The role of research institutes in the cluster development in oil industry

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Abstract

Developments have received considerable attention of policy makers and governors. Science and Technology could influence development, if it is directed toward national requirements and country capabilities.

The oil industry development should be in the center of considerations. Promoting SME can be a very important tool for achieving success in that. Base on that forming an industrial cluster with all its requirements is necessary.

Because of research institutes role in development, RIPI was given the mission to provide know-how and launching it to the industry. Therefore a commercializing team was necessary. The duty of the team was forming a comprehensive model and implements it within the research centers of RIPI. Comprehensive model base on the current conditions was developed. In this paper after a description of literature review the model is presented and its relation with the current RIPI 's purpose and the pad way toward oil industrial development is explained.

Introduction

Development is not necessarily synonymous with growth In Industrial countries, sustainable development may mean a shift from quantitative and material growth to qualitative and nonmaterial growth, in most developing countries it will mean a coordinated measure of both types of growth Equity, whether defined in terms of development benefits, income, consumption levels, or overall economic Indicators.

The central idea of Sustainable Development (SD) is one of the oldest in economics that to live beyond the moment, one must consume income rather than drain capital or the ability to produce future income (1). Equity for existing populations and future generations also is a common theme in many definitions of SD (2). However, a universally accepted definition of SD has yet to emerge. Some consider SD a goal; others prefer to view it as an organizing principle and a process. The definition cited most often comes from the Brundtland Commission: "development that meets the needs of the present without compromising the ability of future generations to meet their needs" (3). This is a concept that most people can relate to and accept. However, it leaves many questions unanswered. However, two models stand out for their sharply contrasting interpretations of sustainable development: the Conventional Economic Growth model (CEG) and the Environmentally Sustainable Lifestyles (ESL) model. Both models embrace the notion of maintaining, enhancing or preserving the environment and natural resource base for future generations.

The CEG model resembles the traditional model of economic growth but places additional emphases on the costs of environmentally degrading activities, and on the allocation of natural resources among generations. It also seeks a higher standard of living through technological innovations to improve productivity of resources.

In addition, SD is viewed as heavily dependent on industry policies and goals (4). As it is obvious one of the main fact in the SD is the industrial development, which is linked to the economic development and base on CEG model innovation should be appreciated.

Theories of economic development

The story of economic development starts with Adam Smith. Smith wished to find the determinants of development that created wealth. At the same that he presented his criticism against mercantilism and developed his theory of the indivisible hand, he concluded that an open economy, fewer regulations, and more political stability were the fundamental factors that led a nation to experience sustained and systematic process of wealth creation. The theory of comparative advantage, developed by David Ricardo, was one of the most important models in international economics theory. Then Schumpeter came with his brilliant book that dealt exclusively with the idea of economic development. In that book, he focused his analysis on the idea of entrepreneurship as the most important element of economic development analysis (5).

Many economists especially the ones who work on economic development speak of the idea of entrepreneurship and its role in economic development. These three individuals, Israel Kirzner, Joseph Schumpeter, and Ludwig von Mises, come to mind that considered this concept from a deep perspective.

Schumpeter did not equate entrepreneurs with inventors, suggesting instead that an inventor might only create a new product, whereas an entrepreneur will gather resources, organize talent, and provide leadership to make it a commercial success (6).

The main weapon of entrepreneurs is the technology that has on hand for manufacturing products. By other means developing an entrepreneurship is equal to implementing new technology in a certain business field.

According to realities technology will be enhanced and developed in small businesses or in large cooperations. Iran with SMEs (98% of firms are categorized under the definition of SMEs) (7) as basic stake of its industrial structure, should emphasis on investigating within the best practices and academic literature in order to find models of innovation enhancement system for SMEs.

It's no secret that technology and innovation are at the heart of sustainable economic growth. An "innovative economy" affords a quality lifestyle – abundant career options, high wage jobs, globally competitive companies, and increased wealth in the region (8).

Also new firms must often have an innovative edge on their competition in order to survive, particularly in younger and high technology industries where competitive pressure and firm churning are high. As such, they are often the source of new processes or products and contribute to productivity improvements in the economy as a whole. Thus entrepreneurship as a tool for new business creation is critical for economic development.

Entrepreneurship and SME policies have an important local dimension. Indeed, facilitating increasing rates of enterprise creation is an almost universal concern for local authorities that seek to accelerate development or reverse decline in localities, whether disadvantaged or prosperous. Programmes aimed at reducing social distress and unemployment, including chronic unemployment, has been implemented in many countries. New enterprises can procure a range of benefits that contribute to local development. Base on all the facts it is essential to accelerate policies and strategies in order to enhance SMEs with innovative prospect.

Tools for SME Innovation

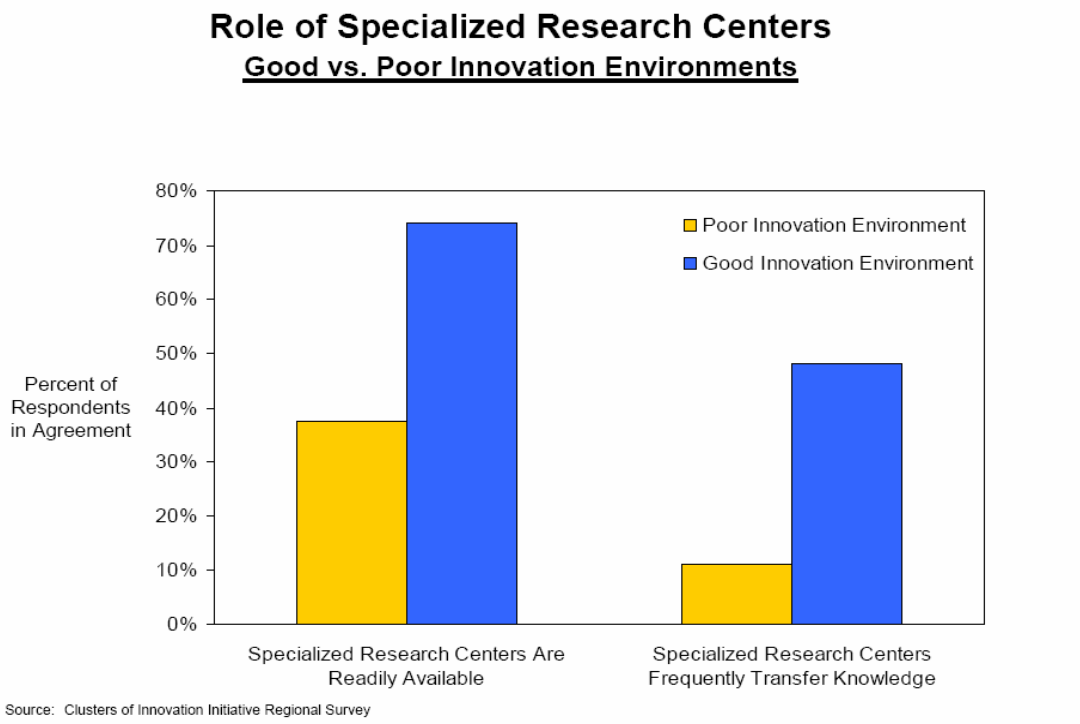
High administrative costs and uncertainties about future performance often make financing SMEs unattractive to potential funding sources in the private sector. These problems are amplified for innovative SMEs seeking to expand, making it difficult to write contracts that are mutually agreeable to investors and SMEs looking for risk. First, the returns to innovative activities are highly uncertain and often skewed. Second, entrepreneurs may possess more information about the nature and characteristics of their products and processes than potential investors. Third, innovative activities are usually intangible so that it is difficult to assess their monetary value before they become commercially successful (9). Addressing these problems requires finding ways to fuse entrepreneurship and finance. This involves ensuring the availability of entrepreneurial, technical and managerial expertise to the providers of finance and engaging investors actively in the development of

the firm. This requires a class of intermediaries capable of assessing the quality of applicants, undertaking due diligence and monitoring prospects and performance, and providing management assistance to SMEs. The desirability of close contacts between suppliers of funds and those requiring finance also points to the importance of regional and local initiatives, support of business angel networks and business incubators. Government via its different ministries and organizations should provide a complete portfolio of services and supports.

Another promising approach is to encourage geographically concentrated clusters of such firms. Clusters are localised innovation systems where increasing private and social returns on public and private investment result from physical or cultural proximity that encourages human networks and facilitates flows of tacit knowledge. They also result from close cooperation between firms and government in building tangible and intangible infrastructures for innovation and in coping with market failures (10). The "art of cluster-based policy making" is not well understood; studies suggest that stress should be placed on working through partnerships and networks to achieve outcomes that the market by itself will not. Such networking and partnership initiatives should also have an international dimension, and national, regional and local integration. In addition, further examination of best practices and countries' experiences is suggested in such areas as the role of universities and knowledge-intensive services in cluster development, the regional attractors of knowledge-intensive foreign direct investment, and the governance structures and means of evaluating cluster initiatives also have impacts on cluster developments.

Intellectual property rights have emerged as key tools for managing innovation and resolving some of the "market failures" regarding the appropriability and tradability of knowledge faced by innovating firms, especially in high technology sectors. It is, therefore, increasingly important for entrepreneurs, inventors, researchers, SMEs and business consultants to have a good understanding of the intellectual property system, including its strategic use by large firms, in order to manage all the processes involved in building and using a firm's intellectual assets effectively. This is especially true for new technology-based firms that are not only more numerous than in the past (especially in areas such as nano-technology, biotechnology, software and new materials) but also play an increasingly important role as innovation agents (11).

The following chart shows the importance of research institute in SMEs development and overall country evolution.



Global trend in industrial production indicates that manufacturers are utilizing high technology mechanism for production. According to Industrial structure of the country oil industry is ranked as the second (13.3%) value adding section. In recent years developed countries had led down Industries such metal, textile and consuming electronic to developing countries. In Middle East textile industry is the most active Industry among all. Oil and petrochemical industries are the second field that has absorbs lots of investment. Referred to oil recourse exploration in CIS countries during recent years there seems to be forming of a new threat to the Iran (12). Therefore a national movement toward keeping oil industry competitive as the market leader appears to be necessary. This might be achieved by launching valuable knowledge into private and governmental sector.

Countries in Middle East are mainly importer of electronics and chemical specially medicine and drugs. As far as the monopoly of some developed countries such as; US and Switch land in pharmaticular it is required to put much effort and heavy finances on these fields with taking advantage of new technology. These also provide new opportunity of business within the area.

Dependency of Iran rational Income to the oil production and trade has caused this industry as the bases for the overall country grow. But unfortunately this resource was commonly used as a tool for wealth creation rather than technology creation. During past years oil industry have improved in engineering maintenances while base on technology limitation and US sanction, we have been kept behind of developed countries and the gap have increased. This is the most reason of the fact that Iranian petrochemical are market leader of basic petrochemical product section but in high value product we lose against developed countries. The following table illustrates a comparison of international activities of different companies in high value added segment of industry. The table illustrates that the oil industry has to move toward more internationally market but according to the global trend the knowledge should be the main driving factor.

According to three facts cluster development model should be considered as the policy of knowledge base industry creation. First, there are wide ranges of activity in oil industry with different condition and production requires therefore each of this sector has its own structure. Second the industry already is sectoral base and high geographically concentrated. Beside of all there is also a sign of cluster base activity in old days.

Company	Petrochemical	Production discovery	Marketing product refinery	Production gas
Gas petroleum	*		*	
Iran National oil company				
Sandi arabiia arama co				
Kuwait oil company	*		*	
Petronance	*	*	*	*
Exson mobile	*	*	*	*
Total	*	*	*	*
BP	*	*	*	*

Table1- activity range comparison of market leaders.

Therefore the Research institute of petroleum industry (RIPI) as a technology-driven organization has targeted to launch new know-how into existing oil-base firm in order to improve their performance within the internal and external market. Hence RIPI has developed certain programs and policies. According to the mentioned facts RIPI has started developing new technology and know-how. The following is a summary of last two seasons functional report.

Achievement: 38 project in oil filed

Professional activity:

Foreign negotiation: 7
Internal negotiation: 26
Patent registration: 6
Number of product for sale: 32
Fair attendance: 5

Academic activity:

Articles: 56
Books: 2
PhD thesis: 8
Conferences: (13)

RIPI has projects on two special bases. First, those projects that were ordered from government in order to solve definite problems. These projects were budgeted by government itself and it is also supervised by the special organization that requires the solution. Most of the RIPI's activity has been focused on these projects. As it illustrated in the chart there are some activity with customer perspective but in contrast with what has come from government cannot be accountable.

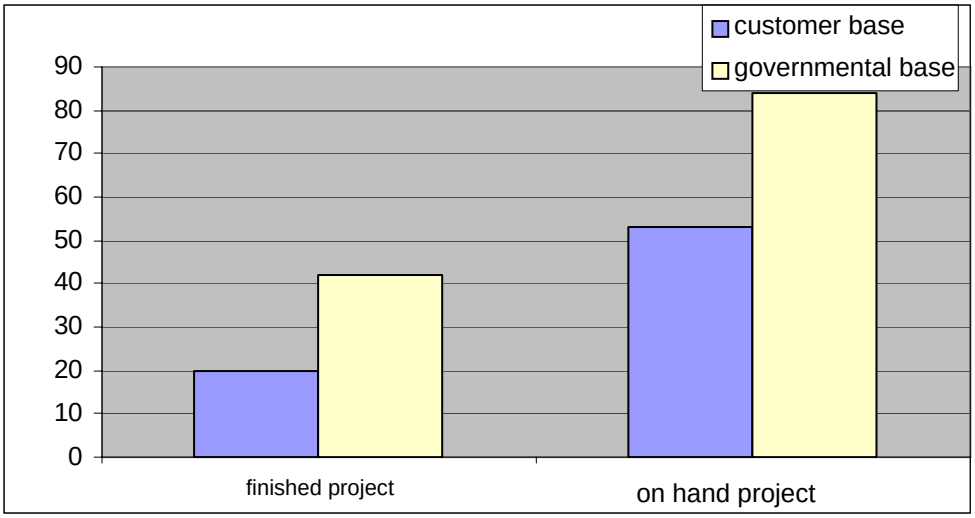


Chart 2- Number of project

The following chart indicates the condition of projects that has been ordered by the private sector. Two important points is considered, first most of projects are in the fielded of environmental activity also the sectoral view of RIPI in scanning the industrial environment

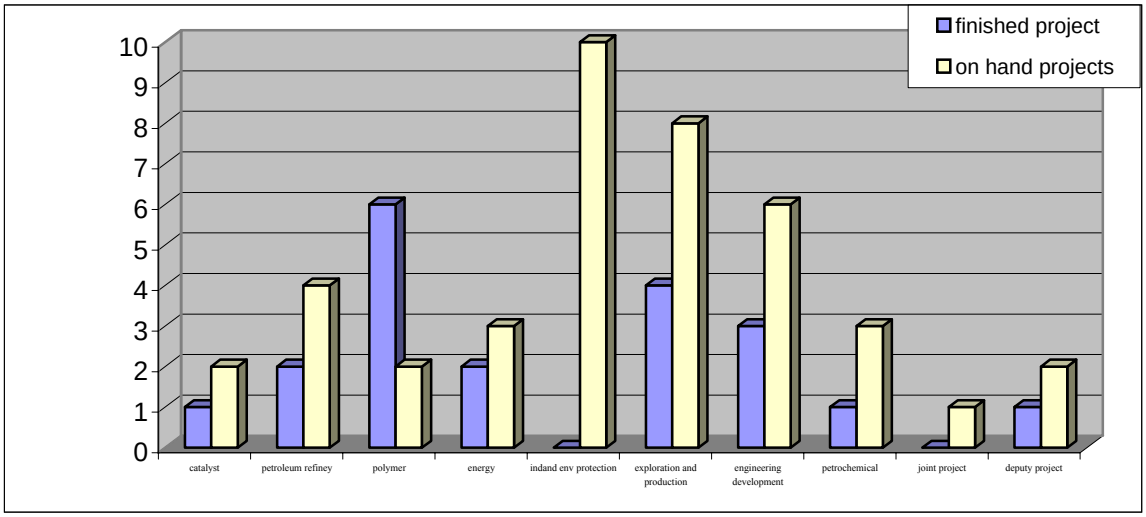


Chart 3- number of customer ordered project

On the other hand the government has ordered projects mostly in Gas field and oil field refindery and production.

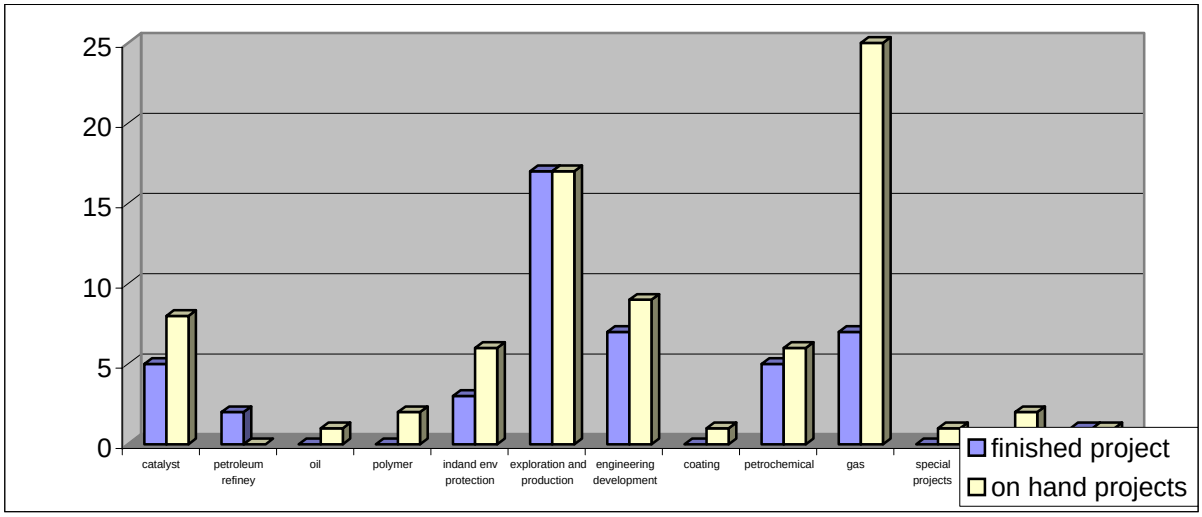


Chart 4- number of government ordered project

All the facts shows the RIPI was not successful in the private section of industry were it should concentrate more on the issues of commercialization and technology transfer terms. Therefore in the recent years RIPI has decided to run a department with focused of commercial activity within the private sector.

Technology Development, Transfer, and Commercialization

In many regions, certain development tools aim to build value by encouraging the development and commercialization of new technologies. Successful development and commercialization of innovative technologies is a difficult, multifaceted endeavor, and a variety of development tools exist to promote this activity. One approach is indirect, aiming to create the proper environment within which innovation and commercialization can take place. For example, through building research parks, and innovative firm development is encouraged though entrepreneurship programs and industry cluster organizations.

A second, complementary, approach is direct in nature—seeking to facilitate and support the development and commercialization of specific technologies. For example, through targeted investments, public venture capital funds support successful technology innovation and corporate development. However, by far the most popular approach to directly promoting successful innovation is through technology transfer and commercialization programs.

◆ Technology Transfer Programs

Technology transfer occurs when a firm obtains technology from an external source (e.g., a university, a federal laboratory, another corporation, or an individual). All innovation builds on existing knowledge. So technology development very much depends on scientists and engineers knowing about and having access to other researchers' good ideas and discoveries. Technical staffs in small and medium-size enterprises (SMEs) are often at a particular disadvantage in gaining access to technical information, as they typically do not have the same information-gathering resources as larger firms.

The ability of technical staff to find valuable technical information depends in no small part on the interest of the suppliers of technical information in promoting access.

Historically, government and nonprofit research institutions (e.g., federal laboratories and universities) have not been highly active in transferring research findings to individual companies for use in the technology development process. In recent years, however, their behavior has changed significantly.

The four types of technology transfer can be distinguished from each other as follows:

- In cooperative R&D, the technology transferees are active ("hands-on") in working with one or more external organization to develop a new patentable, commercializable technology.
- In technology licensing or sale, transferees typically purchase an already patented, commercializable technology from another source.
- In technical assistance, transferees seek help on relatively narrow technical questions that, if answered, can lead to a commercializable technology.
- Through nonproprietary information exchanges, transferees aim to expand the knowledge base on which they can draw as they carry out R&D that, one hopes, will lead to a commercializable technology (14).

◆ Technology Commercialization Programs

Commercialization is the process of transforming new technologies into commercially successful products; it is "to cause something having only a potential income-producing value to be sold, manufactured, displayed, or utilized so as to yield income or raise capital." Commercialization encompasses a diverse array of important technical, business, and financial processes that together aim to transform a new technology into a profitable product or service. These processes include such efforts as market assessment, product design, manufacturing engineering, management of intellectual property rights, marketing strategy development, raising capital, and worker training.

Typically, commercialization is a costly, lengthy process with a highly uncertain outcome. The costs of commercialization can run from between 10 and 100 times the costs of development and demonstration of a new technology. Moreover, success is rare—less than five percent of new technologies are successfully commercialized. Even when successful, technology commercialization does not happen quickly. From a regional economic perspective, unsuccessful commercialization due to lack of resources is seen as a loss of possible jobs and incomes. As a result, numerous public and nonprofit initiatives have been created at the state and regional level to facilitate the technology commercialization process, particularly for SMEs.

Commercialization is the process of transforming technology into economically successful products. The commercialization process has three components (15).

- Technical Aspects
- Business management and market analysis
- Factors of production

Technical Aspects

Two major technical aspects of the commercialization process are product development, design and manufacturing engineering. In product development and design, scientists and engineers transform innovations into products with technical, value, and aesthetic characteristics attractive to prospective users and suitable for cost effective manufacturing (16). Technical areas of focus include functionality, reliability, manufacturability, and maintainability.

Business Management and Market Analysis

Solving the technical issues of product design and manufacture is a necessary, but insufficient, condition for successful commercialization; a firm needs to obtain sufficient revenue from product sales to gain an adequate return on its investment. Elements of the business management and market analysis strand of the technology commercialization process include the following:

- ***Business planning*** – ensuring that the business built around the product is viable and able to fully support and take advantage of successful product commercialization.
- ***Market characterization*** – determining market size, segments, and trends; ascertaining patterns in market growth and structure; identifying competitive products and firms; and understanding distribution channels and purchasing patterns.

- ***Marketing strategy*** – establishing a price structure and developing an effective approach to increasing buyer awareness of and appreciation for the product
- ***Manufacturing, supply chain, distribution, and service systems development***
- ***Management of intellectual property rights*** – ensuring that IP rights remain in force and are not violated by other parties.

Factors of Production

Technology commercialization cannot take place without key factors of production, including financial capital, physical facilities, and a skilled workforce. An important part of general economic development practice is providing access to these factors; so most readers will be familiar with the process for doing so. Thus, this subsection's discussion will be relatively brief.

Successful technology commercialization depends on access to a skilled workforce in management, production, sales, distribution, and support. Many technology firms choose to outsource certain functions, giving contractors the responsibility of managing a workforce. For some retained functions, technology firms can upgrade and enhance workers' skills through standardized and customized training programs (17).

According to RIPI objectives and goals, it is necessary to have and built a close relationship with market and industry. Thus a commercialization team was created and starts the role from 3 years ago. The following describes responsibility and procedure of the team in order to enhance the competitive position of the organization specialty in the foreign market. The team has four main strategic pathways:

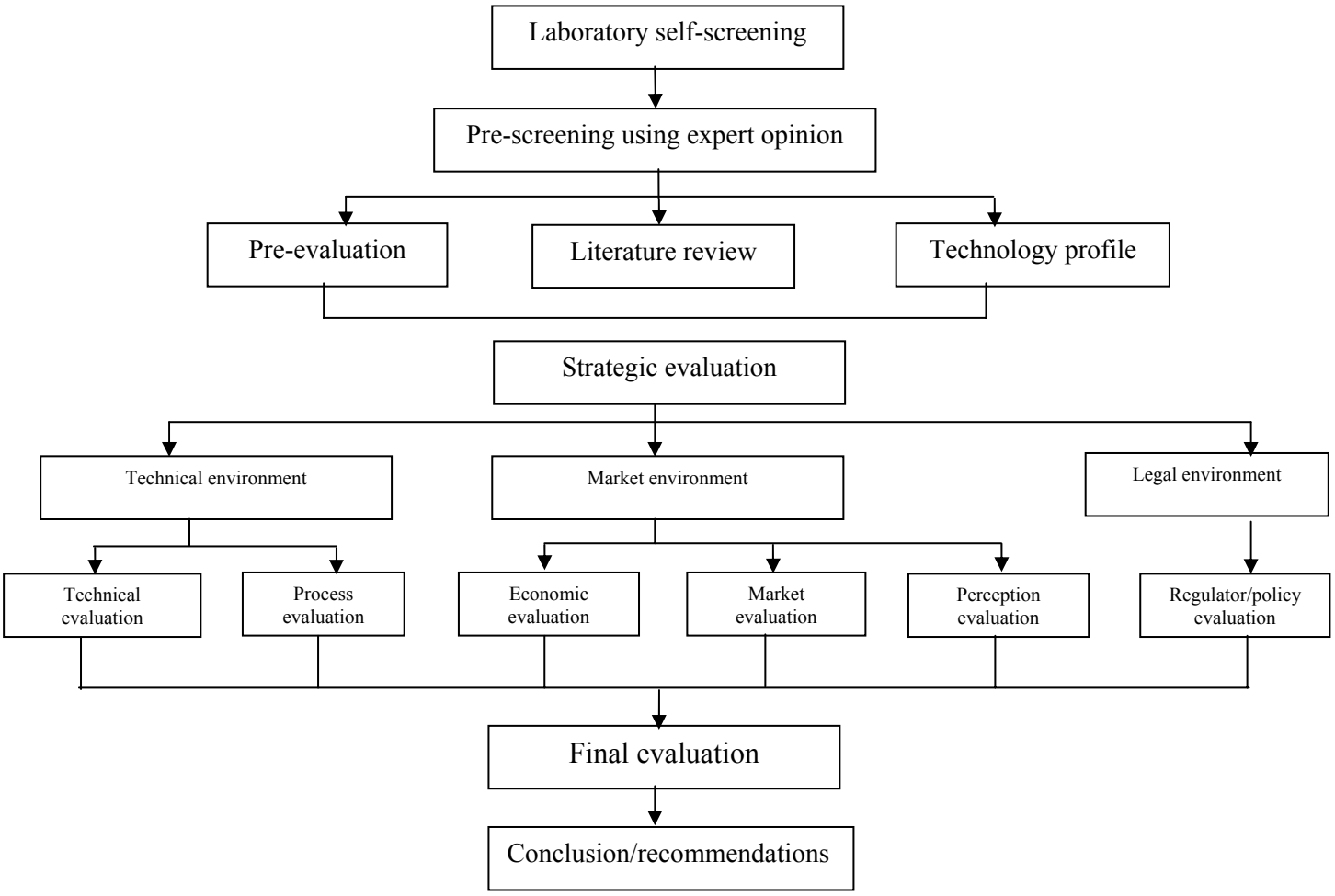
1. Outright sale of technology,
2. Licensing of technology,
3. Joint venture,
4. Start-up ventures.

The type of mechanism to be used in commercializing any particular research depends on various factors. Outright sales and licensing of technologies are only practical when they are able to attract the interest of companies, which could commercialize them on a sufficiently large scale. Otherwise it would be very difficult to provide sufficient return on investments.

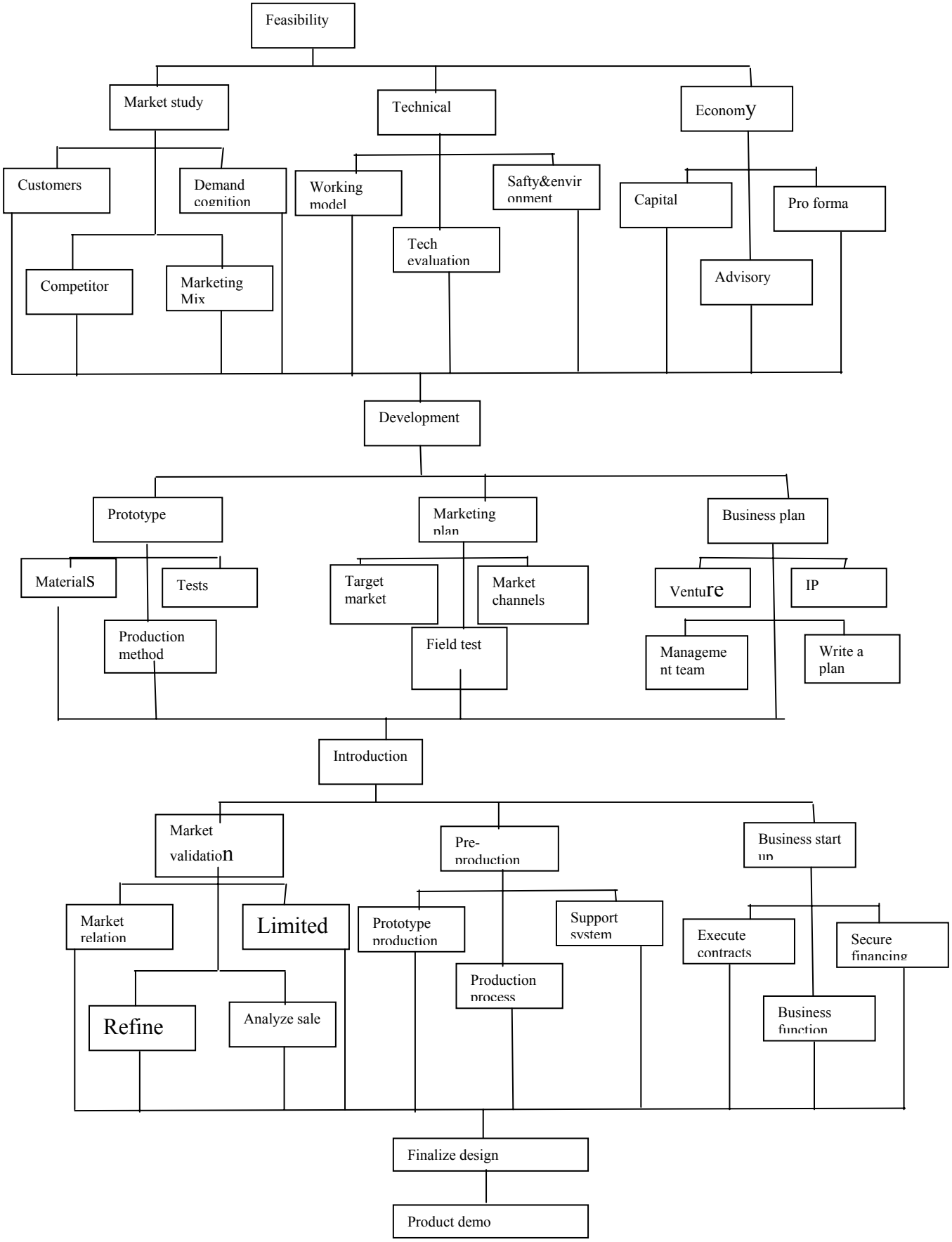
Commercializing technology through outright sales and licensing would need more effort in promotion. Nevertheless, these forms of technology commercialization would have minimum involvement of the universities or research institutions, once the technology has been transferred to the company.

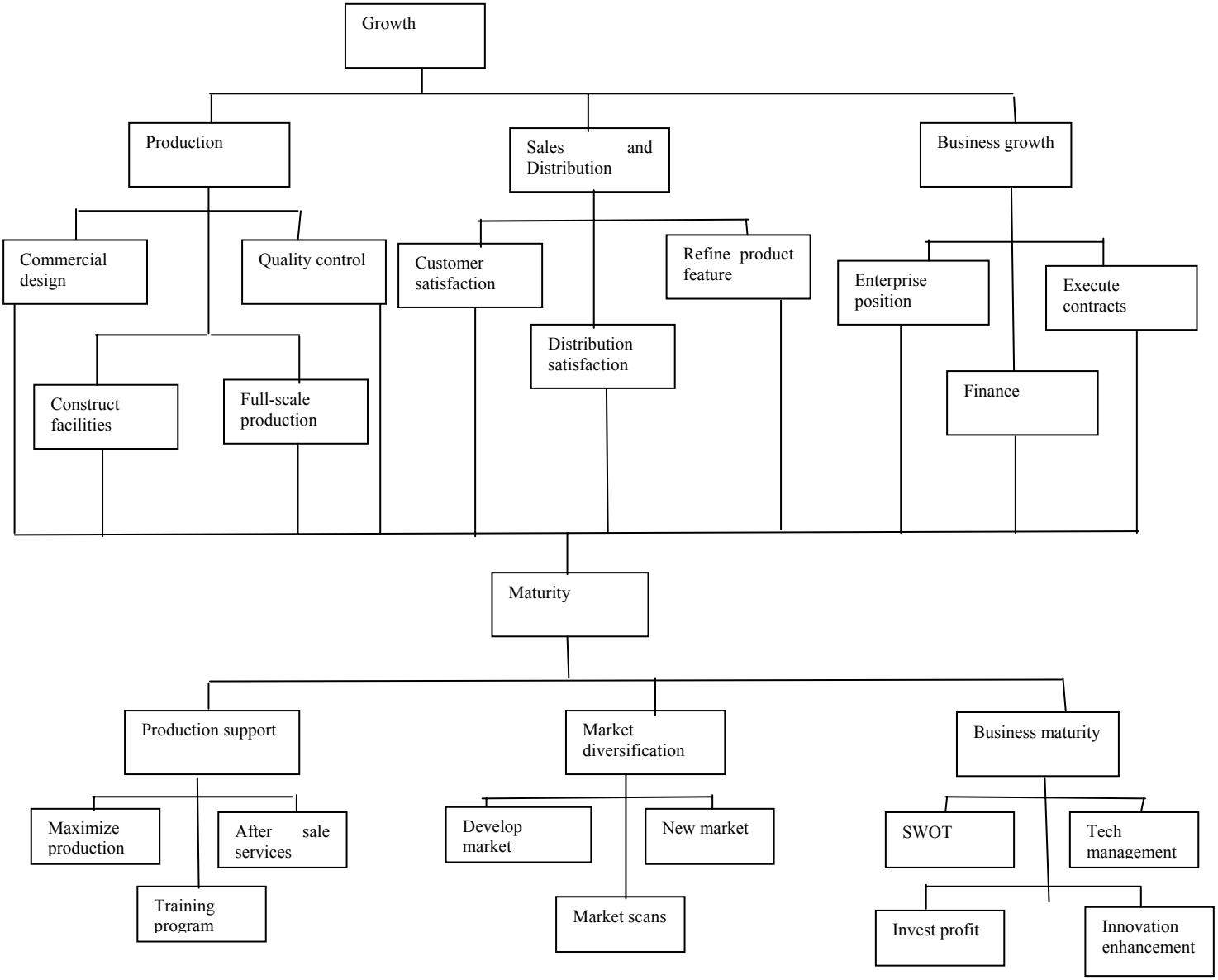
The commercializations of technology through the creation of new businesses or joint ventures by means of provision of venture capital funding have become more prevalent. Joint ventures and start-up ventures, although harder for local universities and research institutions, provide many advantages to them.

The following is the RIPI technology assessment procedure (18).



In the conclusion section of the model the suitable decision for technology and promotion method for commercialization will be identified. If the out right alternative is recommended therefore it is obvious that the decision can be made base on the above information and analysis. But on the other hand if the chance is to work on the three remain alternatives the procedure can be found as following.


Feasibility
Market study
Technical
Economy
Customers
Demand cognition
Working model
Safty&environment
Capital
Pro forma
Competitor
Marketing Mix
Tech evaluation
Advisory
Development
Prototype
Marketing plan
Business plan
MaterialS
Tests
Target market
Market channels
Venture
IP
Production method
Field test
Management team
Write a plan
Introduction
Market validation
Pre-production
Business start up
Market relation
Limited
Prototype production
Support system
Execute contracts
Secure financing
Refine
Analyze sale
Production process
Business function
Finalize design
Product demo



The above diagrams indicate that there are two main steps in commercialization process in RIPI. First step is development phase, which contains three stages; feasibility, development and introduction. The final products of this step are final design and product demo. The second step is defined as a commercialization phase that contains growth and maturity. This step will guide the real start of the business in the market. Base on the exact strategy chosen by decision makers these two steps may vary.

The joint venture alternative includes lot of negotiation and collaboration in order to run and start a business in any field specially base on a new technology. Thus the procedure is more quality oriented and cannot be modeled. In this conditions usually the information are only used when the real issue of contract and expenses and the other issues are discussed. In licensing the involvement of RIPI in business part is not as much as the other two alternatives but intervention in production and quality control remain sustained as the others. Therefore the above procedure should emphasis more on technical part rather than business section of the study. Running a new business from the start point requires lot of executive and administrative work beside of financing, management and coordinative issues that have to be defined and managed.

As the information delivered before in the text indicates, RIPI was not successful in the innovation enhancement programs in the private sector of the market or by other mean it was not flourish in

absorbing projects from industry in order to improve the companies market position. Accordingly beside of the described methodology of commercialization RIPI has to consider several points in order to move more efficiently in the market.
1- Marketing: identifying the exact need of the customer and translating it into technical language.
2- Industrial scanning: seven-research center active in different industry provide the opportunity of serving to seven different markets that have similarity in oil base production but with different industrial structure. Therefore it is necessary to build long lasting relationship with the industries for each research center.
3- Technology transfer: to understand the weakness of the industry and the urgency of the problem can give the alternative of technology transfer for RIPI base on the technical background and their familiarity with new technologies that can help enterprises not to lose their investments.

Conclusion and recommendation

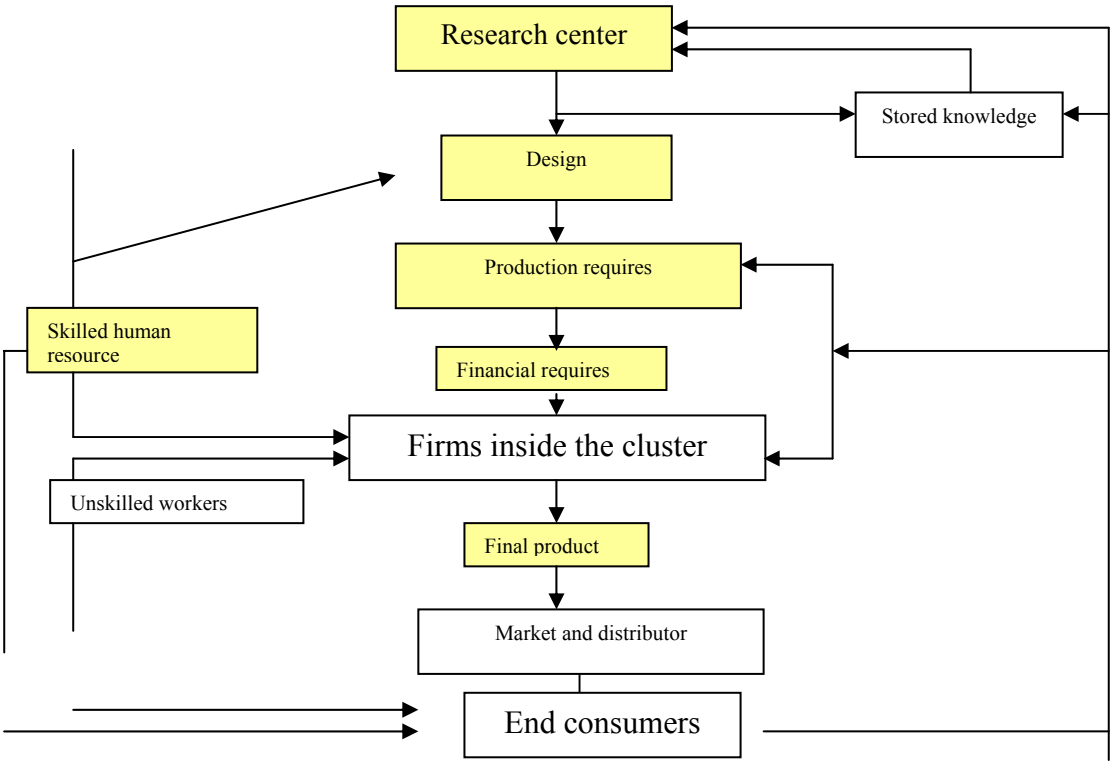
The commercialization of university research and the establishment of clusters of entrepreneurial firms are often considered the magic seeds for driving economic growth in developed and developing nations (19). Government research centers can provide benefits to industry. Base on that there should be an investigation on finding technology-driven clusters potential in country and looking for ways to enhance the relationship with the cluster in order to improve the technology level of the firms.
Refer to ISIPI there is a drilling equipment cluster in Ahwaz and they are looking for more oil-base cluster in Khuzestan province. Therefore there is a good opportunity for the RIPI to test and improve its level of activity around those clusters.
The following points should be considered in order to enhance the relationship and improving the technology level of the cluster.

1. Diagnoses and attracting of any innovative activity inside the cluster
2. Publishing monthly paper including of new information about the RIPI activity and knowledge development in the area and world
3. Try to provide services for their IP registration
4. Running an incubator for the idea generator of the cluster
5. Providing an competitive environment for the idea generators in and out side of cluster

Beside of all the above-mentioned activities the following activity should take place inside the RIPI as well

1. Intellectual human resource management
2. Industrial management section
3. Developing an appropriate level of bureaucracy
4. Information network system
5. Financial supporting system
6. Ranking of intellectual Properties
7. International communication system
8. Competitive system
9. Distribution system (20)

Of course some of the systems are implemented or in progress and the other should be implemented because the important role of the center in development of clusters in the oil industry with knowledge base. The following chart indicates the role of RIPI and the form of its relationship with the clusters. The boxes with yellow are the places that RIPI can play role in.



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