

INSTITUTIONS, SUPPLY CHAINS AND RESOURCE MANAGEMENT FOR AGRICULTURAL DEVELOPMENT¹

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INTRODUCTION

The New Institutional Economics (NIE) and Neo-classical Economics are applied to understand the organization of economic activities, regulations, and functioning of the markets. The former has added to better understanding of the framework under which the markets can be governed for improved economic outcomes, while the latter continues to be the main theoretical concept guiding efficiency in allocation of scarce resources. The NIE has several new concepts and insights relating to nature of the firm as governance structure, 'bounded' rationality of human behavior, collective actions, and transaction and information cost. However, a large body of the work consists of the study of the institutions or the 'rules of the game' aimed to govern behaviour of the economic agents. These rules can be evolved over a period of time, largely derived from social systems and beliefs, or evolved by the community and interest groups for a specific purpose. These are often referred to as 'informal' institutions which are very effective due to their embeddedness in the social and economic systems. The second set of rules are to govern the markets, commonly referred to as institutions of the capitalist economies. These are formal rules or acts, but enacted within overall economic and social systems. Both the institutions function well when there is some consistency between them (Williamson, 2000, Nabli and Nugent, 1989, North, 1990).

The application of the principles of NIE has contributed to the understanding of the institutions how they have evolved, and how appropriate institutions lead to better economic outcomes. In the market economies, firms are considered a form of governance of economic transactions and incentives for the firm is to reduce the transaction cost. Therefore, transaction cost economics has emerged as one of the important principles of NIE to study organization of the firms and their interactions with economic agents. Various forms of contracting arrangements are made to reduce the cost and therefore theory of contract is an important area of analysis. In this context, transaction cost is defined as the cost associated with establishment and enforcement of the contract (Williamson, 1985). The concept has been widely applied to the provision of private goods and services and use of resources with defined property rights. The second element of the transaction cost is applied to those goods for which property rights are not well defined, e.g. common pool goods, and the institutions to govern these resources are formed by the users and stakeholders to regulate access and management. In this case, transaction cost is the cost of establishing these institutions and their enforcement (Ostrom, 1990).

The principles of NIE are also applied in the field of agriculture to understand the evolution and efficiency of the institutions. A body of literature focused on management of common

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pool resources, mainly water to address the problem of degradation and over exploitation. The provision of agricultural inputs and price discovery in the product markets is another important area of the study. Extension of property rights to research and development (R&D) and innovations has also received considerable attention of economists (Pal et al, 2003, Marothia, 2010). This paper discusses these broad areas of the investigations in the context of Indian agriculture. The focus is on the direction of the institutional change, economic efficiency, and contribution to agricultural development and farmers' welfare.

R&D SERVICES AND PROPERTY RIGHTS

New knowledge and technology are the products of research with characteristics of a public good, which should be provided by the government or public-funded institutions. The Indian Council of Agricultural Research and State Agricultural Universities have been taking the responsibility of research education and frontline extension in India and have done well by all standards. However, R&D in the field of agriculture has witnessed significant changes globally and India is no exception to this. This shift is primarily because of the fact that knowledge and technology are delivered through inputs like seed, fertilizer, pesticide, etc, which are mainly supplied by private companies. Many of the private companies have diversified into R&D to strengthen their market power. This shift has not only diversified the providers of R&D services but also changed contractual relations among the companies and with public agencies. It is now estimated that 15-20 percent of the national expenditure on agricultural research is contributed by the private sector, primarily input companies. The contributions of the Central and the State Governments are almost equal in the total public expenditure (Pal, 2017). The relations between the public and private companies and among the private companies have also changed significantly. There is an increasing interaction between public R&D and private companies, the latter approach the former for source material and technology (e.g. varieties). A similar kind of licensing arrangements are also taking place between the private companies (Tripp and Pal, 2000).

Intellectual Property Rights

The diversification of the provision of R&D services was facilitated by the opportunity to make profit through appropriation of research benefits. This trend was further strengthened by application of intellectual property rights in the field of agricultural science. The patent regime was strengthened by providing both process and product patents, which have significant applications in plant and animal health, biotechnology, food processing, etc. Plant varieties conforming the criteria of *distinctness, uniformity and stability* were allowed to be protected under the Protection of Plant Varieties and Farmers' Right Act (2001). An Authority is also established to administer this Act. There is another authority to oversee the implementation of the Biological Diversity Act (2002). These Acts have provided a regulatory framework to access, and share cost and benefits from the use of plant genetic resources, and facilitate interactions among the conservator and use of genetic resources. The relations among the plant breeders have also become more formal for exchange or licensing of genetic material. The nature of seed companies has also changed. The companies with adequate resources have diversified and integrated seed business with plant breeding. But the

companies with limited resources preferred access to improved varieties from the market (private or public programs) and thus contractual arrangement became more common in seed or input industry. In summary, there are changes w.r.t. providers of service (seed) (public, private), property rights and contractual relations among the providers of the material (farmers, breeders, seed producers).

Access to technology

The institutional change has brought many changes in the input industry, particularly seed and pesticides. First, there is greater participation of the private sector, which has made the service more demand-driven and competitive. Farmers have benefited from the access to improved technology available within India and globally (Pal et al, 2007). Table 1 also shows that a large number of varieties are bred and the trend is sustained over the period of time. The share of private sector in supply of quality seed has also increased and now the seeds of crops with hybrids like maize, pearl millet, sunflower and cotton is largely supplied by the private sector. The share of private sector in the supply of seeds of paddy and wheat, crops with mostly open pollinated varieties, is 45.56 and 60.91 percent, respectively. Plant breeders from public and private sectors have confidence in plant variety protection mechanism and now the share of proprietary varieties in the certificates issued during 2009-19 was higher than the public sector for the crops of maize, pearl millet, sunflower and cotton. Surprisingly, the private companies registered 140 varieties of paddy as against 214 by the public sector. The technology is also changing and now hybrids form dominant proportion of the total seed sale and this is more so for private seed. This has contributed to higher seed replacement rate, particularly for maize, vegetables, pearl millet, cotton, etc. All these developments point to the diversification and competitiveness of the seed industry, benefitting the Indian farmers.

Table 1. Public and private sector's share in quality seed and plant varieties

Crops	Notified varieties		Availability of quality seeds (TE 2018-19)			Number of PVP certificates issued (2009-19)		
	2001-10	2011-19	Quality (lakh quintals)	Public share (%)	Private share (%)	Private sector	Farmer	Public sector
Paddy	282	275	100.10	54.44	45.56	140	1557	214
Wheat	103	97	141.77	39.09	60.91	9	25	155
Maize	111	98	14.46	10.83	89.14	161	6	108
Sorghum	46	34	3.20	33.40	66.60	47	4	88
Pearl millet	48	53	2.85	7.24	92.87	98		34
Chick pea	62	28	20.17	69.22	30.77		2	48
Red gram	30	16	3.32	42.91	56.98	13	7	23
Black gram	26	22	3.59	67.35	32.56	1	1	18
Groundnut	60	36	26.48	59.43	40.58			35
Mustard	53	47	2.67	51.19	48.81	16	12	64
Soybean	32	36	32.69	40.03	59.96	3		32
Sunflower	28	6	0.35	4.81	95.19	46		10
Potato	13	5	29.34	33.30	66.69	10		15
Cotton	85	31	2.76	2.66	97.58	297	1	75

Source: Based on DAC&FW and PPV&FR data

Another major advantage of the institutional change has been access to foreign technology. Introduction of bt gene, single cross maize hybrids, and vegetable hybrids are notable examples with large scale impact at farm level. Similarly, many foreign companies have registered their patents in India and these are in the field of pesticides, pharma (animal health) and biotechnology (Table 2). This shows that these companies either shall have commercial production in India, or license to someone else for commercialization and sale to farmers. For the newer products with higher intellectual and business significance, imports shall continue to protect from possible infringement of intellectual property or copying. In any case, farmers shall have access to foreign technology useful for increasing crop and livestock productivity and higher farm income.

Table 2. Number of patents granted in the field of agriculture in India

	2007-2015			2016-2019		
	Residential	Non-residential	Total	Residential	Non-residential	Total
Public	105	41	146 (12.2)	80	23	103 (16.5)
Private	94	868	962 (80.0)	23	443	466 (74.5)
Individual	58	35	93 (7.8)	39	17	56 (9.0)
Total	257 (21.4)	944 (78.6)	1201 (100)	142 (22.7)	483 (77.3)	625 (100)

Source: Indian Patent Office database

INSTITUTIONS AND INPUT SUPPLY

The institutional changes have resulted into major changes in the structure of the input markets. The scale of operation of input companies has increased considerably and these are now more organized. Small firms have either grown in size or taken over by the large firms with professional management. There are contracts for technology access and production, and distribution of inputs. The nature of contracts varies from access to technology or source material, commercial production, e.g. contract growing of seed by farmers, and distribution of inputs by dealers. There is more competition and the markets are open to transnational companies. There are strategic acquisitions and mergers of the companies, which has changed the market structure. The market is now dominated by large national and transnational companies of seeds and pesticides. For example, top four companies produced 20 percent of pesticides, and the share of top nine companies was 29 percent in 2014-15 (Subash et al, 2017). Similar estimates are not available for seed market, but it was found that top four varieties occupied more than 40 percent of seed sales of paddy and wheat, whereas this share was more than 90 percent for hybrids (maize, cotton and sorghum) in many states (Venkateshand Pal, 2013). The implication of such market concentration is increase in input prices. The price increase was observed for hybrid seed and few pesticides. However, the increase was moderate because of large number of companies and presence of the public

sector. In the country like US where most of the business was done by private sector, market concentration and price increase was comparatively higher (Fuglie et al, 2011).

The market changes were driven by the private sector and it is likely that this trend shall continue or even become stronger in future. But there are concerns of non-participation of business activities in some R&D services and inputs. These relate to delivery of high volume seed of self-pollinated crops like groundnut, where small non-profit or local seed agencies are in operation. The same holds true for biological agents for pest control and growth regulators. The provision of these inputs may need additional incentives, or some decentralized arrangements with support of public R&D agencies could be effective.

CONTRACTS AND PRODUCT MARKETS

The main constraints in the marketing of agricultural produce has been information asymmetry, lack of quality standards in some products like vegetables, long supply chains with no or limited value addition and high marketing costs. These constraints are being addressed by the government through creation of market infrastructure, regulation of trade to check unfair practices, and attracting private sector for greater competition and efficiency. In spite of these efforts, trade in agricultural commodities remained informal and considerable amount of the produce is still sold to local traders. This is particularly true for the states with limited market infrastructure, and in the states like Punjab and Haryana, most of the produce is sold in *mandis*. The share of cooperatives or other public agencies is rather low in almost of the crops, except in the states where there is significant amount of procurement of paddy and wheat is done by the public agencies. Most of milk is marketed through local vendors and direct sale to consumer households. Only in the states of Andhra Pradesh, Maharashtra and Rajasthan where milk cooperatives are operating, 24 to 43 percent of the production is sold to the organized dairy (Table 3). Sugarcane is the only crops which is directly supplied to sugar mills, either direct linkages with farmers or through farmers' cooperatives. The procurement by the public agencies, both central and state, is largely concentrated for rice and wheat, and only recently the procurement started for pulses, oilseeds, vegetables (onion) under the Price Support Scheme and Price Stabilization Fund.

The Government has taken steps to seek participation of private sector in a significant way. The APMC Act envisages participation of private sector but the success was rather limited. A model act, viz. Agricultural Produce and Livestock Marketing Act (2017) was suggested to the states for its adoption, but the progress remained weak. The PM ASHA scheme also has an option to attract private sector in agricultural trade and procure at the minimum support price and freedom to sell anywhere or export. Again not many states have opted this option and nor the private traders appear to be optimistic about this scheme. For creation of market infrastructure also, efforts are made to attract private investment. One such effort was expansion of storage facilities under public-private partnership mode under the Private Entrepreneur Guarantee Scheme (2008) with a guarantee to hire storage. So far, 14.38 million tonnes storage capacity has been built under the scheme. Recently, the Government has announced Agri-Infrastructure Fund of rupees one lakh crore for farm-gate infrastructure development and promotion of value chains. The Primary Agricultural Cooperative Societies

(PACS), Farmers Producer Organizations, entrepreneurs, startups are eligible for financing with interest subvention of three percent upto two crores.

Table 3. Percent quantity sold to various agencies out of first major disposal by farmers, 2012-13

State	Agency	Paddy	Wheat	Cotton	Gram	Pigeon pea	Soybean	Potato	Milk	
Punjab	Local private	7.8	8.1	2.7				91.6	Directly to other households	27.7
	Mandi	56.0	47.5	93.4		100		8.4	Local traders	49.8
	Coop. & govt agency	34.5	43.0	3.1					Coop. & govt agency	10.6
Uttar Pradesh	Local private	47.2	36.2	51.9	12.0	4.0	43.4	36.8	Directly to other households	21.1
	Mandi	22.6	48.5	40.0	83.7	96.0	56.6	51.2	Local traders	66.4
	Coop. & govt agency	1.6	0.8						Coop. & govt agency	0.3
Madhya Pradesh	Local private	22.0	16.6	37.5	35.0	47.5	28.2	9.6	Directly to other households	25.0
	Mandi	18.5	44.7	25.7	58.4	40.6	66.5	69.5	Local traders	56.6
	Coop. & govt agency	48.4	33.4		0.2		0.1		Coop. & govt agency	6.8
	processors		0.2	10.6			0.1		Processors	1.2
Andhra Pradesh	Local private	84.1		62.3	95.3	99.4	100.0		Directly to other households	11.3
	Mandi	0.2		25.6	4.7	0.2			Local traders	42.3
	Coop. & govt agency	0.4		2.3					Coop. & govt agency	24.1
Rajasthan	Local private	0.2	37.0	9.5	18.1	100.0	44.4		Directly to other households	14.4
	Mandi	99.8	50.5	75.6	80.1		52.0	100.0	Local traders	47.2
	Coop. & govt agency		2.1	0.3	0.1		1.1		Coop. & govt agency	31.8
Maharashtra	Local private	42.5	56.0	68.8	28.0	26.3	44.6	88.7	Directly to other households	8.7
	Mandi	29.7	43.0	22.6	69.5	63.4	51.9	11.3	Local traders	44.5
	Coop. & govt agency	13.1	0.1	1.7	2.4	0.0	2.7		Coop. & govt agency	42.7
Tamil Nadu	Local private	68.5		88.1	100.0	79.4		70.2	Directly to other households	15.3
	Mandi	9.4		3.0		20.6		29.8	Local traders	59.6
	Coop. & govt agency	19.9		2.2					Coop. & govt agency	18.8
West Bengal	Local private	67.3	75.7	33.3	100			95.0	Directly to other households	32.0
	Mandi	21.8	23.9	66.7		100		4.8	Local traders	46.2
	Coop. & govt agency	0.6							Coop. & govt agency	0.3

Source: Situation Assessment Survey of Agricultural Households, National Sample Survey Office (2014)

These developments in agricultural markets indicate that the efforts were directed towards diversification of the markets with multiple actors. Asymmetric information, risk associated with transactions and government interventions to direct private trade during the shortage of production proved to be major bottlenecks. There were not much incentives for private investment in the market and associated infrastructure. Therefore, the markets remained dominated and regulated by the public agencies. On the contrary, this could have been a market dominated by private agencies facilitating the production-consumption linkages.

Regulatory Environment

The main regulatory environment for agricultural marketing was regulation of APMC markets and it was effective in those states where market infrastructure was good. In many states, these markets are still ineffective. The Essential Commodities Act (1955) was another important regulation to ensure supply of food products at a reasonable price. It was being considered that this Act was mainly to protect consumers and control undue hoarding of food products. Therefore, food products have been taken out from the list of commodities under ECA, allowing private traders to buy and store food products. In addition, in order to attract private trade, the Farmers Produce Trade and Commerce (Promotion and Facilitation) Act (2020) accords freedom to farmers to sell their produce anywhere, and private sector establishing any kind of purchase facilities, including electronic trading. This is a major change allowing traders and processors to directly purchase the produce from the farmers. The regulations for quality standards were shifting from a simple AgMark labelling to standards for organic products and quality standards of the Food Safety Standards Authority of India. This is a major departure from the past.

The second major regulatory environment relates to governance of contractual arrangements in the production of agricultural commodities. Under this arrangement, processing industry or traders enter into a contractual arrangement with farmers for the production of a commodity conforming to their standards. This is common for vegetables like potato, poultry, basmati rice, organic product, etc. The contract is usually linked with market price for better transparency and low risk. The company also provides knowhow, variety and finance to the contract farmers. The contract was successful based on mutual interest, but there were instances of conflict. In order to provide a legal frame work to this practice, a model Contract Farming Act (2018) was prepared by the Government for adoption by the states. Recently, the Government has provided a legal framework through The Farmers (Empowerment and Protection) Agreement on Price Assurance and Farm Services Act (2020). The Act also has a provision of conflict resolution in a cost-effective manner and within the reach of farmers.

Third important group of institutional reforms deals with aggregation of produce of large number of smallholders. This is being attempted right from the increasing access of small farmers to land through the Model (Agricultural) Land Leasing Act (2016). In a number of states, land leasing was not allowed but followed in practice. Therefore, it is suggested to make land-leasing legal and the model act is suggested to the states. This shall be helpful in increasing the size of operational holdings and reduce the cost of production due to resource sharing. This is a matter of property rights and even the states making land-leasing legal, the

success shall depend upon the conflict resolution process, which is still cumbersome and cost inefficient. This must be addressed to make the land markets functional.

Other route for the aggregation of production suggested is the farmer producer organizations (FPOs) promoted by Small Farm Agri-business Consortium and the National Band for Agriculture and Rural Development. The Government aims for 10,000 FPOs and extend several financial incentives for their promotion. There are also attempt to promote business model linking farmers with the processing industry. Formation of commodity clusters, food processing and modernization of commodity value chains are the efforts in this direction. Availability of venture capital, infrastructure along the value chains, technology and risk management shall influence the success. These value chains shall also be influenced by contractual arrangement for different services. The economic package announced by the Government extends financing facility for agriculture and MSME, but professional management to enforce contract and risk management need attention. Public institutions for skill development can be useful in this direction.

Market Information Asymmetry

One of the major problems with agricultural product markets is information asymmetry on supply-demand scenario and prevailing market prices. Traders have information on the market but lacks the information on the national and international scenario. On the other hand, farmers do not have access to information about commodity prices. Their sources of information are mass media and traders who purchase their produce. Although the situation has improved to some extent, but national efforts to promote price discovery and information dissemination is the establishment of e-National Agricultural Market which covered now almost one thousand *mandis*. The system has a provision of onlinetrading, and inter-state trading is permitted. Farmers can also access information about prevailing market prices. Efforts are in progress to institutionalize a system of commodity price forecasting for major markets using historical price data and current production scenario. This will also collate information on international supply and trade scenario. The early efforts have been quite positive in terms of price forecast accuracy and farmers' response (Saxena et al, 2019). The role of digital technology, linkages with farmers, and support of marketing agencies/boards are critical to improve access to market information and facilitate price discovery.

COLLECTIVE ACTIONS

Natural resources make basic foundation of Indian agriculture and most of early growth in the post-Independence era was driven by natural resources, particularly expansion of cultivable land and irrigation. These resources are still important but property rights for some of these resources, e.g. common land, forest and water, are not well defined. As a result, these resources are over exploited and poorly managed. The natural resources should be managed in a sustainable and inclusive manner. Institutional change to achieve this objective has greater role and many studies have been done globally to address this issue (Hardin, 1982, Ostrom, 1990). There are two levels of institutions which are important. First is macro-institutional framework which provides direction and legal backing to micro or village-level

institutions. Notable examples of these institutions are Joint Forest Management Policy of 1988 which recognizes the rights of the community to access forest for non-timber, minor-forest products. Under this policy, Joint Forest Management Committees were constituted and performance of these committees is found to be better in central India, where non-timber forest products are rich and dependence of tribal community on forest for income is high (Marothia, 2010). The second example is recognition of the role of water user farmers in water distribution and cost-recovery in canal and watershed command areas. The direction of the reforms has been quite encouraging but there are operational issues at the micro-institution, involving people's participation.

The behavioural rules for the micro-institutions are framed within broad framework of macro-institutions, contextual realities of the resource, and its role in livelihood of the people. One of main characteristics of these institutions has been participation of the stakeholders, organizational framework, and developing the behavioural rules for member farmers for the cost and benefit sharing. Umpteen studies have examined the performance of watershed development. A meta-analysis of these studies showed that performance of watershed depended largely on people's participation, which in turn, was influenced by potential benefits, demand-driven, decentralized approach, and linkages with support institutions and services like credit, input and technology (Joshi et al, 2003). Further studies in this area focused on water users' association promoted for participatory irrigation management and it was observed the performance of these associations was determined by the clarity of the objectives, design and scale of the association, interconnectedness with other institutions, compliance and adaptability. The associations with homogenous groups for a specific purpose, greater interaction, responsive governance, compliance to tasks, and conflict resolution were found to be more effective in terms of achieving the purpose and reducing the transaction costs (Cruse and Gandhi, 2009). This institutional framework is being applied to more and more natural resources and collective actions even for market or local goods, which together will provide new insights. The cooperative management of the natural resources is also tried but there is not much success because of limited people's participation, inflexible management structure, and inadequate resources (Singh and Ballabh, 1996). On the other hand, social traditions and taboos and compliance of the people to these norms were helpful in conservation of biodiversity in the protected forest (Pal, 2018).

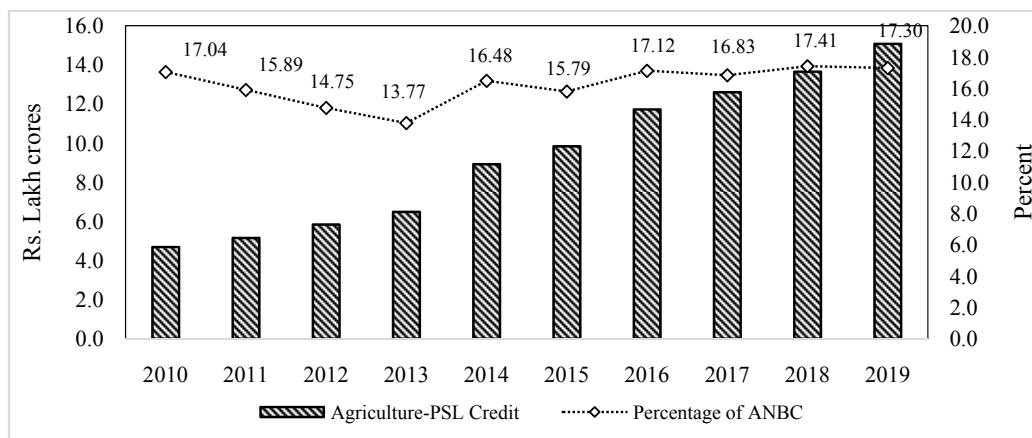
Another common property resource where a different institutional mechanism is adopted is access to water bodies for irrigation and fisheries. Usually, riparian rights are used for access to water from river and reservoir for irrigation. In some cases, 'modified' riparian rights can be used to allow inclusiveness in water use, or to establish priority of a social group in access to water (NRC, 2002). However, in case of village ponds and reservoirs, mostly a policy of leasing the water body for fisheries is followed. The practice varies from state to state, depending upon the ownership of the water body, viz. *panchayat*, revenue or forest department, fisheries department, and irrigation department. The water bodies are leased out mostly for a year or a longer period. In some cases, cooperative or women groups are preferred for lease (NFDB, 2020). It is observed that the lease should be for a reasonable period for optimal use of the resource. Similar lease rights are also given for cultivation of seasonal fruits and vegetables in river beds at a nominal cost. The system is working well as

there is not much degradation of the resource and people have incentive to follow the norms. It is often argued that this system can be followed for restoration of waste lands with the state governments, but not pursued much due to a longer lease required for development of these lands. Also, resource poor people can't participate in this process due to lack of resources for land development and as a result, leasing out of these lands to rural elites or business sector can set in the process of intensification and degradation. Therefore, a decentralized system involving forest and revenue departments and civil society organizations could be a better option.

ACCESS TO FINANCE AND RISK MANAGEMENT

Traditionally, financial services in villages were provided by private money lenders at a very high rate of interest. In most cases, land, labor and credit markets were inter-linked, which provided control to landowners over the resources and farm produce. There was not adequate incentive for the tenants to invest for higher productivity under insecure tenancy and therefore, it was considered to be an inefficient institutional arrangement (Appu, 1975). This arrangement is still working on the basis of monetary contract between the landowner and the tenant, and in the developed region like north-west India, 'reverse' tenancy is popular. The power relations changed with the changes in relative scarcity of factors of production (land, capital and labour). This change was witnessed in developed countries during agrarian transition (Brenner, 1976, Bardhan, 1989) and now see in India also. This is a positive development to optimize use of resources and help aggregate the production. Concomitantly, efforts were made by the government to increase access of farmers and rural workers to financial institutions. The efforts include revival of Primary Agricultural Cooperative Societies (PACS), financial products like Kisan Credit Cards (KCC), and priority sector lending for agriculture and allied sector. The National Bank for Agriculture and Rural Development (NBARD), as an apex financial institution, provides refinancing facility and funding for infrastructure development. All these efforts are now directed to improve access of farmers to institutional finance at a nominal cost, strengthen rural financial institutions (cooperatives), and attract investment for agri-infrastructure and food processing. In spite of these efforts, 59.8 percent farmers have access to institutional finance. Furthermore, the institutional finance was largely concentrated in the southern region and the penetration in the eastern region was abysmally low (NSSO, 2013). The official data show that the share of cooperatives in total agricultural credit remained 10.9 percent (2019-20), and target for agriculture was nearly achieved (17.3 percent, 2019-20).

Fig 1. Trend in agricultural credit and its share in the advances by the commercial banks



At the heart of financial reforms was to reduce the transaction cost of institutional credit and improve access of the farmers. The major success in direction was achieved by introduction of KCC, which is now extended to livestock owners and fishermen. It has also some element of investment credit that remained a small component. The second major success was provision of input credit under the contract farming, but its share remained rather low because of less area under this system. Landing to the Joint Liability Groups was encouraged by it also remained a local practice in the areas with collective actions, functioning of the groups, and their demand for credit. Revival of PACS can make a significant improvement in the access to institutional finance, provided these have adequate working capital, professional management, and people's confidence in cooperative institutions as a viable institution.

In the field of agricultural insurance, efforts are made to pool the risk of farmers and provide a viable financial product. In order to reduce the transaction cost, crop insurance was linked with institutional credit and part of the premium is borne by the state and central governments, and farmers have to pay a small proportion of the premium, 1.5 percent for *rabi*, 2 percent for *kharif* and 5 percent for commercial and horticultural crops. Although there is considerable progress and the official statistics shows that 55.7 million farmers with 44.2 million ha area was covered under crop in 2019. However, PMFBY continues to fraught with the information asymmetry. Farmers are uncertain about potential benefits, procedures, and timely settlement of claims, restricting their participation. The second major issue is premium as cost to the farmers growing less risky crops, e.g. wheat, sugarcane, under assured irrigation conditions. The operational procedures to settle the claims in case of crop loss is another area needing attention. With the advancement of remote sensing and digital technology, the procedures should be more transparent and less time taking. Finally, the insurance product has to be financially viable and affordable to farmers. Therefore, new insurance product linked with weather parameters affecting crop productivity shall reduce the implementation cost.

SUMMING UP

The NIE has provided new concepts and principles which have been applied to study the institutional change and its efficiency. However, information and transaction cost economics have been applied to study contractual relations among the economic agents and governance

structure of the firms. The well-established property rights and their enforcement help reduce the transaction cost and therefore promote contractual transactions. These principles have also been applied in the context of Indian agriculture. Some significant progress has been made to improve the institutional environment for the provision of R&D services, participatory resource management, contractual arrangements in the supply chains, and financial services. The structure and governance of the firms are undergoing significant change, improving scale of operations, diversity of firms, and contractual relations. These changes are dynamic in nature and therefore role and appropriateness of the institutions can be best understood in the development context. The theory of the Neo-classical Economics to set the prices right for better allocative efficiency has to be supplemented with the NIE principle of setting the institutions right. The latter will facilitate the price discovery and reduce the transaction cost. In order to set the institutions right, property right should be well defined and enforced, so that contractual arrangement can work well and the transaction cost of the regulation of the contract shall be low, and thereby promoting economic efficiency. It is therefore expected that much of the future work shall focus on reducing the information and transaction cost.

The structure and governance of the organizations shall also depend on the nature of goods and services under consideration and balancing the roles of state, markets and CSOs. Most of the institutional reforms in this direction have taken place to attract people's participation in the governance and delivery of goods and services. There are umpteen examples in management of natural resources and civil goods, but large scale successful replication model is still eluding. The principle of Principal-Agency can be applied for implementation of government programs, but one can't rule out the probability of moral hazards and appropriation of public resources for private benefits. Crop insurance is one area where information asymmetry along with problems with the Agency, i.e. insurance company may fail to deliver the service to the client farmers by withdrawing from the business. Therefore, development and governance of Principal-Agency model shall be a major area to balance the role of the state and partnership with private sector or CSOs.

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