



IMMUNITY TO TECHNOLOGY DIFFUSION: PLANNED TECHNOLOGY AND UNPLANNED ADAPTATION

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ABSTRACT

The phenomena of technology transfer and adaptation are not only compelling elements of the business environment for managerial commitment, but also the manageable fit and acceptance of the phenomena with the principal actors in the structural settings that are immune to change. Effectiveness of technology diffusion primarily depends on the process of its transfer and acceptance of the principal actors in the structural settings for its adaptation.

This paper analyzes the technology planning priorities of the government of Nepal by covering the period of the last fifty years of the country's planned economy at one part and examines the organizational/structural settings for technology diffusion on the other. An extensive overview of national plan documents determines the government's planning priorities and initiatives for technology diffusion in the country. Examination of the organizational settings in the country indicates the degree of congruence between the planning priorities and arrangement for organizational settings in the enduring process of technology diffusion. An analysis of the response of opinion leaders from selected organizations involved in technology works/projects supplements to the analysis and conclusion of the study. This study concludes with an identification of unplanned organizational settings remaining as a structural immunity to the planned technology diffusion in the country.



Keywords: *technology planning. technology diffusion. organizational setting. structural immunity. technology adaptation.*

1. INTRODUCTION

Structural settings and technology diffusion in a country are prerequisites and reciprocals of each other. In this study, structural setting refers to the set of organizations or institutions working in the area of technology absorption, development and transfer. The process of technology dissemination, transfer, and absorption in multiple areas like infrastructure, socioeconomic, governance, and compliance sectors of an economy refers to the diffusion of technology.

An assimilation of national technology planning priorities and functional priorities of the organizations working in the areas of technology dissemination and transfer is a condition of technological advancement in a country. The process of technology diffusion is an integration of the priorities with the working priorities of the technology adopters.

The instrumentality of organizations involving in the process of technology diffusion needs to be assessed at different levels of analysis. It is necessary to understand the dialectical relationships between the forces of conflict, coercion, and disruption at one level and forces of consensus, unity, and integration at another level of the organization (ASTLEY; VAN DE VEN, 1983).

Organizations and their leaders master the immunity to change which will be dominant in their functional areas. They will set the standard in terms of accomplishing their own goals and they will have the greatest loyalty and commitment of their internal constituents (KEGAN; LASKOW LAHEY, 2009). There may be incongruence between the national technology planning priorities and the priorities of the adopting organizations involved in technology diffusion process.

In the context like Nepal, where government presence in the economy is nominal but the private and non-government sectors are enjoying freedom for the establishment and operationalization of organizations in the areas of their own choice, diffusion of technology as intended in the national plan documents is in limbo. Unplanned permission for organization establishment increases the number of organizations but it does not assimilate the technology planning priorities and functional priorities of the adopter organizations. The organizations develop their own



structural immunity with strong commitment to their own constituencies or stakeholders. The immunity does not only prevent the organization in bringing change but remains incompatible with the intended change initiatives and planning priorities.

1.1. Statement of the Problem

In pursuance of self-reliance, Nepal developed technological capabilities in some specific areas such as agriculture, civil engineering, architecture, metallurgy, water management, medicine, textile and paper manufacture, dyeing and food technology (SINGH; BHUJU, 2001) in its own way until the beginning of her planned economy. Traditional technologies like constructing religious artifacts, images, and temples; construction of temples, pagodas, and stupas; textiles using handlooms; handmade paper; brewing wine and hard liquor; preserving meats, fruits, and vegetables (JOSHI, 2007) were in practice during the period.

Modern science and technology began along with the beginning of the planned economy. The country has made only a little progress in a few areas like biogas, biomass, micro-hydropower, solar energy, software development, construction materials, and food processing.

Although, science and technology systems in Nepal still need much more structural improvement in almost all the sectors like infrastructure, socioeconomic, governance and compliance. In view of the statement, this paper concentrates on the two major problems. The one is to get insight into the technology planning priorities during the planned economic efforts of more than 50 years; and the second one is to examine the technology planning priorities and structural settings aligned for the technology diffusion.

1.2. Objectives

The study argues that diffusion of technology represents the cumulative number of adopters of a new product, material, or process in a particular society. It follows S-shaped curve and needs an integrated efforts of all the socio-industrial actors. It is passing through various channels to the socioeconomic sector of a nation. Similarly, the study further argues that an alignment between the structural and organizational settings and national technology priorities is essential in order to



develop and diffuse the technology because organizations are the carrier of the technology as well. More specifically, the objectives of the study are:

- a) To examine the technology planning priorities during the planned economic efforts of more than 50 years ; and
- b) To ascertain the alignment between technology planning priorities and structural settings for the technology diffusion.

The results of this study provide ample evidences and illustrations to the policy makers and planners that the phenomena of technology transfer and adaptation are not only compelling elements of the business environment for managerial commitment, but also the manageable fit and acceptance of the phenomena with the principal actors in the structural settings that are being immune to change.

1.3. Methods

This study overviewed technology planning priorities of Nepal covering the period from 1956 to 2013. An overview of 5849 plus pages of the periodic plan and review documents of Nepal had been completed in order to determine the planning priorities for technology diffusion in the country. An exploration on the organizational settings had been made to identify the major organizations involved in the process of technology diffusion.

Overview of the objectives and working areas of the selected organizations was also done in order to ascertain their functional priorities. Unstructured interviews with selected opinion leaders associated with one or more of such organizations at different point of time were also incorporated while determining the reasons of structural immunity to change.

Overview of the plan and review documents determined the technology diffusion priorities and initiatives as well as achievements in technology branding, grading, and diffusion in the country. Subsequent exploration of the organizations found some major works/projects aiming at technology development/diffusion in different sectors in different ways. The opinion leaders' response complemented the discussion section as well.



Triangulation of the planning priorities, initiatives, and responses of the opinion leaders over the works/projects of their organizations had been made in order to determine the structural immunity to technology diffusion in the country.

2. ANALYSIS

Technology advancement program in less developed countries like Nepal is influenced by the diffusion of imported technology. The adaptation process of a new technology encounters structural barriers like sociocultural, psychological, and economical in due course of its diffusion (PANDEY; YADAMA, 1992).

Institutional interdependence, mainly between the organizations involved in training, education, research and development and the technology adopters as well as supporting services industry actors are derailing the process of technology diffusion in the less developed country. It has been argued that role of the regulators and government officials in bringing these two sets of institutions and actors needs to be consultative and participative instead of authoritative one.

2.1. National Periodic Plan Documents

Nepal adopted planned economy from the beginning of second half of the twentieth century (NPC, 2012). The technology planning priorities concentrated into two paths of technology diffusion. The first one is to develop and diffuse the indigenous technology and the second one is to transfer-in already developed technology from developed countries. The priority of Nepal was on both the paths of developing the indigenous technology and transfer-in of foreign technology as well.

a) First Plan (1956 - 1961)

Technology and capital equipment considered key factors in the growth of production. The Plan assumed that improvement of economic condition within the country was depending upon knowledge of technology and expanded programs in education. Until the end of the first plan, there were nine institutions in the field of technical knowledge and skills development in the country, and 6351 persons were getting education and training in different fields.

b) Second Plan (1961 - 1965)

Technical knowledge shortage was realized sharply and high emphasis was given on technical training. Low and medium level skills training was intended to



deliver within the country and foreign countries were sought for higher-level training. The country was receiving technical assistance from foreign countries and agencies namely America, India, China, Russia, Britain, Australia, Switzerland, New Zealand, Canada, United Nations, and Ford Foundation as well during the period.

In the first and second plans, special attention was given for the establishment of experimental farms and livestock centers and the training of middle-grade technicians. During the second plan period, 680 middle-grade technicians were trained and sent them to the districts.

c) Third Plan (1965 - 1970)

Technology transfer/diffusion was sought in the field of agriculture in order to replace the primitive practices. Agriculture extension to date had not been very successful because of the lack of transport facilities, technicians, and coordination with other developmental programs, improved seeds, fertilizer, credit, and efficient administration.

Decentralization of authority was in priority and the government agencies (*Panchayats*) were expected to handle the tasks of developing and/or diffusing technical skills. High emphasis was on the vocational and adult education. Most of the high-level technicians like doctors, engineers, and agriculture specialists were receiving education and training in India. Technical assistance for private sector development was assured and high priority was on the production of food grains. Technical assistance for training facilities, transport development, storage as well as private sector development was quite laudable during the period.

d) Fourth Plan (1970 - 1975)

Expansion of foreign trade considered as a mean of obtaining capital goods and technical expertise. Labor-intensive technology and use of indigenous resources had been realized as an important vehicle for employment generation. It was expected that the use of labor-intensive technology would bring multiplier effects in the economy. Emphasis was given to the technical education especially in the fields such as engineering, health, education, and commerce.

Several technical and vocational training centers were opened during the period; however, foreign assistance was sought in order to train the personnel in



technical fields. Research programs in agriculture sectors were considered to be carried out as an integrated way of various units- agricultural botany, agronomy, agricultural engineering, entomology, plant pathology, soil science, etc. Emphasis was on the production of agriculture sector technicians like Junior Technician (JT) and Junior Technical Assistant (JTA) in district agriculture offices.

Lead farmer training program, food research program, and forestry programs were much more desired at that time. The World Bank group was expected to conduct technical and economic feasibility survey for roads throughout the country. Technical experts and equipment were sought from the United Nations for the development of telecommunications facilities. Computer technology was introduced from the year 1971 and National Computer Center was established in 1974.

e) Fifth Plan (1975 - 1980)

Encouragement of labor-intensive techniques and extensive rural works programs were major concentration of the plan. Emphasis was given for the development of technical manpower from concerned institutions in the field of engineering, medicine, agriculture, and so on.

f) Sixth Plan (1980 - 1985)

Development and use of technology involving biogas, solar energy, wind power, and natural gas was emphasized. Maximum use of local skills and technology was desired in the implementation of development project.

The plan intended to improve technology in the area of breed development of calves, bulls, buffaloes, goats, sheep, chicken, fish, and fingerlings was expected to disseminate very soon. Emphasis was put on the development of practical production technology that had immediate relevance to the problems confronting the farmers.

Intention of labor-intensive technology and job creation was continuous. Drug research and productivity improvement of the cottage industries were also emphasized in the Plan. There was also encouragement to adopt foreign technology and capital in the extraction of mineral deposits as well as establishment of mineral processing industries.

The plan intended to adopt cost efficient technology in connection with the construction of small hydel projects. Similarly, maximum use of labor-intensive



technology and development of construction technology, which would permit maximum use of locally available construction materials was emphasized.

This Plan specified national science and technology objective, policy and program for the first time in the history of planned economy of Nepal. The objectives were focused to increase capability of national science and technology that would enable to embrace the entire development processes of the country, to inform the people at large on the use and utility of science and technology, and to maintain coordination among the different units that were engaged in developing and extending science and technology.

g) Seventh Plan (1985 - 1990)

This plan intended to expand and diversify the export market by enhancing competitiveness of exportable goods from the adoption of high technology and own skills as well. It was assumed that judicious use of science and technology would shift the dependence from agriculture to industries.

The Plan set objective of developing science and technology in the same pace as that of economic and social development of the country. The objectives included as upgrading the capability of science and technology by developing scientific and technical manpower, conducting research and development activities, transfer of know-how on organizational development and management; and expanding the use of science and technology by bringing awareness among the people.

The plan intended to make amendments and changes in imported technology in order to suit the local needs as well as manpower training for the use of appropriate science and technology. It was expected that indigenously developed technology would be further tested for its improvement and people would be informed about the concept, utility, and importance of science and technology in their daily lives.

The attempt of transfer of technology to the cottage industry continued during the period. The plan intended to continue research works for the development of technology in the areas of low cost construction and use of local raw materials. Emphasis was given to maximize the use of local technology, expertise, and skills and to explore and develop new and appropriate technology as well.



h) Eighth Plan (1992 - 1997)

It was assumed that advanced technology and institutional reforms would be made indispensable tools of support to private sector and organizations down to the village level. Dissemination of appropriate technology in agriculture sector was continuous in the plan as well.

In order to accelerate the technology transfer process, it was aimed to increase participatory role of agricultural research in training and communication programs. Some joint venture and technology promotion institutions were expected to be set up with a view to providing support to manufacture energy related equipment. Indigenous labor, skill and resource as well as foreign investment and technology were desired to utilize in development of hydropower. Rural telecommunication services were intended to be provided by adopting appropriate technology to the geographical features of the country.

Foreign investment was expected to be increased for maximum utilization of managerial and technical skills, modern technology, and in the process of promoting industries. The Plan made institutional arrangements to familiarize the cottage and small-scale industries with market, technology, skills, and the like.

There was an intention to establish technology transfer and development center to collect and publish statistics related to technology development and transfer, and to assist technically in the selection, evaluation, and replication of suitable technology. Technical schools started to be established in different parts of the country. The plan included activities like development of national information bank and network system, social communication program, and development of technology for the poor.

The plan continued with the objectives of developing science and technology in a way that it could support all-round development of the nation; supporting rural development sectors such as agriculture, cottage and small scale industries by enhancing scientific and technological capabilities available in the country; and encouraging import of foreign technologies that have a direct bearing on the country's economic development.

Major programs of the Plan included the management and expansion of infrastructure necessary to enhance the potentials of scientific research and



development; promotion of technology transfer and replication; productivity of quality workforce; and publicity and dissemination of technology.

The Plan further attempted to promote technology transfer and replication in agriculture, industry, transport, communication, and construction, and if necessary, it was intended to permit for import of such technology. The concerned government, private and non-government organizations, and institutions were encouraged to undertake this task.

i) Ninth Plan (1997 - 2002)

Priority to communication and information technology was given more in the Plan in order to adopt the changing technology. It was essential to launch programs such as experiment and development of indigenous and advanced technology, reforms in education, and development of information and communication infrastructure. Similarly, development of indigenous technology and adoption of new and advanced technology were also in priority.

Establishment of an Information Technology (IT) Park and production and export of software at lower cost were other attractions of the Plan. Emphasis was continuous on adoption of employment-oriented technology. Appropriate technology for food industries in the areas of collecting, grading, processing, and marketing was desired to develop even after several trials and findings.

Attention was given to the environment and pollution control. It was planned that National Broadcasting Authority (NBA) would be established and an effective broadcasting of radio and television would be arranged. It was desired to prepare national information infrastructure for contributing to the development of agriculture, health, education, tourism, and commerce sectors through the information technology park and information highway.

Focus of the objectives were maintaining sustainability in economic, social, cultural and environmental perspectives; improving traditional technologies; developing and transferring appropriate rural technology; developing and transferring advanced technology in order to reduce foreign trade deficit; improving teaching and learning in higher education; improving energy use efficiency; expanding hydro and meteorological services; and emphasizing the research and development activities.



System of developing science and technology sectors was expected to be initiated in the districts, municipalities, and village development committees. A twenty-year science and technology perspective plan was likely to be formulated during the plan period; application of hydro, solar and wind energy was encouraged to replace imported energy through the adaptive study, research and development and commercialization of energy technology.

Advanced technology transfer and development programs were intended to be conducted through the agencies that were interested to produce goods having comparative advantage, alternative energy use was emphasized; and arrangement of subsidy was also be made for those efforts that were developing and transferring for export and/or trade promotion.

j) Tenth Plan (2002 - 2007)

This Plan included the use of high-tech technology in rural area. Micro and rural industrial technology, telecommunication, and information technology, appropriate and environment friendly technology, agricultural technology, biotechnology, labor-intensive technology in rural areas were some areas of concentration.

Technology related with geographic information system was intended to apply to prepare soil database. Use of technology was considered instrumental in fulfilling basic needs, alleviating poverty, promoting income generating activities, generating employment opportunities, conserving environment and natural resources. The plan wished for making children, women, and deprived section economically independent with science and technology.

A national level electronic network of science and technology information centers was in priority to integrate the scattered science and technology libraries and records across the country. Commercialization of alternative energy technologies and reducing the dependence on imported energy through the planned technology development and expansion programs were also included in the plan.

k) Three Years Interim Plan (2007 - 2010)

The industry sector faced problems in technology transfer and absorption. Rural information centers were started to be established in different parts of the



country. Promotion of indigenous skill, efficiency, and technology became the conditions of foreign aid acceptance. Priority had been accorded to industries, professions and programs based on labor-intensive technology to generate employment opportunities in rural areas.

The agricultural production system would be made more competitive and commercial through the extension of appropriate agricultural technology. Promotion of rainwater harvesting in rural areas was emphasized. Utilization of information technology in order to make farmers capable of making decision by disseminating advanced technology and market information to the rural levels emphasized.

Multi sector technology development trials were expected to carry out. Agriculture research and technology transfer got high priority in public investments. National Agriculture Research and Development Fund (NARDF) was intended to be involved to develop and expand technologies for short terms with social mobilization.

Department of Food Technology and Quality Control (DFTQC) was expected to be extended to districts to render the service of maintaining food hygiene and safety. Introduction of Safety Management System by utilizing advanced technology of international standard in the civil aviation sector was proposed to ensure the flight safety. The concept of a working system of cleaner production technology and green productivity was also highlighted. The Plan had mentioned the physical improvement of urban and rural houses by using earthquake resistant technology.

Use of information technology in government works was intended to be expanded, and provisions had been made to give legal recognition to e-information dissemination. Quality human resource in the science and technology sector was also in priority.

Preservation of indigenous technology and its research as well as development of competitive capability, reduction of the digital divide and prevention of brain drain was noticed some of the major challenges to the country.

I) Three Years Plan (2010 - 2013)

There was quite satisfactory improvement had been made in adoption of solar energy technology, but nominal progress in adoption of other sources of alternative



energy. Employment creation was a major criterion in selection of investment projects.

This Plan emphasized for adoption of information technology in the government revenue offices including customs. Adoption of new technology in food laboratory, promotion of technology to minimize the impact of climate change, transfer of technology through electronic communication media, establishment, and operation of technology development fund with collaboration of private and cooperative sectors, technology transfer through economic diplomacy, promotion, and extension of telecommunication services for technology transfer were some other attractions of the plan.

Use of information technology in corporate governance, emphasis on research and development of information technology, encouragement of construction and operation of electronic Hardware Technology Park, promotion of information Technology Park, establishment of Public Key Infrastructure (PKI) data center as well as government integrated data center were other focused areas of the Plan.

There was emphasis on public-private partnership for the development of science and technology as well as the study and use of biotechnology, information technology, Nano technology, nuclear technology, and space technology. Establishment of space science and technology center, nuclear technology center, biotechnology research center, and preparation of Bioinformatics database were a few ambitions of the Plan.

2.2. Technology Policies and Sectorial Priorities

The country adopted a couple of policies in line to its planning priorities set by the national periodic plan documents. Foreign Investment and Technology Transfer act 1982, National Science and Technology Policy 1988, Science and Technology Policy 1990, Information Technology Policy 2000, Science and Technology Policy 2004, Bio-technology Policy 2006; Rural Energy Policy 2006; Technology Directives 2006 were a couple of major technology related policy initiatives and changes in the country.

This study has categorized the sectorial priorities of the periodic plan documents into three main categories- research and infrastructure development, socioeconomic development, and good governance and compliance (see



Table 1). Research and infrastructure category included road transport; electricity and power; irrigation; information and communication facilities; housing and urban development; environment, science and technology as well as research and development activities. Education, culture and sports; health, population, water supply and sanitation; children; youth; senior citizens; natural disaster management; local development; non-governmental organizations; and human resource development, agriculture; cooperatives; land reform and management; forest and soil conversation; tourism and civil aviation; industry; commerce; supply management; labor management and employment; and transport management are included in socioeconomic development category.

Decentralization and deregulation; planning and statistical system development; and implementation, monitoring, evaluation and reporting included in the category of governance and compliance.

Table 1: Sectorial priorities concerning technology diffusion in Nepal

Plan	Research and infrastructure	Socioeconomic development	Governance and compliance
First 1956 – 1961	Mineral and hydropower exploration; technical institution establishments; investment in technology and capital equipment	Technical training; provision of scholarships; emphasis on agricultural and forestry education	Desire of competent administrative and technical personnel, formation of technical committees and provision of advisors
Second 1961 – 1965	Focus on engineering institute establishment and development	Technical training assurance; establishment of experimental farms and livestock centers; technical training assurance	Technical training to the personnel at the government agencies, and the <i>Panchayats</i> were made more effective in technology transfer
Third 1965 – 1970	Technical assistance for transport development, storage, and private sector	Intended to replace the primitive technology in agriculture; technical assistance for private sector development; emphasis on vocational education and adult education	Considered <i>Panchayats</i> as a vehicle for technology transfer in social sectors; decentralization prioritized; coordination among the development programs emphasized
Fourth 1970 – 1975	Focus on vocational and training centers establishment; nucleus seed production program; food research programs, forestry programs; feasibility survey for roads; expansion of telecommunication facilities and industrial services	Foreign trade considered as a mean of obtaining technical know-how; leader farmer training program; provision of JTs and JTAs	Maintaining records of technical manpower realized; foreign technical assistance sought; labor intensive technology and indigenous resources emphasized;
Fifth 1975 -1980	Emphasis on strengthening the organizational network; agricultural research and education; promotion of technology center	Extensive rural work programs; focus on manpower development in technical field	Encouragement of labor intensive programs and technology



Plan	Research and infrastructure	Socioeconomic development	Governance and compliance
Sixth 1980 - 1985	Wish-for the studies on production and use of bio-gas, solar energy, wind power, and natural gas; programs on drug research and development; cost effective technology in building small hydel projects; labor intensive technology promotion in road building	Efforts to disseminate technology that improves the breed of calve, bull, buffalo, goat, sheep, chicken, fish, etc. Efforts on the improvement of production technology of the cottage industries; encourage foreign technology and capital in extraction of mineral deposits	Emphasis on the use of local skills and technology; use of locally available construction materials; determination of national science and technology objective, policy and programs
Seventh 1985 - 1990	Intended to upgrade science and technology capabilities; desire to reduce dependency on agriculture; shifting attention to industrial sectors	Desire of high technology and skills development to expand export; enlarge international assistance and its participation in the field of science and technology	Intended to increase awareness on the usefulness of science and technology; maximum use of local technology, know-how and skills emphasized
Eighth 1992 - 1997	Institutional arrangement to familiarize small and cottage industries with technology; establishment of technical schools; development of national information bank and network system; computerization of commercial banks; research works on low cost construction and use of local raw materials	Agriculture extension program in outreach; foreign investment and technology transfer for hydropower development; rural communication services; mineral exploration and development; social communication program, development of technology for the poor	Priority in dissemination of appropriate technology in agriculture sector; advance technology and institutional reforms; promotion of technology transfer and replication; publicity and dissemination of technology
Ninth 1997 - 2002	Emphasis on the development of indigenous technology; development of adaptive and advanced technology; provision for the establishment of IT park; preparation of national information infrastructure; twenty years science and technology prospective plan	Emphasis on communication and information technology; adaption of environment conducive and labor intensive construction technology; use of appropriate technology in foods processing; rural technology development and dissemination program	Intention of reform in education; emphasis on employment oriented technology; environment pollution control initiatives; encouragement for application of hydro, solar and wind energy
Tenth 2002 - 2007	Desire of an electronic networking of scattered science and technology libraries and records; national level science and technology information center formation	Intention of high-tech in rural area; adoption of agricultural technology, bio-technology, micro and rural industrial technology, telecommunication and information technology; environment friendly technology; commercialization of alternative energy technology	Priority for the technology that promotes employment opportunities; use of geographic information system; use of labor-intensive and environment friendly technology; technology directives
Eleventh 2007 - 2010	Rural information center; multi-sector technology development; land management technology; safety management system in aviation; concept of science and technology university; health management research and technological development institutions	Self-employment promotion; employment opportunities in rural areas; rain water harvesting in rural areas; physical improvement of urban and rural houses; development of high level human resources, bio-technology; information technology; institutional capability enhancement and strengthening program	Technology dissemination; conditions to foreign aid- indigenous skill, efficiency and technology; cleaner production technology, and green productivity; use of information technology in government works



Plan	Research and infrastructure	Socioeconomic development	Governance and compliance
Twelfth 2010 - 2013	Concern to climate change; telecommunication considered as a major vehicle of technology transfer; expansion of IT facilities emphasized; concept of electronic hardware technology park; study and use of bio-technology, Nanotechnology, nuclear technology, and space technology	Adoption of solar energy; employment creation emphasized; technology development fund; Bioinformatics database preparation	Emphasis on the adoption of IT across government revenue offices; priority in food technology adaption; technology transfer through economic diplomacy; use of information technology in corporate governance

Source: The national periodic plan documents of Nepal

2.3. Structural Settings

Unplanned efforts of technology diffusion were dominating until the end of the first half of twentieth century. Planned efforts started to take place in the country only from the beginning of the second half of the century (*also see **Erro! Fonte de referência não encontrada.***). The interrelationship among the organizations involved in technology education, training, research and development; national planners and regulators including national planning commission, ministries, and departments; supporting industries and intermediaries including telecommunication and Internet service providers, banking and financial institutions as well as accessories, parts and support service providers; and technology suppliers and the technology adopters is considered structural settings for technology diffusion.

Table 2- Selected organizations working on technology diffusion

From	Institutions	Major works/projects
1951	Department of Agriculture (DOA)	Food security, agricultural productivity; screening and standardization of the technologies
1951	Department of Industry (DOI)	Technology and environment, foreign investment and technology transfer, technology development; industrial data system improvement and monitoring
1969	Center for Economic Development and Administration (CEDA)	Socioeconomic and administrative development assisting/working with the policy makers
1972	The Institute of Agriculture and Animal Science (IAAS)	Education, research and technology transfer in the agriculture sector
1972	The Institute of Forestry (IOF)	Education and training to middle and high level professional in forestry and natural resources management
1972	Institute of Medicine (IOM)	Research, education and services in the health sector
1972	Institute of Engineering (IOE)	Research, education and training in engineering; consultancy services
1973	Department of Cottage and Small Industries (DOCSI)	Business incubation; technology diffusion and consultation services
1977	Research Center for Applied Science and Technology (RECAST)	Renewable energy; bio-technology; appropriate technology; plant science; natural product utilization; low cost building materials
1982	Nepal Academy of Science and	Advancement of science and technology for all-round



	Technology (NAST)	development; preservation and further modernization of indigenous technologies; identification and facilitation of appropriate technology transfer; promotion of research in science and technology
1989	Institute of Science and Technology (IOST)	Research, education, training, publications and advisory services in the area of science and technology
1991	Nepal Agricultural Research Council (NARC)	Research on agriculture; coordination, monitoring and evaluation of agricultural research activities
1992	Asia Network for Sustainable Agriculture and Bio resources (ANSAB)	Biodiversity conservation and livelihood improvement in South Asia
1996	Industrial Enterprise Development Institute (IEDI)	Need-based programs to develop technical know-how and skills
1998	Nepal Telecommunication Authority (NTA)	Regulating telecommunication sector
1998	Micro-Enterprise Development Program (MEDEP)	Appropriate technology and quality assurance, micro-enterprise management information system; entrepreneurship development; and others
2000	Department of Food Technology and Quality Control (DFTQC)	Development and dissemination of appropriate food (processing) technology
2005	Ministry of Science, Technology and Environment (MOSTE)	Program of action on climate change; climate resilience; technology needs assessment; mountain initiative; environmental impact assessment; and others
On top of the above mentioned organizations, the universities, colleges, schools, training institutions and other governmental and non-governmental organizations were also involved in the process of technology diffusion in Nepal		

Source: The webpages of respective organizations

Technology diffusion requires a strong network of reciprocal interdependence among the organizations involved in the diffusion process. Individual organizations in isolation finds hard to diffuse technology in an effective and efficient way because of a number of shortcomings in the areas of technology development, transfer, and adoption along with difficulties in supporting multiple actors. Organizations may be working in all the stages of technology diffusion ranging from the technology development, adoption to the disposition.

The organizations under study were quite tall and hierarchical instead of flat and networked as required for the diffusion of technology. The traditional pyramid type structure of adopting organizations and all other organizations involved in the area of technology development and diffusion was not instrumental in transforming the national technology planning priorities in practices. The plan documents were not acknowledging the urgency of control and monitoring in the establishment and operationalization of the organizations in the field of technology. There was absent of priorities about the carrier and linkage between technology planning priorities and the technology developing and adopting agencies in the country.



The government of Nepal adopted liberal economic policy from the very beginning of 1990s, and encouraged private sector for their active participation in technology development and transfer; but the government did not regulate the registration and formation of the organizations in consideration of monitoring thereof. In absence of technology regulator in the country, haphazard entry or no entry of organizations into the economy become obvious. Functional areas of the organizations already established as such could not address and carry the technology planning priorities to the real adopters of it. Ultimately, the organizational settings could not assimilate the technology planning priorities and the subsequent development and diffusion process of it.

3. DISCUSSION

Agriculture sector was one of the priority areas for technology development and diffusion in Nepal. Most of the farmers/cultivators were illiterate and they were reluctant/hesitant to be changed from their traditional system of cultivation to the modern one.

Almost all the development projects were based on technical assistance of foreign countries. Consequently, the materials, parts, and expertise required for the projects were accordingly foreign. Foreign technology transfer could not promote employment level because of a slow technology absorption capability of the country.

The plan documents could not determine the priority areas specifically for locally available technology development and other supporting areas, if there was any foreign technology transfer. There was haphazard shift in policy shifts as well, for an instance, the seventh plan intended to shift focus from an agriculture based economy to industry based economy in absence of sufficient evidence of agriculture based economy failure at one part and in absence of similar evidence for success of industry based economy on the other.

The ninth plan acknowledged that traditional technology, skill, and knowledge were disappearing gradually in the country, which means the past efforts of indigenous technology development were ineffective despite the continuous attempts of developing it. Without making reasonable assessment on the disappearing of indigenous technology, the tenth Plan intended for application of high-tech in rural



area as well that further contradicted the commitment made to develop and promote indigenous technology from the beginning of the planning period.

Promotion of indigenous skill, efficiency, and technology became the conditions of foreign aid acceptance, but the donor funded project specifications included internationally standardized technology, products, and services thereof. Similarly, employment creation had been made one major criterion in the selection of investment projects, but the statistics of about 500,000 youths leaving the country every year in search of employment in foreign countries (BHATTARAI, 2010) could not support the effectiveness of the government's policy of acceptance and selection of only projects that provide employment first.

There was adoption of information technology in the government revenue offices including customs. However, the respondents clearly indicated a number unwanted scenarios like delay in customs clearance, unnecessary and unethical behaviors at the government's revenue offices; avoiding the role of independent researchers and professionals in national technology development processes; prevalence of supremacy of the politicians and civil servants in the technology policy formulation and implementation; tendency of the government officials especially high ranking ones just to use their power instead of the use of their expertise in due course of providing services to ordinary people and organizations as well as in the areas of implementation of the policies, acts, rules and regulations for the development and diffusion of technology.

There was continuous emphasis on the technology dissemination in absence of provisions of appropriate mechanism for such dissemination. The mechanisms, known as structural settings and technology planning priorities were in parallel. There were a few attempts in the area of institutional capability enhancement during the planned period. However, such attempts could not establish appropriate and effective linkage across the actors in the process of technology diffusion. The linkage among the organizations/institutions engaged in technology assessment, research and development, technology adaptation, and the supporting service providers would have been facilitating to defuse technology in the country, if such linkage were established.



Science and technology system in societies needs to establish a strong link between knowledge creation and social demands. The link is required to strengthen the process of addressing social demands and solving their problems. This study argues that organizational setting is also an interface of technological advancement in a country because it is linking the initiatives of technology development, utilization, and diffusion in the society.

The study found that absence of technology regulating mechanisms in the country; increasing dependence on foreign technology by neglecting the indigenous one; and emphasis on search of international economic aid than developing the self-reliance capability were making the parallel standing of the organizational settings and technology diffusion in Nepal.

4. CONCLUSIONS

This study concludes with identification of structural immunity to technology diffusion in Nepal. In appropriate balance between the continuous efforts for promotion of indigenous technology at one part and encouragement to foreign investment and technology transfer on the other could not bring significant improvements in the areas of technology development, but the efforts made near extinction of indigenous technology instead. Contradictory commitments of the plans like emphasis to the labor-intensive technology/projects and encouragement for import of advanced technology did not follow distinctive areas in the technology development interventions in the country

There was incongruence between organizational settings and the periodic planning priorities in absence of technical organizations cooperation coordination mechanism for technology development, diffusion, and absorption. The planning priorities could not enhance the alignment of the structural settings with the requirement for technology transfer and diffusion in the country. More specifically:

- Agriculture sector was immune to technology diffusion. The farmers were habitual with traditional technology/processes and they were unable to adopt new technology in absence of socioeconomic compatibility for their efforts and outcomes;



- The industrial sector was immune to technology diffusion. There was incompatibility with hardware, software, brainware, know-how and know-why;
- Educational sector was immune to technology diffusion. The instructors and students both were uncomfortable with the new course contents and teaching pedagogy thereof;
- Government sector was immune to technology diffusion. Government officials were more authoritarian instead of being ethically cooperative consultant;
- Political sector was immune to technology diffusion. The political leaders were engaged in self-flattering and blame games, instead of commitments and determination to the national interests of technology development;
- Compliance sector was immune to technology diffusion. Good (corporate) governance was taken as a compulsion and ethical business behavior was questioning; and
- Organizational setting was immune to technology diffusion. Solidarity was mechanistic with a rigid authority hierarchy in parallel of national planning priorities.

The planned efforts remained unable to identify what type and level of indigenous technology would be in effect to what extent. There were no clear demarcations for new technology development and existing technology enhancement. The technology planning priorities were confined within the plan documents rather than fitting them into the structural settings. The periodic planning priorities did not acknowledge the urgency of a strong congruence between the national technology priorities and the immune organizational settings in the country.

Technology diffusion is strictly required to be a deliberately coordinated effort of the actors in the structural settings with their strong interdependence. Unplanned hierarchical structural settings of mainstream organizations in an economy stands as a barrier in the process of technology diffusion.

Advancement in telecommunication facilities and access to the Internet has shadowing the hierarchical taboos in most of the organizations in real sense.



Adoption of information technology shall help to maintain the congruence at one part and the same will facilitate in order to overcome the barrier of structural immunity to technology diffusion on the other part. Immunity of the policy makers and policy adopters to change only strengthens structural immunity to technology diffusion, which is strongly opposing the endeavor of technology advancement.

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