the budget what would be a reasonable time to complete the project. At the second stage, the focus would be given a resource budget, what would be the best technology to create an infrastructure which would maximize the intended utility of the project. At the last and final stage of the development process, the models would be used to guide to design systems which would aim to increase resource productivity and also utility based multiple options. For an example having created an infrastructure, the administrator or the service provider would design a price structure which would provide multiple options to the user in terms of when and what price the facilities to be used, what are the other possible alternate options to the main alternative (rail Vs road transportation etc.).

In Table 1 and 2, we provide several contextual examples to illustrate the choice, nature and variety of OR applications.

## Conclusion

The role of operational research in the Indian context is clear. It is not only important, it is even critical given the size and magnitude of the tasks ahead to transform India as a developed nation. In order to achieve the goals of Vision 2020 at the core, we need a responsive and accountable government to foster a positive environment of OR applications. It is hoped that the Indian democracy would lead to this. It is believed that the globalization process would accelerate this transition.

OR has had its origin in World War II, the most realistic and aggressive form of competition. With increased industrial competition, and enhanced ambition of globalization, OR can be effectively used to gain, retain and enhance the competitive position of India.

Usually, operational research models are developed to enhance performance (profit). We need to move towards models and methodologies which would enhance stakeholders interest. Further in addition, in the context of India, we need to develop models and methodologies which would provide optimized responses to resolve complex problems, which are sustainable (from the society, ecology and environment point of view).

In order to enhance the role of operational research and accelerate the process of achieving Vision 2020 goals, different stakeholders should work closely and complement each others effort. In this process, the academicians should take the lead in the design, development and demonstration of sustainable operational research models. Industry should support this initiative and accelerate the propagation of this methodology. This would ensure wealth creation in the short term, and sustainable development in the long term. The government should encourage this initiative by adopting optimized responses. Subsequently, optimized policy responses and its implementation would bring about positive changes in the socio political and economic environment. This will in turn raise issues and choices, related to policy options, resolution of which would require application of sophisticated and advanced operational research. Consequently, sustained use of operational research would be a regular feature in the decision making process of the government, industry and the society. Such a wide usage of operational research

models by the government, industry and academicians would not only contribute to the discipline but also would contribute to the enhanced quality of life in India.

We hope the 37<sup>th</sup> ORSI Annual Convention with a theme ‘Vision 2020: The Strategic Role of Operational Research’ would make an important beginning in the transition of efficient and effective use of OR methodology in building a prosperous India.

### **Acknowledgement**

The broad outline on the content and approach to Vision 2020, was based on the public information available on the same topic and cited in the reference. Manoj Bayon, Academic Associate at Indian Institute of Management, Ahmedabad provided research support in preparing this section. This is gratefully acknowledged. However any omissions, inaccuracy in statements or inappropriate conceptual understanding are solely due to the limited understanding of the author.

Ankur Roy, Research Assistant, Indian Institute of Management, Ahmedabad provided the much needed editorial support in preparing this article. He also helped the author in sharply focusing some of the earlier ideas of this article. His involvement is recorded with great appreciation.

### **End Notes**

References (1) and (2) provide a detailed background related to Vision 2020. Reference 3 is an informal history of operations research, which traces the origin, evolution and growth of OR as a discipline. Reference 4 is a well known book in operations research which is written with a strong application flavour without compromising the academic rigour.

**Table 1: Potential OR Applications in various sectors of the Economy**

Sectors	Stage 1 (2010)	Stage 2 (2015)	Stage 3 (2020)
Infrastructure	<ul style="list-style-type: none"> <li>• Construction methods for a given resource budget</li> <li>• Reduce/Optimize completion time</li> </ul>	<ul style="list-style-type: none"> <li>• Choice of Technology, Method and Process</li> <li>• Value for Money</li> <li>• Minimize completion time</li> </ul>	<ul style="list-style-type: none"> <li>• Design policy and price options to recover investment (like pay and use services)</li> </ul>
Government Services	<ul style="list-style-type: none"> <li>• Provision of Motor Vehicle Licences</li> <li>• Services design based on dated rules and procedures</li> <li>• Regulation oriented supply driven approach</li> </ul>	<ul style="list-style-type: none"> <li>• Identify suitable options to automate the processes and procedures</li> </ul>	<ul style="list-style-type: none"> <li>• Reengineer the system</li> <li>• Evaluate and identify third party managed systems</li> </ul>
Tourism	<ul style="list-style-type: none"> <li>• Provide limited options for those who have time and resources</li> <li>• Supply driven product design</li> <li>• Limited choice on locations and experiences</li> </ul>	<ul style="list-style-type: none"> <li>• Models to interconnect transportation, accommodation, access to fund, safety etc.</li> </ul>	<ul style="list-style-type: none"> <li>• Optimized product, features and price</li> <li>• Customized product offering</li> <li>• Dynamic pricing models</li> <li>• Multi segment, multi product offering</li> </ul>
Health care	<ul style="list-style-type: none"> <li>• Models to design basic services, budget driven</li> <li>• Maximum coverage to treat minor ailments</li> </ul>	<ul style="list-style-type: none"> <li>• Optimized models and procedures to minimize the cost of health care delivery to individual citizens</li> </ul>	<ul style="list-style-type: none"> <li>• Optimized insurance models, risk management models</li> </ul>
Air transportation	<ul style="list-style-type: none"> <li>• To provide maximum connectivity in a given budget</li> <li>• Models to design schedules to ensure economic feasibility</li> </ul>	<ul style="list-style-type: none"> <li>• Scheduling system to maximize user comfort and convenience</li> <li>• Multi-model inter connectivity optimization</li> </ul>	<ul style="list-style-type: none"> <li>• Dynamic pricing models</li> <li>• Several optimized choices</li> <li>• Innovative ways to manage capacity</li> </ul>
Agriculture	<ul style="list-style-type: none"> <li>• Crop mix decisions at the planning</li> </ul>	<ul style="list-style-type: none"> <li>• Integrated crop planning systems</li> </ul>	<ul style="list-style-type: none"> <li>• Models to design and manage</li> </ul>

	level	(Seed to Harvest)	commodity markets
Logistics and Distribution	<ul style="list-style-type: none"> <li>Models to plan and operationalize activities</li> </ul>	<ul style="list-style-type: none"> <li>Optimized models on location, mode choice etc.</li> <li>Inventory flow decisions</li> </ul>	<ul style="list-style-type: none"> <li>Design and development of Third Party Logistics solution providers</li> </ul>
Sourcing	<ul style="list-style-type: none"> <li>Feasible options based on economic considerations and technical needs</li> </ul>	<ul style="list-style-type: none"> <li>Selection of vendors based on multiple criteria related to cost, quality, delivery and flexibility</li> </ul>	<ul style="list-style-type: none"> <li>Optimized models for co-operative manufacturing</li> </ul>
Manufacturing	<ul style="list-style-type: none"> <li>Models for plant location</li> <li>Distribution network design</li> <li>Allocation of capacity etc.</li> </ul>	<ul style="list-style-type: none"> <li>Optimized production planning and control</li> <li>Design of quality control systems</li> </ul>	<ul style="list-style-type: none"> <li>Design of cooperative manufacturing network</li> </ul>
Services (in General)	<ul style="list-style-type: none"> <li>Capacity driven service models</li> <li>Resource utilization based models and approaches</li> </ul>	<ul style="list-style-type: none"> <li>Models to improve customized response by optimal configuration of service elements</li> </ul>	<ul style="list-style-type: none"> <li>Models to enhance optimal quality of service and experience</li> <li>Design of virtual queuing system etc.</li> </ul>
Banking	<ul style="list-style-type: none"> <li>Models based on managing the spread</li> <li>Fund based revenue models</li> </ul>	<ul style="list-style-type: none"> <li>Optimal fund allocation</li> <li>Churning of Assets</li> </ul>	<ul style="list-style-type: none"> <li>Customized structured products</li> <li>Risk management models</li> <li>Customer retention models</li> </ul>
Education	<ul style="list-style-type: none"> <li>Location of educational facilities (primary and secondary)</li> <li>Subsidized price based models on budget utilization</li> </ul>	<ul style="list-style-type: none"> <li>Models and system design to minimize dropouts</li> <li>Models to evaluate new methods of delivering primary education</li> </ul>	<ul style="list-style-type: none"> <li>Models to help public private partnership</li> <li>Market price based system</li> <li>Process optimized educational delivery systems</li> </ul>

**Table 2: Evolution and use of OR Techniques in the context of Vision 2020**

	<b>Stage 1 (2010)</b>	<b>Stage 2 (2015)</b>	<b>Stage 3 (2020)</b>
Project Management	<ul style="list-style-type: none"> <li>• PERT / CPM Models</li> </ul>	<ul style="list-style-type: none"> <li>• Resource scheduling Time Vs Budget Trade Off</li> </ul>	<ul style="list-style-type: none"> <li>• Managing uncertainty in project network</li> </ul>
Optimization Models	<ul style="list-style-type: none"> <li>• Product Mix</li> <li>• Linear Optimization</li> </ul>	<ul style="list-style-type: none"> <li>• Multi-period, multi criteria optimization</li> </ul>	<ul style="list-style-type: none"> <li>• Models with stochastic elements</li> </ul>
Queuing Theory	<ul style="list-style-type: none"> <li>• Simple models to manage capacity and demand</li> </ul>	<ul style="list-style-type: none"> <li>• Realistic models to manage dynamic changes in demand and supply</li> </ul>	<ul style="list-style-type: none"> <li>• Network of queues</li> </ul>
Data Envelopment Analysis	<ul style="list-style-type: none"> <li>• Resource allocation efficiency</li> </ul>	<ul style="list-style-type: none"> <li>• Performance measure and benchmarking</li> </ul>	<ul style="list-style-type: none"> <li>• Applications to focus on rationalizing facilities</li> </ul>
Simulation	<ul style="list-style-type: none"> <li>• Basic models to support modeling</li> </ul>	<ul style="list-style-type: none"> <li>• Real-time complex models</li> </ul>	<ul style="list-style-type: none"> <li>• Embedded systems to optimize responses</li> </ul>
PDCA / TQM	<ul style="list-style-type: none"> <li>• Small group activities</li> </ul>	<ul style="list-style-type: none"> <li>• Network of small group activities</li> </ul>	<ul style="list-style-type: none"> <li>• Small group activities to be integrated to achieve competitive positioning</li> </ul>
BPR	<ul style="list-style-type: none"> <li>• Simple process mapping</li> </ul>	<ul style="list-style-type: none"> <li>• Connected to performance budget</li> <li>• Process automation</li> </ul>	<ul style="list-style-type: none"> <li>• Process simplification (simulation based)</li> </ul>
Dynamic Optimization	<ul style="list-style-type: none"> <li>• Multi period optimization models</li> </ul>	<ul style="list-style-type: none"> <li>• Multi period, multi objective models with stochastic elements</li> </ul>	<ul style="list-style-type: none"> <li>• Dynamic pricing</li> <li>• Dynamic capacity allocation</li> </ul>
Risk Models	<ul style="list-style-type: none"> <li>• Investment analysis</li> </ul>	<ul style="list-style-type: none"> <li>• Pooling of risk at the individual and group level</li> </ul>	<ul style="list-style-type: none"> <li>• Designing commodity market</li> </ul>
Game Theory	<ul style="list-style-type: none"> <li>• Trade off analysis and conflict resolution</li> </ul>	<ul style="list-style-type: none"> <li>• Designing winning strategies for negotiations</li> </ul>	<ul style="list-style-type: none"> <li>• Optimal response strategies by partners to resolve long standing disputes.</li> </ul>



## Appendix 1: Examples

### Airline operations

- Scheduling and crew planning
- Traffic planning, and traffic estimation
- Pricing, revenue management and optimized promotional schemes

### Infrastructure

- Efficient project management
- Resource allocation and activity scheduling
- Monitoring on-time project completion

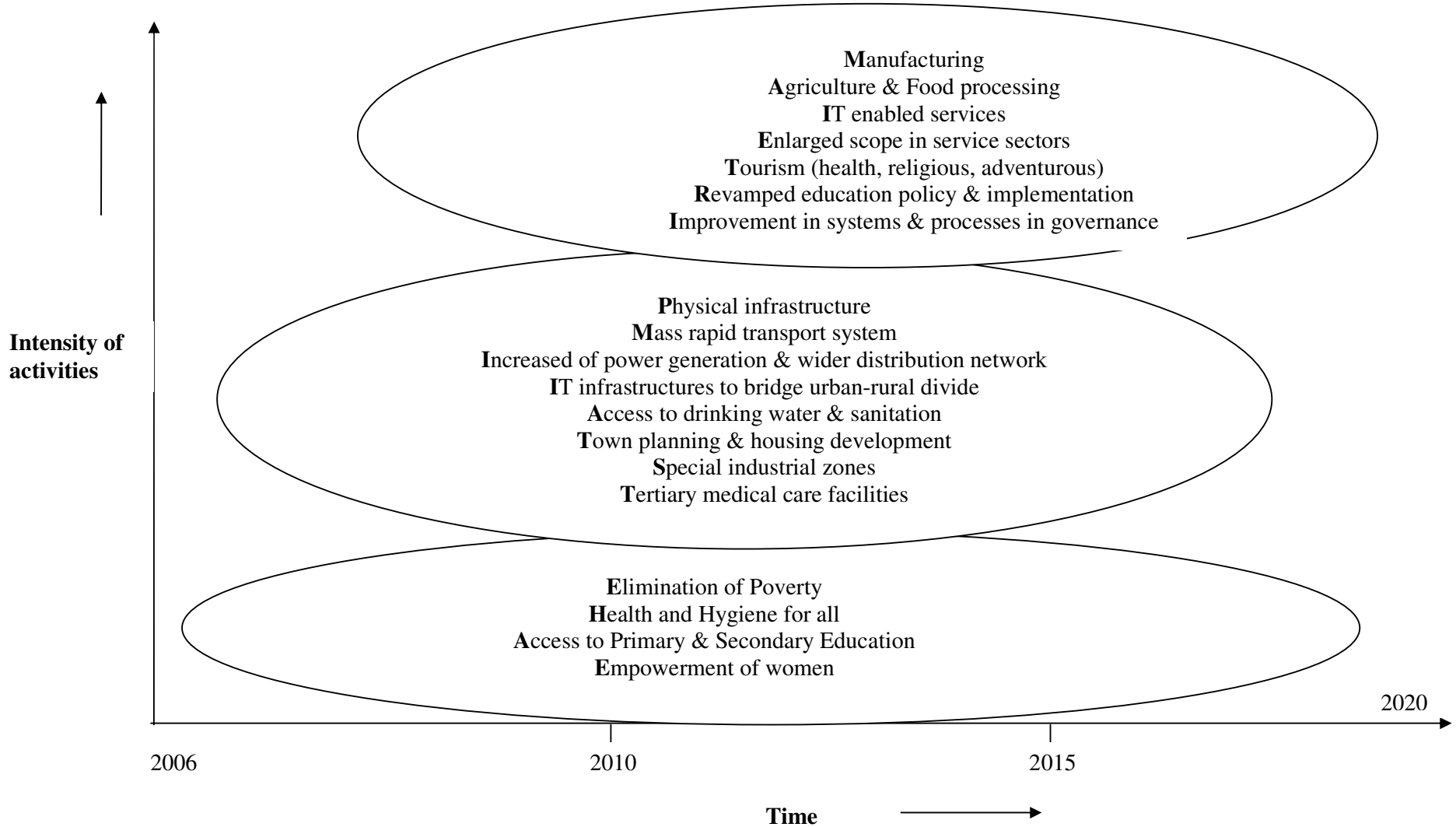
### Health care

- Management of facilities
- Operational planning to reduce the waiting time of users
- Effective utilization of critical resources
- Optimization of cost of health care delivery

### Government systems

- Balance score card (At the Panchayat, District, State level)
- Friendly and efficient local administration (Simplified systems and procedures, consumer orientation, total quality management)
- IT enabled delivery of products and services (Business Process Reengineering, process redesign, process reorganization)
- Responsive government (accountable on results and on resources utilized) would require optimized methodology to benchmark results and measure resources deployed.

**Figure 1: Vision 2020: Timeline of Implementation Stage**



**Figure 2: Anatomy of Vision 2020**

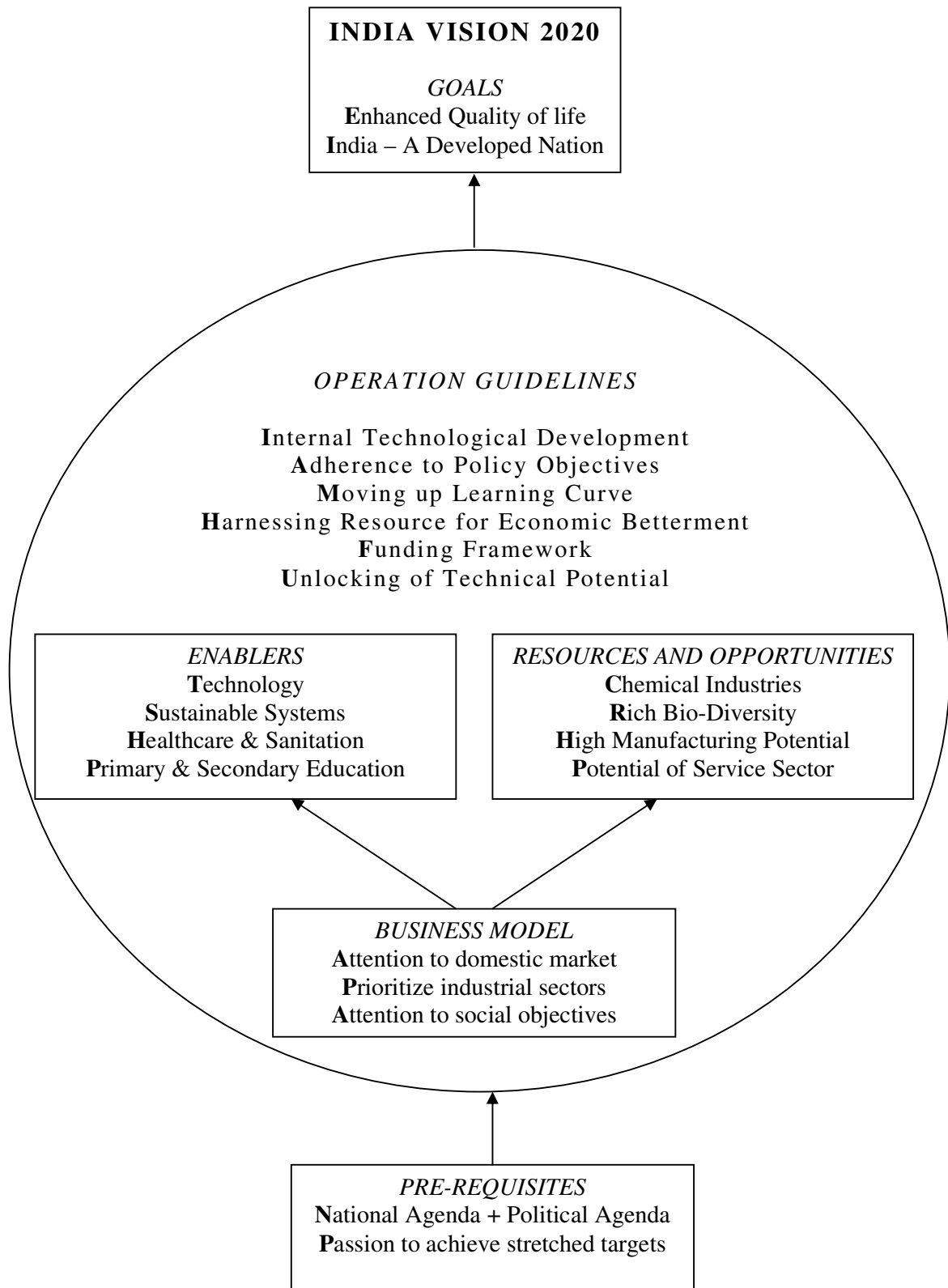
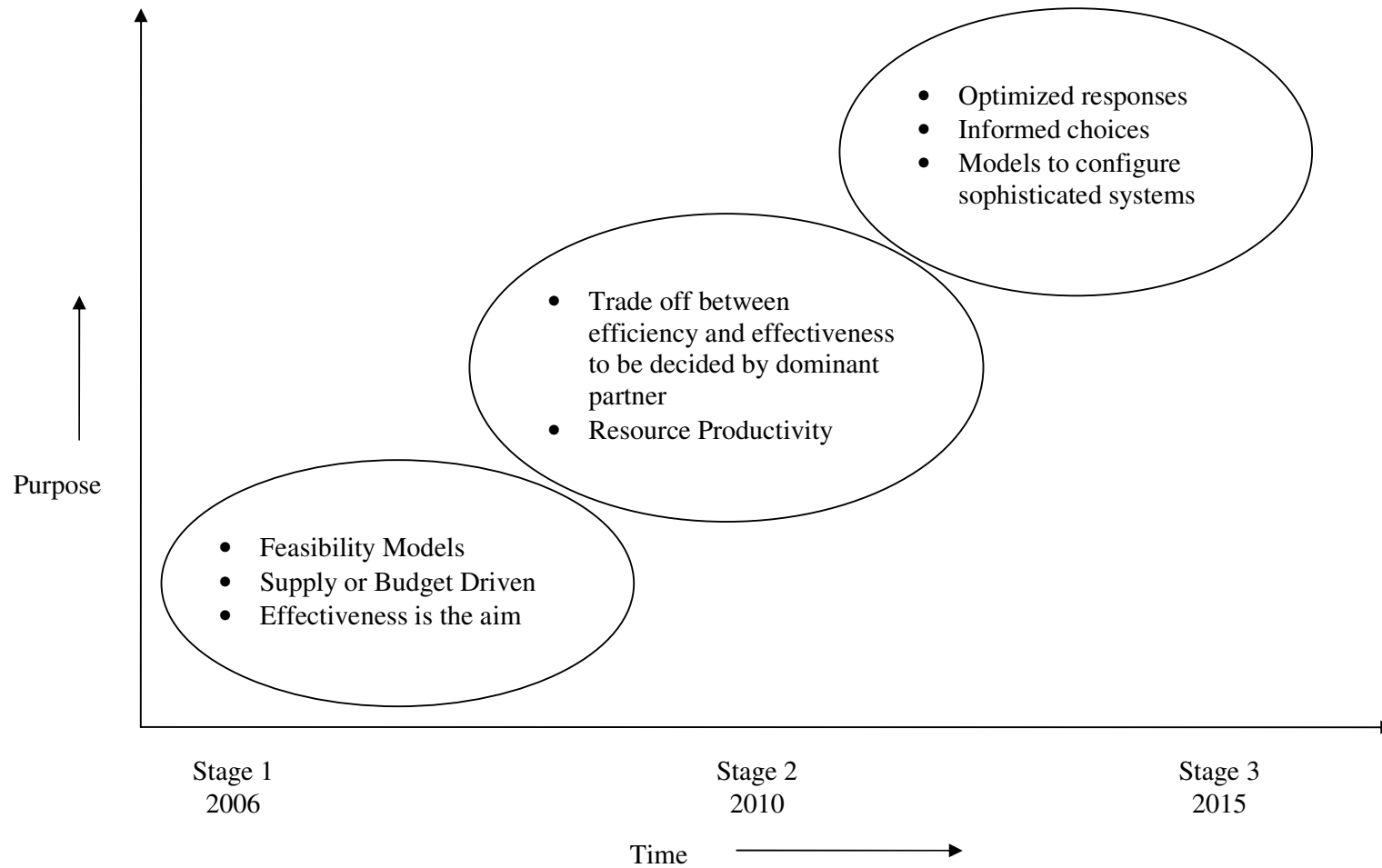


Figure 3: Stages of OR models in the concept of Vision 2020





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