INTELLECTUAL PROPERTY RIGHTS AND TECHNOLOGY DEVELOPMENT: THE CASE OF SOFTWARE INDUSTRY

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ABSTRACT

Software, the major component of digital world, is all about the using the power of ideas to solve problems. The relation of software industry and the Intellectual Property Rights is a tricky one. There is a debate going on worldwide on the issue: copyright or open end free software? As per the legal opinion, IPR provisions must be implemented irresoective of firm, industry or country os concerned. But from an analyst's point of view, this issue needs to be viewed in a wider perspective. The paper is an attempt to analyze the IPRs with reference to socio-economic dynamics of software piracy.

Keyword: ITR. Software Electric, Technology Development, Piracy

INTRODUCTION

It is unanimously agreed by all that global economy of today is characterized by an interesting dichotomy: "digital age" along with "digital divides" (Hardy 1980, Norton 1992, Cannibng 1997, Easterly and Lavine 1997). The developing countries are increasingly alarmed at an emerging "digital divide", in which those without access to the latest and most expensive tools and technology will find themselves unable to compete in the global market (Hanna, 1994; 1994). Software, the major component of digital world, is all about the using the power of ideas to solve problems. The relation of software industry and the Intellectual Property Rights (IPRs) is a tricky one. There is a debate going on worldwide on the issue: copyright or open end free software? As per the legal opinion, IPR provisions must be implemented irrespective of a firm, industry or country is concerned. But from an analyst's point of view, this issue needs to be viewed in wider perspective. The paper is an attempt to analyze the IPRs with reference to socio-economic dynamics of software piracy.

PROBLEM DEFINITION

Worldwide the software industry is plagued by problem of piracy, a situation of "copying and using commercial software purchased by someone else without paying for it to the copyright holder". Business Software Alliance (BSA) estimates the monetarily, software piracy costs publishers $28784 million in year 2003. In the world software industry, developed countries are constantly putting pressure on developing countries to implement stricter patent legislation than required under TRIPS, exclude compulsory licensing, parallel imports provisions and include provisions that would result in increasing the life of patent. The viability and sustainability of such strict laws needs to be analyzed in the contexst of role, nature and dynamics of the software piracy system.

METHODOLOGY

Out of the available database of 74 countries, 55 countries with consistent data availability have been selected for analysis of dynamics of piracy. First, the nature and magnitude of softward piracy has been analyzed; Secondly, the underlying dynamics of piracy has been explored; and finally, the case of Indian software industry has been briefly summarized. In addition to tabular analysis, the techniques like percentage analysis, growth rates and the factor analysis have been used. Wherever needed, appropriate price adjustments have been made.

ANALYSIS

Nature and Magnitude of Piracy

The piracy continues to pose challenges to the global software industry. Table 1 underscores the fact that software piracy is an oddly distributed worldwide phenomenon. Software piracy rate is the least in U.S.A./Canada region. It is only 25 per cent in the year 2000, which is less than the overall world piracy rate. Eastern Europe, Latin America and the Middle East are first three high-ranking region in terms of piracy rate. Piracy rate, in the year 2000, has been 63 per cent in Eastern Europe, 58 per cent in Latin America and 57 per cent in the Middle East. Asia/Pacific region, in which India is significant player, falls in the medium piracyranking category. An analysis of the trend based growth rate, throught the years 1994 to year 2000, shows that U.S.A./Canada region depicts a growth rate of 3.13 per cent per annum which the least in the global economy. A sharp decrease per annum is depicted by Western Europe, Middle East and Africa it is more than 6 per cent per annum in the same period. On the whole, world level software piracy rate registerd a growth rate of 5.07 per cent per annum for the period under study. For the first time the world piracy rate in the year 2000 did not decline, but instead showed a slight increase to 37 per cent as against 36 per cent in the year 1999. The factor that kept piracy rates from falling in 2000 is that the fastest growing regions were the ones with the highest piracy rates. Growth in Asia/Pacific region, with its higher piracy rate, offset decline elsewhere.

Initial high rate of software piracy may be attributed to several factors. First, the higher prices of legal software and non-availability of user support had been the prime booster to software piracy. Later, the decline in the prices of original software and availability of user support for the software products led to decrease in the piracy rate. Secondly, in the first half of 1990s, the time lag between the demand for new software and the effective supply of the software, led to cases of piracy due to expedient use of PCs. Thridly, patent laws and intellectual property rights related laws were not that very stringent and effective as they are becoming now under the present W.T.O. regime.

Many regions experienced smaller dollar losses in 2000 as compared to 1999 (Table 2). A combination of slow growth and somewhat lower prices for software slightly reduced to dollar losses due to piracy. The dollar loss due to piracy amounting to US$ 11.75 billion, in year 2000, is not a so small magnitude. The revenue loss in terms of dollars is not a true indicator od decrease in piracy because it is, in fact, the result of several other factors. First, the U.S. dollar was strong in the year 2000. Secondly, the overall market growth for the software grew t the slow rate since 1994. Thirdly, software prices continued to fall, advancing a trend of declining prices that has evolved over the last decade. Hence, it is combination of slow growth and lower prices that depitched a slight reduction in the dollar losses due to piracy.

The regions with the highest dollar losses in 2000 were Asia/Pacific, Western Europe and North America. These regions have the largest economies and correspondingly, the largest PC and software markets. Their relatively low piracy rate translates into large dollar losses. Trend growth rate based analysis shows that a decline of more than 9 percent per annum, in retail software revenue lost due to piracy, has been experienced by two regions: Eastern Europe and Africa. Western Europe and U.S.A./Canada regions show a negligible increase in the retail software revenue loss due to piracy for period under study. Regions like Latin America and Asia/Pacific depict a decline of more than 2 per cent per annum for the same period. Decline of dollar losses in slow growth environment economies is primarily due to economic slow down of these regions and is not expected to continue as they recover.

Dynamics of Software Piracy

The global technology generation of innovative activity is highly concentrated in a handful of technologically advanced developed countries with just top ten countries accounting for as much as 84 per cent of the global R&D activity. The uneven diffusion of the information and communication technology, the digital divide, is the root cause of the problem of software piracy. The Technology Achievement Inder (TAI) of the UNDP gives a snapshot of each country's average achievement in creation and diffusion of technology and building human skills to master new innovation. TAI has been computed using variables relation to Technology creation, diffusion of recent innovations, diffusion of old innovations and human skills. According to TAI countries have been classified as leaders; potential Leaders, dynamic adapters, and marginalized (Table3).

Logically, Software piracy both in terms of piracy rate should be inversely related to the technological achievement index. Patents granted to residents of a country and the receipts of royalities and the license fees may be assumed as proxy variables to identify the technology creation lower should be the piracy rate. Hence, the piracy rate should also be inversely related to the technology creation. Diffusion of innovations both recent and old can also affect the piracy rate depending upon the level of development of a country. Diffusion of recent innovations may be identified by number of internet hosts and share of high and medium technology exports in the total exports of a country. Diffusion of old innovations may be measured by number of telephones and the extent of electricity consumption in a country. Level of human skills may also be perceived as one of the determinants of the piracy rate. Level of human skills may be measured by mean years of schooling and gross tertiary science enrolment ratio or more compactly by Human Development Index (HDI) rank. So the functional form of the model for analyzing software piracy may be specified as:

PRATE=f (TECHNDX)

(A)

PRATE = f (PATENTS, ROYAL, INTNET, TECHEXP, PHONES, ELECT,

SCHOOL, SCIENCE, R&D1, R&D2, ENGG, HDI)

(B)

Where:

PRATE Piracy rate

TECHNDX Technology Achievement Inder (TAI) Value

PATENTS Patents Granted to Residents (per million people)

ROYAL Receipts of Royality and License fees (US$ per 1,000 people)

INTENT Internet Hosts (per 1,000 people)

TECHEXP	High and Medium Technology Exports (as a % of Total Goods Exported)
PHONES	Telephones (all marine, cellular etc. per 1,000 people)
ELECT	Electricity Consumption (KWH per capita)
SCHOOL	Mean Years of Schooling (age 15 and above)
SCIENCE	Gross Tertiary Science Enrolment Ratio (%)
R&D	1R&d Expenditures as a % of GNP
R&D2	R&d Expenditures in Business as a % of Total
ENGG	Scientits and Engineers in R&D (per 100,000 people)
HDI	Index Rank

In an attempt to further identify the underlying factors that explain the pattern of correlations within a set of observed variables, factor analysis has been applied. Factro analysis is often used in data reduction, by identifying a small number of factors, which explain most of the variance observed in a much larger number of manifest variables. For this purpose "Principle Component Analysis" extraction method in conjuction with Varimax (with Kaiser Normalization) rotation has finally yielded two components only. The cumulative total variance explained by the first two components comes out to be 90.013 per cent. Rotated components matrix shows that variables INTNET, ELECT and PHONES form the first component and the variables R&D1, R&D2, TECHEXP; and PATENTS form the second factor. First component identifies variables that are related with technology relatd infrastructure and the second one is related with creation and diffusion of technology.

Regression results for model specification (A) are as follows:

PRATE = 92.272 - 88.199 (TECHNDX)

S.E. (9.104)

t 9.688

R2 = 0.8864

That is piracy rate is negative function of technological achievement index. The regression coefficient is significant at 2 per cent level of significance. The coefficient of determination is also sufficiently high. This means that the higher the level of technology creation, diffusion of innovations and the human skills, lower is the piracy rate.

Since many of the independent variables in the above specification (model B) are highly correlated and may cause a problem of multi0collinearity, if the regression coefficients are to be extimated by using the method of ordinary least squares. Hence the next option is to follow the principle of parsimony and go for a stepwise regression. The final functional form selected by the steowise regression comes out as follows and is perfectly in consonance with above factor analysis results i.e. INTNET belongs to first factor and the R&D1 belongs to the second component and the third one, the HDI, is independent of the first two. Hence,

PRATE= f (INTNET, R&D1, HDI)

That is to say software piracy rate is a function of level Internet use, Research and Development expenditure as a percentage of Gross National Product (GNP) and the Human Development Index rank.

PRATE = 51.633 + 0.226 (HDI) - 0.084 (INTNET) - 4.301 (R&D1)

S.E. (0.050) (0.034) (1.874)

t 4.526 2.459 2.295

R2 = 0.9235

The regression highlights an interesting result that software piracy rate is positively related wit the human development index ranking and negatively related with Internet use and research and development expenditure as a percentage of GNP. All the regression coefficients are significant at 2 per cent level of significance. Coefficient of determination, the R-square, is an indicative of the fact that model exmpains 92.35 percent of the total variation in software piracy rate. Higher rank in terms of HDI means lower human development level. As the education, per-capita income and the heath indices, improve, the HDI ranking also improves. So, software piracy is a phenomenon more prevalent in countries with lower human development levels. An improvement in the human development level leads automatically to reduction in th piracy rate, Number of Internet hosts indirectly measures number and rigor of the computer use. As the computer user base improves, there is demand for licensed software and fall in the piracy rate. Share of research and development expenditure as a

percentage of GNP signifies the step towards technology creation. More the share of R&D expenditure in a country, less will be the piracy rate in a country. All the three determinants of the piracy rate ane macro-economic policy variables. An investment on human development, in general, and on education health, information technology and research and development, in particular can solve the problem of piracy to a greater extent.

As already said, the software piracy implies a loss of revenue to the genuine producer countries and companies as well. Same above model when tried with revenue loss as a dependent variable provided the following selection of variables by the stepwise regression criteria :

REVLOSS = 93.624 + 1.335 (PATENTS)

S.E. (0.290)

t 4.611

R2 = 0.8592

Loss of revenue is a direct function of number of patents with the residents of a country. The regression coefficient is significant at 2 per cent level of significance and the R-square is sufficiently high. Hence, major sufferers of the dollar loss due to piracy are the countries with higher levels of technology creation.

Software rate is the function of socio-economic underdevelopment and the dollar revenue loss due to piracy is a function of technology creation. Software piracy and the loss of revenue due to piracy are negatively related and the correlation coefficient is significant at 5 per cent level of significance. In general, the higher revenue loss is associated with lower piracy rate and vice-versa. First this is because the countries with lower piracy rate are countries with higher technology creation and diffusion level. Secondly, the level which reanslates even a small rate into an enormous dollar revenue loss. On the other hand countries with higher piracy rate because of low market share ar3e characterized by a low revenue loss due to piracy. Hence in this menace of piracy loss sufferers are: one, the major players and, two the players who are actively involved in the process of technology creation and diffusion.

Case of Indian Software Industry

In terms of number of patents Indian industry in general (table 4) and the software industry in particular is a too low profile but in terms of performance and piracy the software segment is quite signigicant. As per Heks (1999) unbranded assembled computers loaded with pirated software still form a significant segment of the Indian market (fig.1). Thus software includes operating systems and other general-purpose software. In the decade of 1990s when Indian software industry was preparing itself for the boom, assembled computers coupled wit pirated software acted as a catalyst in providing training to masses at a low cost (Mehta, 2001). India was able to generate such a specialized skill formation, in a very short span. This lead to both R&D and production in large quantum at at low cost that finally gave a comparative cost advantage to the Indian software industry. Being primarily an export oriented industry, the gains of its low cost production dissipated to importing countries (USA and EU). In turn, over time India due to specialization beceme the hub for some of the future technologies likes that of IT Enabled services. The benefits of such a specialization are again meant for advanced world. Thus piracy and unbranded hardware has acted as catalyst in developing the hubs for the future technologies of the world.

If a strict IPR regime had been there in the early nineties, Indian software industry, the giant source of software products and services for USA and EU, would have not come into existence at all. If the pioneer institutions and firms in earlier developments in both hardware and software had gone in for strict IPR in the decades of 1960s and 1970s, the giant girms like Microsoft would have not been on the world map today. All big firms and leading nations in the software industry are reaping the benefits of past liberal IPR regimes. The tighter IPRs will, no doubt help the few countries and firms to earn more but will raise the costs and will hinder the future technology development at lower end. The whole process of skill formation and specialization generation will be affected adversely.

Table 1.1

Region-wise Software Piracy Rate (Per cent)

Region/Year	**1994**	**1995**	**1996**	**1997**	**1998**	**Trend 1999**	**Growth 2000**	**Rank**	**Rate (%)**
Western Europe	52	49	43	39	36	34	34	(6)	-7.50
Eastern Europe	85	83	80	77	76	70	63	(1)	-4.50
U.S.A./Canada	32	27	28	28	26	26	25	(7)	-3.13
Latin America	78	76	69	64	62	59	58	(2)	-5.22
Asia/Pacific	68	64	55	52	49	47	51	(5)	-5.54
Middle East	84	83	79	72	69	63	57	(3)	-6.39
Africa	80	74	70	60	58	56	52	(4)	7.02
Total World	49	46	43	40	38	36	37		-5.07

Source : BSA/SIIA/SPA

Table 1.2

Region-wise Software Piracy Rate (Per cent)

Region/Year	2005	2006	2009	2011	2013	2015	2017
Western Europe	35	34	34	32	29	28	26
Eastern Europe	69	68	64	62	61	58	57
U.S.A./Canada	22	22	21	19	19	17	16
Latin America	68	66	63	61	59	55	52
Asia/Pacific	54	55	59	58	62	61	57
Middle East	57	60	59	58	59	57	56
EU	36	36	34	32	29	28	28

Source: Statistca and BSA

Table 2.1

Retail Software Revenue Lost due to Piracy (US$ 1000)

Region	Y 1994	e 1995	a 1996	r 1997	Trend 1998	Growth 1999	2000	Rate (%)
Western Europe	2783000 (22.54)	3642939 (27.32)	2574871 (22.77)	2518726 (22.02)	2760337 (25.15)	3629371 (29.84)	3079256 (26.21)	0.81
Eastern Europe	1100800 (8.92)	748077 (5.61)	782508 (6.92)	561356 (4.91)	640015 (5.83)	505213 (4.15)	404491 (3.44)	-11.45
U.S.A./Canada	3931100 (31.84)	3287379 (24.66)	2718251 (24.04)	3074266 (26.87)	3195821 (29.12)	3631212 (29.85)	2937437 (25.00)	0-99
Latin America	981200 (7.95)	1141516 (8.56)	980568 (8.67)	977994 (8.55)	1045506 (9.52)	1127639 (9.27)	869777 (7.40)	-2.47
Asia/Pacific	3144500 (25.47)	3991399 (29.94)	3739304 (33.07)	3916236 (34.23)	2954812 (26.92)	2791531 (22.95)	4083061 (34.75)	-2.94
Middle East	206400 (1.67)	264820 (1.99)	285522 (2.53)	206003 (1.80)	190139 (1.73)	284445 (2.34)	240451 (2.05)	-1.63
Africa	199500 (1.62)	256512 (1.92)	225234 (1.99)	185507 (1.62)	189881 (1.73)	193747 (1.59)	135892 (1.16)	-9.79
Total World	12346500	13332642	11306258	11440088	10976511	12163158	11750365	-1.29

Note : Figures in perenthesis are percentages.

Source : BSA/SIIA/SPA

Table 2.1

Retail Software Revenue Lost due to Piracy (US$ Million)

Region/Year	2004	2005	2006	2015	2017
Western Europe	9600	11843	10630	13749	9461
Eastern Europe	2111	3262	4124	3136	2910
U.S.A./Canada	7232	10255	12356	10016	9458
Latin America	1273	2026	3125	5787	4957
Asia/Pacific	7553	8050	11596	19064	16439
Middle East	1026	1615	1997	3696	3077
EU	-	12048	11003		

Source:BSA and IDC(Annual Survey) and Statistca.com

Table 3

Countries Categorized on the basis of Technology Achievement Index (TAI)

Leaders	Potential Leaders	Dynamic Adapters	Marginalized
Finland	Spain	Uruguay	Nicaragua
United States	Italy	South Africa	Pakistan
Sweden	Czech Republic	Thailand	Senegal
Japan	Hungary	Trinidad & Tobago	Ghana
Korea	Slovenia	Panama	Kenya
Netherlands	Hong Kong	Brazil	Nepal
United Kingdom	Slovenia	China	Sudan
Canada	Greece	Philippines	Mozambique
Australia	Portugal	Bolivia	Tanzaia
Singapore	Malaysia	Colombia	
Germany	Mexico	Peru	
Norway	Argentina	Jamaica	

Ireland	Romania	Iran	
Belgium	Chile	India	

Source : Human Development Report, 2001.

Table 4

No. of Applications and Patents Granted for Selected Countries

Country	Applications filed (p.a.)	Patents granted (p.a.)
Japan	400000	250000
United States of America	90000	35000
United Kingdom	70000	30000
India	10000	2000

Source : www.wipro.com

Table 5

List of top 20 Countries (with software Licence misuse and piracy Hotspots

Country	Country
China	France
Russia	Iran
USA	Turkey
India	Germany
Ukraine	Brazil
Italy	Columbia
Taiwan	Indonesia
Korea	Peru
Mexico	Thailand
Vietnam	Hungary

Source: RCI data

As per BSA Global Software Survey May 2016, 43 percent and 39 percent of software installed on PC was not licensed during the yars 2014 and 2015.

IMPLICATIONS

In the light of foregoing analysis, soe facts can be stylized as:

a) The progress of software development hinges on the developers' ability to use both new and old ideas, but software patents prevent this. Hence countries that do not have software patents are giving their software developers an advantage. Developing countries must incorporate the provisions of allowing its researchers to experiment on the patented invension for research.

b) Intellectual Property protection is important to encourage innovation and creativity in the information society; similarly, the wide disseminating, diffusion and sharing of knowledge is important to encourage innovation and creativity. Although transfer and dissemination of technology is an explicit objective of TRIPs but it leaves the transfer related provisions quite vague.

c) The patent system grants temporary monopoly to the firme that introduce innovation. Strengthening and harmonization of IPR regime is going to affect to process of development of poorer countries in a significant manner by chocking an important contributor of growth described as adaptation and imitation and re-engineering in the technology learning process. The developing countries may be compensated for the adverse effects of the strengthening of IPR regime by international funding to local enterprises to help them to build local capabilities.

Hence to sum up we can say that investing in the developing and underdeveloped countries for technology creation, diffusion of innovations and human skills is not in contrast to the competitive interests of leader and potential leader countries. A little relaxation and/or compensation in the present IPR system will benefit finally the developed world to long-run.

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Figure 1

Data Flow diagram of Indian IT industry in absence of IPRS (in 1990s).