Designing Policy Initiatives in Emerging Economic Environment

Case of Indian Computer Hardware Industry

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Since the mid-1980s there has been a perceptible shift in the role of the government from 'doer-controller' to 'facilitator-intervenor' vis-a-vis the industry. The experience of the computer hardware industry in which the government role has always been of 'facilitator-intervenor' can hold important lessons for policy initiatives in the future.

Introduction

POLICY announcements made by governments are declarations as well as directions which it shall be taking to achieve national objectives. These policies bring to the forefront new opportunities and remove certain constraints keeping in view the overall development of the nation. In November 1984, the New Computer Policy (NCP) was announced by the government of India. Enterprises which took the lead in implementing this policy were largely from the private sector. As a result, the experience of the computer hardware industry can act as a good example to analyse the interactions between public policy and the activities of the corporate sector within the ambit of the economic liberalisation underway at present.

Six variables have been identified which capture the computer hardware industry scenario. These variables along with the policy initiatives are considered to form one system. Systems analysis approach has been applied to analyse the interactions between various subsystems. Keeping the NCP as the point of reference, the case of computer hardware industry from 1984-1990 has been analysed to draw con-clusions. This has led to the identification of certain pointers for designing govern-ment initiatives in the currently changing Indian economic scene with its ultimate objective of globalisation.

Systems Approach

Social, economic, political and technological sectors of countries are extremely complex in characteristics. Each one comprises a number of subsystems interacting with one another within the entire whole. All these subsystems constitute to make larger and complex super-systems. Certain sectors have a direct link with global developments, e g, economic, technological, etc Understanding the dynamics of such sectors becomes even more difficult. Thus policy designers and formulators have to understand the dynamics of the given sector within a complex mosaic of the nation. In recent years, systems analysis has been successfully applied to policy analysis and design [Srivastava 1979].

The systems analysis approach involves definition of objectives; identification of subsystems, including their characteristics, boundaries and interrelationships; and analysis of the system so as to explore alternative ways to achieve the objectives. This approach helps policy framers to understand the inter-dependencies among the subsystems so as to plan a set of actions-interventions (policy) which eases the restrictive factors, strengthens the supportive factors, or add some new sub-systems or interdependencies. On close examination of the data on Indian Computer Hardware Industry (ICHI), subsystems which capture the whole gamut of computer industry need to be outlined. The following subsystems and their characteristics can be identified for analysing the 1984-1990 period:

(1) New Computer Policy (NCP) of November, 1984: The provisions of the policy which have direct influence on the evolution of computer industry.

(2) Computer Technology: Domestic technology developments are closely linked with the developments taking place around the world. Foremost is the development of computer architecture, which in turn is based on the developments in integrated circuits (IC) technology. The developments include the launch of new products, import substitution, newer applications of computers, e g, engineering analysis and manufacturing, integration of computers and communications technology. This subsystem also include developments in software.

(3) Human Resource: Changes in the number and proficiency of computers users in the country. This subsystem captures availability of consumers of output of the computer industry.

(4) Extent and type of computer usage: This subsystem captures expansion of demand for computers, both in terms of new users and new applications. It also includes specific initiatives, government or otherwise, which facilitated expansion.

(5) Indian computer hardware industry: This subsystem consists number of enterprises active in the industry, market shares and sector (public or private), technology competencies, and marketing reach.

(6) Indian economy: This subsystem captures overall economy and industrial growth which have a direct impact on the evolution of computer industry.

These six subsystems are considered to be constituents of Indian computer hardware industry (see the figure) In the next section each subsystem is described in detail for the period 1984-90. The focus is on describing the changes, while trying to analyse the changes in terms of inter-dependencies on other subsystems. The key here is that policy initiative is considered as just one subsystem.

Indian Computer Hardware, 1984-1990

The era of computers and computerisation began in India in 1955. At ISI Calcutta a Russian computer was installed in that year. The second system that came up was IBM 1400 at Standard ESSO – a multinational company. Next to follow were Hindustan Aeronautics and TIFR, Bombay. The period between 1955-77 saw the dominance of IBM as it controlled 70 per cent of the Indian market. This phase saw IBM bringing in those punched-card systems which had become obsolete in the developed countries. IBM concentrated on the research and academic institutions of India who were on a look out for computing facilities. It provided extensive maintenance support.

IBM dominated the Indian market till 1971, when it ran into an argument over providing computer systems and services in India. This event became a turning point in the evolution of computer industry in India. A committee under the chairmanship of M G K Menon was established. Its recommendations gave rise to the establishment of Electronics Commission in 1971, Computer Maintenance Corporation (CMC) and Semi-Conductor Complex (SCL) in 1976. Organisations such

as Electronics Corporation of India (ECIL) established in 1967, got a boost during this period and entered computer hardware industry. Simultaneously, Central Electronics active in related activities was brought under department of science and technology in 1974. By 1977 the government had realised the importance of information technology. Government had taken crucial initiatives which finally paved the way for the eventual growth of computer industry in India (Public Enterprise Survey 1988-1989).

There was one major landmark during this period, which was though not directly related to computer industry, had a lot of bearing on its growth eventually. This was the promulgation of Foreign Exchange Regulation Act of 1974 (FERA). By virtue of it, foreign companies operating in India were allowed to hold only 40 per cent equity. This became a catalyst in the process of exit of IBM from India in 1977, when it refused to dilute its equity. IBM which had earlier leased its machines to various Indian organisations, transferred its systems to them for a final payment

The exit of IBM created a major vacuum in the field of systems maintenance which was plugged in by CMC. On the other hand, ECIL started the production of 12-bit systems and subsequently progressed to produce 16- and 32-bit mainframes comparable to French IRIS 55 Systems. Private sector made its entry into the computer market through calculators. Private sector companies such as DCM, Televista, Omron, HCL, and even ECIL launched desk-top and pocket size calculators. In 1978, HCL and DCM launched microcomputers for standardised business applications like payrolls. By 1983, several private sector enterprises had launched more powerful microcomputers for a variety of applications, while Wipro and HCL had launched minicomputers also.

The government announced the New Electronics Policy in 1983, and reduced customs and excise duty on electronics industry. By 1983 private sector enterprises dominated the computer hardware industry, and there was reasonable amount of competition. Several companies like HCL and Wipro had developed their proprietary hardware and operating systems.

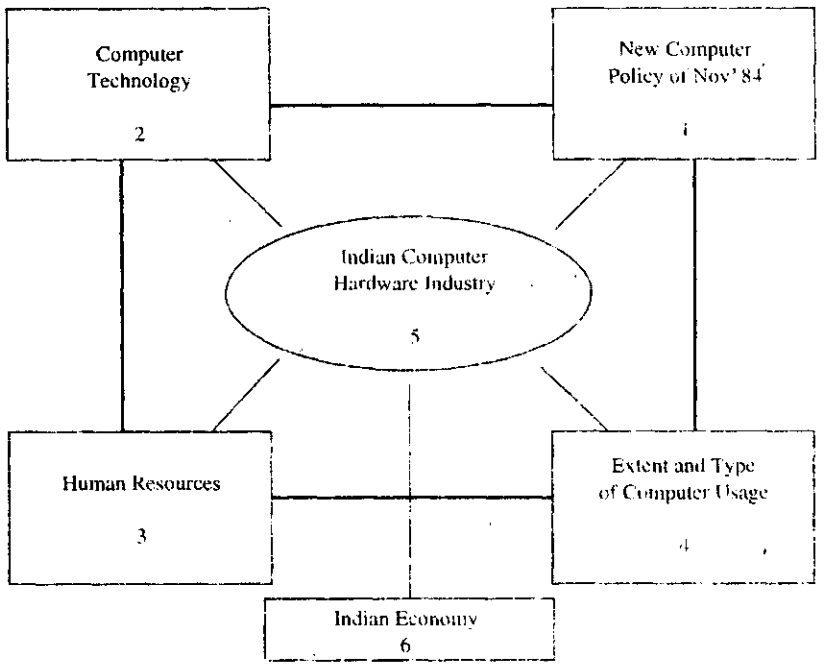
Subsystem 1 – New Computer Policy 1984: Some of the salient features of the New Computer Policy (NCP) announced in November 84, soon after Rajiv Gandhi assumed power were:

(a) Regulation of all clearances through inter-ministerial standing committee (IMSC).

(b) Reduction in import duty on peripherals.

(c) Liberalisation on the import of computers.

FIGURE: SYSTEM DIAGRAM OF ICHI FOR THE PERIOD 1984-90



(d) Granting permission to foreign equity participation.

(e) Recognising software as a separate industry and formation of a software development agency for the overall growth of this industry.

(f) Allowing import of computers by government institutions as well as R and D organisations.

One immediate result of this policy was the reduction in prices of the systems by as much as 25 per cent, as enterprises passed on the duty reductions to customers to gain an edge over competitors.

Subsystem 2 – Computer Technology: During the period technology development was one of the fastest in computer industry. Significant developments were – emergence of personal computers as powerful office tool, networking of computers of different manufacturers and processing capacities and workstations for CAD/CAM applications. The technology trend was towards standardisation (from proprietary). IIT Kanpur developed Graphics Indian Script Terminal (GIST) card for using computers in regional languages. The pace of technology was so fast that computers based on a new technology were introduced every three years and product life cycles were less than a year. Barring the US, all the countries acquired the technologies through licensing, collaboration, or by inviting US multinationals. Even in the US the technologies were developed by a large number of severely competitive enterprises. It was impossible for any country to develop the entire range of computer technologies on its own and also keep pace with the developments. There was no single source of all the technologies and the technology was complex; it was imperative for the government to facilitate the access to the technology. NCP provided for freer access to the needed technology and faster clearances. NCP made it possible for Indian

TABLE 1: GROWTH OF INDIAN COMPUTER HARDWARE INDUSTRY, 1983-91

Year	Industry Turnover (Rs in Crore)	Per Cent Growth
1983-84	125	–
1984-85	138	10.4
1985-86	234	69.6
1986-87	347	48.3
1987-88	510	47.0
1988-89	674	32.2
1989-90	900	33.5
1990-91	1094	21.6

Source: Bhatnagar, 1991.

TABLE 2: SALES OF LEADING COMPUTER HARDWARE COMPANIES

(Rs Crore)

Year	HCL	Wipro	Sterling
1983-84	20	8	Nil
1984-85	23	15	Nil
1985-86	44	25	2
1986-87	60	35	17
1987-88	115	50	35
1988-89	180	85	51
1989-90	215	115	56

Source: Bhatnagar, 1991.

enterprises to launch computer products of nearly all types after making some adaptations (some enterprises acquired capabilities), and more importantly almost at the time of their worldwide introduction.

Subsystem 3 – Human Resource: Shortages of technical/skilled manpower was felt in the industry specially after 1987. This was primarily due to the rapid growth in the requirements of the industry as a result of its expansion catalysed by the provisions of NCP. At university and engineering college levels, a number of new courses such as Masters of Computer Applications, Diploma in Computer Applications, BTech/BE in computers, etc, were introduced. In private sector, computer training centres were started by enterprises such as NIIT, ICE, ICS, etc. Government also started ambitious CLASS project in over 10,000 schools. Further, there was a qualitative shift in the composition of manpower – from earlier pure science (mathematics, statistics, physics, etc) graduates to engineers, MCAs, DCAs and MBAs.

Subsystem 4 – Extent and Usage of Computers: Initially when computers entered India, they were primarily used by the scientific organisations for their research and development activities. Slowly the computers started finding their utility in the area of electronic data processing (EDP) in organisations which required handling of huge data, e g, NSSO, Census, and payrolls in large business enterprises. However, with the entry of PCs in post-1984 period, there was a definite broadening of the scope of computers in an area which till then had not been explored in India – more and more organisations started using computers for wordprocessing activities. This soon graduated into desk top publishing area by 1989-90 on a regular commercial basis. Then came the use of computers in the area of inventory management, on-line transaction processing, etc, which found utility in a number of private/public sector organisations.

This phase also saw a boost given to the process of computerisation by organisations and institutions belonging to the government. National Informatics Centre (NIC) had played a pivotal role during the processing and analysing of Asiad 82 results. During this exercise it had also demonstrated the establishment of a wide area network (WAN) within Delhi using its Cyber 170/730 mainframe system. This period saw the announcement of building up of NICNET (NIC network) through INTELSAT/INSAT satellite up to the district level. Through this project plans were launched for major computerisation drive at the central/state/district level government offices. With NICNET attaining its target of reaching district level by the end of 1989, the problem of working in regional language became a major issue – which was solved by academia of IIT Kanpur. The initiation of computerisation of land records at Morena (MP) and Kanpur (UP) gave another fillip to the process of computerisation in particular and the computer industry at large.

Amongst other major initiatives were the announcement of the launching of computerised railway reservation system; mooting of INDONET; computerisation of passport offices and last but not the least, organisations such as Indian Airlines, ONGC, SAIL, etc, launching schemes of computerising their operations.

NCP acted as a catalyst towards widespread (eg, CAD, CAM, MIS, project management, etc) application of computers even in organisations which were conventional in their operations (such as engineering construction and manufacturing units). This was due to the availability of a large number of software packages and hardware configurations, along with the approach of computer companies to adopt aggressive marketing techniques. A direct consequence of NCP was to facilitate institutions, laboratories, and large government organisations to import computers. This became easier and faster through the inter ministerial standing committee. One of the biggest outcomes was the establishment of NICNET through NEC-1000 super computers and ND-500 superminis between 1986-89, which facilitated intensive and extensive use of computers in the country.

Subsystem 5 – Indian Computer Hardware Industry: Within India interesting developments started taking place. Items banned on the import list such as dot matrix printers, floppy drives, power supplies, monitors, keyboards, etc, became freely available and some domestic production also started. In spite of this industrial units in private sector were found wanting an issue of a reliable R and D base of their own. They were more eager to develop/produce microprocessor based supermicros and PC-compatibles. Even for doing this they preferred collaborations with prominent foreign manufacturers. In the public sector, ECIL tied up with Control Data Corporation (CDC) of the US to produce mainframes and Norsk Data (ND) of Norway for superminis. SCL started producing LSI chips. ET and T was identified to produce low cost high quality electronics products.

There was significant increase in the size of the computer hardware industry, with annual growth rates about 50 per cent during the period (Table 1). In 1984-85 top ten companies accounted for 90 per cent of the industry's turnover. This reduced to about 60 per cent by 1990-91 [Bhatnagar 1991]. There were changes every year with enterprises entering and dropping out from the list of 10 largest enterprises. The competition became increasingly severe due to the entry of a large number of enterprises and overpowering thrust on growth by incumbents. This occurred due to the entry of a large number of enterprises, who could import technology in the form of SKD/CKD kits, as a result of NCP's provisions. Increased competition amongst the players culminated in severe price cuts during late 1985 and late 1988. The price cuts further fuelled rapid expansion of the industry.

Subsystem 6 – Indian Economy: The computer hardware industry grew at a much faster rate in comparison to the overall industrial growth rate of about 8 per cent during 1984-1990 (*Economic Survey 1991-1992*). Globally the computer hardware industry was growing during this period at

the rate of 12-15 per cent [Chopra 1993]. This 'disproportionate' high tate of growth of ICHI was possible due to the strong thrust by the government for computerisation, reduction in cost of computers, and easier availability of hardware options and software solutions as a consequence of NCP. Plan outlay for the department of electronics had been increased about 2.3 times compared to sixth plan outlay. In contrast, for steel, petrochemicals, fertilisers, and agriculture the outlay had increased by 37.69, 7.81, 1.6 and 48.8 per cent respectively (*Handbook of Industrial Statistics 1989*). This establishes the concern of the government to give greater impetus to the electronics sector at large, of which ICHI was one component.

The new computer policy of November 1984 thus had a significant impact on the evolution of ICHI [Karki and Cameron 1993]. The impact of NCP was essentially in two ways. First, it made possible for ICHI to be latched with the global computer industry by allowing free access to technology and components. Second, it induced and attracted a large number of enterprises in the ICHI fold which led to competition, resulting in easier availability of computer solutions at lower costs.

Conclusions

India embarked on a wide-ranging initiative to liberalise its economy by reducing controls on entry and operation of enterprises, hesitantly in mid-1980s and quite vigorously since 1991. The initiatives since 1991 are also aimed at globalising Indian economy – removing non-tariff barriers and reducing tariff barriers on import for most of the technologies and products, and freer entry of multinationals. There is a perceptible shift in the role of government from 'doer-controller' to 'facilitator-intervenor' of the industry. Due to change in premise about the role of the government *vis-a-vis* industry, type, magnitude, implementing approach, timing of public policy initiatives is altered. Therefore experience of computer hardware industry in which government role was of 'facilitator-intervenor', can hold important lessons in policy initiatives in the future.

The key objective of industry-related policies of the government in liberalised-globalised economic environment is to help develop globally competitive industries. Roots of globally competitive industries are at multiple levels – enterprise, industry, infrastructure, health of social sector, i e, education [Porter 1991]. Government policy would need to help improve these 'roots' for the evolution of globally competitive industries. Being globally competitive is the key objective, as in the emerging world scenario it would be difficult for any industry in any country to "hide behind tariff or non-tariff walls for long".

Some of the key lessons which emerge from system analysis of ICHI, for policy initiatives of the government are:

'Align' policy initiative with corporate strategies and competencies: The New Computer Policy released the potential of private sector enterprises by allowing freer access to technology and components not available in India. Computer technology is complex and very fast developing, so that no single company or nation in the world (barring the US to some extent, but there too, no single enterprise) has been able to keep pace with the technology alone. Government policies before 1984 hindered computer developments and expansion, by insisting on indigenous development. Indian enterprises despite some valiant efforts of ECIL and HCL could never expect to keep pace with world with indigenous developments. It was prohibitively expensive if not impossible. Instead Indian private sector enterprises had competencies in supporting the latest technology and products, in developing customised user applications, and in reaching large and small customers throughout the country. NCP was successful as it removed the restrictions and allowed Indian companies to use their competencies to the fullest.

Facilitate domestic competition: NCP allowed freer entry of enterprises into ICHI, and many enterprises could enter as capital requirements were small and skilled managerial resources were available. ICHI had become highly competitive by late 1980s. This led to several advantages: due to tough competition the enterprises increased reach to smaller towns and to smaller customers, bringing about wider availability of computer; while trying to beat competitors, enterprises started a race to introduce the latest computers, so that the technology gap rapidly reduced to almost zero by 1990; due to competition the prices in real terms started reducing in real terms, so that by 1990 the difference in price of computers in India and abroad was very small.

'Align' with global industrial developments: NCP allowed for alignment of computer technology in India with the world. Technology developments have their own logic depending on invention, availability of markets, etc. Global integration is the premise of national economies in future. Long-term benefits to the nation of a government initiative would be significantly dependent on its impact to bring about Indian industry to global levels – in technological sophistication and efficiency.

Consistency with other government policies: NCP in some ways had some inconsistencies – with the thrust on indigenous technology, development of technology and industrial policies. But due to extraordinary focus on computerisation led by prime minister Rajiv Gandhi, apparently NCP overrode provisions of other policies. Fortunately the inconsistencies of government policies did not have adverse effect on computer hardware industry. But it can have a crippling effect on some government initiatives.

Focus government efforts on infrastructure creation: As evident from systems analysis evolution of ICHI was strongly aided by the government thrust on computer usage by the departments, investments in INDONET and NIC, spread of computer literacy and establishment of computer training institutions. Such investments could be made only by the government, and which led to development of specialised skills in the country. These skills, which are the principal factors of knowledge-based industries, would stand in good stead for future evolution of computer industry in India.

Promote specialised and sustained investments: This has been the weakness of NCP. Computer industry enterprises in general spent little on research and development during 1984-1990 period. Some of the investments which could have been made on creating facilities and skills for internalisation/adaptation of core and peripheral technologies get into the forefront of technology development for some components or processes, faster development of indigenous sources for parts (done on fewer components and for very slowly). Some like Wipro Infotech which made such investments reaped rich rewards, and many others like Pertech Computers Limited realised the need by 1990. But creation of specialised skills by promoting investments by enforcement or incentives should be an important component of policy initiatives, to reap advantages of globalisation after achieving it.

[The views expressed here are those of the authors and not of the organisations to which they belong.]

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