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PHARMACEUTICAL RESEARCH AND DEVELOPMENT – CASE STUDY OF INDIAN PHARMACEUTICAL INDUSTRY

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ABSTRACT

Pharmaceutical Research and Development (R&D) is time consuming, risky and costly. It takes roughly about USD 1 billion to develop and commercialize a new drug. Indian pharmaceutical companies were not engaged in basic research and the amount spent on R&D was very low. With adherence to Trade Related Aspects of Intellectual Property Rights (TRIPS) agreement, Indian pharmaceutical companies have increase the amount spent on R&D. This study discusses the current R&D scenario in India.

INTRODUCTION

The progress of a country depends on its economic, social and technological advancement. It is important for a country to achieve economic and technological progress which may eventually lead to social progress. Instruments of Intellectual Property Rights are considered to achieve economic, social and technological advancement for a country in all aspects. Of all the instruments of Intellectual Property Rights, patent is the most contentious issue which is deliberated in several international fora. Patents are mostly debated for its role in pharmaceutical field.

The debate on Intellectual Property Rights is continuing with proponents viewing it as a

tool for country's development which in turn would result in social and economic development; whereas the opponents view it as impeding technological development and social upliftment of people in developing countries. The major implications of the Intellectual Property Rights are debated for pharmaceutical industry where the issue of access and affordability of medicines is a prime concern. Whether patents promote technological, economic and social progress in developing countries is to be ascertained.

PATENT SYSTEM IN DEVELOPED AND DEVELOPING COUNTRIES

Viewing patent system differently and taking into account the factor that the implications for patents for developed

countries and developing countries would be different, developing countries vociferously objected to the adoption of patent system specifically for pharmaceuticals. As developing countries are faced with the problem of increased healthcare burden, availability of affordable medicines is a roadblock for these countries. Developing countries seek alternative strategies to meet the growing healthcare needs of their population. History shows that countries have fine tuned their Intellectual protection regimes according to their developmental requirements (Kumar, 2003). Many of today's developed countries have a history of excluding pharmaceutical product patents. The examples include Germany until 1968; France, 1960; Japan, 1976; Switzerland until 1977; Italy until 1978; Spain until 1992; Portugal until 1992; Norway until 1992; Finland until 1995, and Iceland until 1997. (Scherer and Watal, 2001; Nogues, 1990). This clearly shows that countries need to adopt a flexible system with regard to patent that would help advancement of country technologically, socially and economically. An ideal regime of Intellectual Property Rights strikes to balance private incentive for innovators and maximizing access to the fruits of innovation for public interest (Mashelkar, 2001). Correa (2000) argues that any IPR system must try to strike a balance between creating incentives for innovators and consumer's interest. Developed and several developing countries are members of World Trade Organization and have implemented the provisions of Trade Related Aspects of Intellectual Property Rights (TRIPS)

agreement in their national laws to provide for patent protection for all fields of technology. Many countries like India and Brazil provided only process patent and not product patent for pharmaceutical products.

PHARMACEUTICAL RESEARCH AND DEVELOPMENT

Pharmaceutical Industry is research driven and the amount spent on R&D is quite high. It requires an average of 12 years for a single drug to reach market after its extensive evaluation for safety, quality and efficacy. The cost of development to commercialization is estimated at 800 million to 1 billion US dollars according to various reports and it is increasing with regulatory agencies adopting stringent norms for approval of a drug, Out of 10,000 molecules that are preliminary screened for their potential action, only one or two are successfully commercialized after extensive testing and regulatory approval. Companies require regulatory approval at each and every stage of clinical testing to proceed further with research, which again is time consuming and requires substantial financial resources. The financial resources are also required for preclinical and clinical testing of drugs which takes a decade to complete and for about 50% of total cost of drug development. (Grabovski, 2002)

RESEARCH & DEVELOPMENT BY INDIAN PHARMA COMPANIES

With adherence to TRIPS agreement, significant improvements have been observed among Indian pharmaceutical companies. Amount spent on R&D by

companies has increased substantially. Table 1 shows the R&D expenditure as a percentage of sales for a few Indian pharma companies in 2004. It is evident that R&D in Indian pharmaceutical industry is gaining momentum (Sanghi, 2005). In absolute terms, R&D budgets in the Indian pharma industry have risen several times. R&D expenditure by Indian pharmaceutical industry was Rs.220 crores in 1997-1998 which rose to Rs.260 crores in 1998-1999 and Rs.320 crores in 1999-2000 and to Rs.495 Crores in 2005-06. The majority of R&D is conducted by 15 top Indian companies (IBEF, 2006).

India's Pharmaceutical expenditure is shown in the table 2. Since then the amount spent on R&D by Indian pharmaceutical companies have increased manifold. Some of the big companies have started investing 12 to 14 % of their total turnover for R&D

activity. This is a progressive sign on the part of Indian pharmaceutical companies. Table 3 show the amount spent on R&D by a few top Indian companies during last five years. It is seen that company like Dr. Reddy's have spent almost 18% of total sales revenue on R&D during 2004-2005. Many companies started investing heavily during last five years as it became imminent that Indian pharmaceutical companies have to adopt product patent regime and compete with multinational pharmaceutical giants on a level playing field. Though these figures are not comparable with the huge amount spent by MNCs on pharmaceutical R&D, it is a clear indication that expenditure on R&D has substantially increased in recent years. The outcome of increase in R&D is observed as quite a few numbers of patents are filed by Indian pharmaceutical companies in India and the US.

Table 1: R&D Spending by major Indian Pharma companies in 2004

Company	Percent of total sales spent on R&D
Ranbaxy	6 %
Cipla	4 %
Dr. Reddy's Ltd. (DRL)	4.4 %
Sun Pharma	4 %
Torrent Pharma	6.4 %
Lupin	1 %
Wockhardt	10.5 %
Nicholas Piramal	0.7 %
Industry Average	2 %

Source: www.biomedcentral.com/content/pdf/cd-422614

Table 2: India's Pharmaceutical expenditure in (\$ million)

FYear	Value	Percent change
2000-01	97.8	
2001-02	130.5	33
2002-03	175.3	34
2003-04	280.0	60
2004-05	392.4	40
2005-06	495.2	26

Source: Assocham.

Source: Associated Chambers of Commerce and Industry (ASSOCHAM), India

PATENTING BY INDIAN PHARMA COMPANIES

The amount spent on R&D by Indian pharmaceutical companies is in corroboration with the number of patents filed by some of the Indian pharmaceutical companies with the United States Patents and Trademarks Office (USPTO). The number of patents filed by Indian pharmaceutical companies in the last decade with the USPTO has increased substantially. Though a strict correlation between the amount spent on R&D and number of patents filed cannot be established, it nevertheless gives a positive image of Indian pharmaceutical companies with respect to their commitment for R&D and filing of patent application in India and abroad. By closely looking at the figures in table 2, it is quite noteworthy that before 1995 not a single Indian company had patent in the US. Incidentally, 1995 was the year from which India agreed to grant product patent with respect to all fields of technology, including

pharmaceuticals, for a uniform period of 20 years. Even after 1995, the performance of these companies in acquiring US patents was abysmal. Majority of the pharma companies got patents after 2000. Only Council of Scientific and Industrial Research (CSIR), India has applied for and acquired US patents. Even then, the patents granted to CSIR include patents in all classes and not only related to drugs and pharmaceuticals. This apathy towards understanding importance of patent is resolved and the Indian companies are aggressive in their approach for filing and acquiring patents. Indian companies have increased patent filing after 1995. This may be attributed to the fact that the process of acquiring patents takes a few years. One of the plausible reasons could be filing of patents immediately after India adhered to the TRIPS agreement. These companies thought of the inevitable and prepared themselves to face challenges imposed by TRIPS. Among the pharma companies,

Ranbaxy Laboratories Ltd is the frontrunner in acquiring US patents, with 77 patents to its credit from 1969 to 2006. Dr Reddy's comes a close second, with 52 US patents from 1995 to 2006 (Patents for Dr Reddy's Research Foundation (30 patents) and Dr Reddy's Laboratories Ltd (22 patents) combined together). The other major pharmaceutical companies have less than 20 patents each. This can be seen in Table 4. It is not known whether these patents are process or product patents (Chaudhary, 2007), as further classification is not provided by USPTO (Janodia, 2008). The list provided here in the table is indicative of companies that have filed patents with USPTO. Many more companies may have filed for more number of patents which are not listed as the list provided by USPTO is till year 2006. It can be safely assumed that many more US patents may be acquired by Indian pharmaceutical companies after 2006. The comparison of CSIR with pharmaceutical companies is not with respect to pharmaceutical patents. CSIR has acquired patents in all fields of technology and not only related to pharmaceutical products (Janodia, 2008). The comparison of

patents acquired by Indian pharma companies with CSIR is indicative only.

PIPELINE OF MOLECULES OF THE INDIAN PHARMA COMPANIES

Despite increase in R&D spend and number of patents, Indian pharmaceutical industry is not able to come out with a new successful drug molecule in the market. Yet the pipeline of a few Indian companies is promising as a few molecules are at certain stage of development. Another striking feature of R&D in India is that Indian pharma companies R&D expenditure is focused towards "global diseases" like obesity, diabetes, hypertension, cancer rather than diseases affecting developing countries. As these therapeutic segments offer more lucrative opportunities, companies are specifically focused on developing molecules for these segments. On the flip side, Indian companies are ignoring the R&D efforts for tropical diseases such as Malaria, Filariasis, Tuberculosis, Leishmaniasis that are more prevalent in India. Following table shows the progress made by Indian pharma companies in terms of New Chemical Entity (NCE) research.

Table 3: Molecules in various stages of development at different pharma companies in India

Company	Compound	Therapeutic Area	Phase of development
Dr. Reddy's Lab	DRF 2593	Metabolic Disorders	Phase III
Dr. Reddy's Lab	DRF 1042	Oncology	Phase I
Glenmark Pharma	GRC 3886	PDE IV inhibitor	Phase II
Glenmark Pharma	GRC 8200	Diabetes	Phase II
Nicholas Piramal	P 276	Anti Cancer	Phase II
Nicholas Piramal	Oral Herbal Product (Unnamed)	Inflammation	Phase II
Lupin Pharma	LL 3858	Anti TB	Phase I
Lupin Pharma	LL 2011	Anti Migraine	Phase III
Lupin Pharma	LL 3348	Anti Psoriasis	Phase II
Zydus Cadila	ZYH1	Dyslipidemia	Phase II
Zydus Cadila	ZYI 1	Anti Inflammatory	Phase II

Source: Annual Reports of Various companies listed. (Collected from the latest Annual Reports for the year 2007-2008 except for Zydus Cadila for which the data collected from 2006-2007 Annual Report)

Sr.No	Year Company Name	2003-2004		2004-2005		2005-2006		2006-2007		2007-2008	
		R&D (Lakhs)	% of total sales	R&D (Lakhs)	% of total sales	R&D (Lakhs)	% of total sales	R&D (Lakhs)	% of total sales	R&D (Lakhs)	% of total sales
1.	Alembic	1958.0	3.19	3112	5.44	2667	4.01	3454	5.00	4624	4.51
2.	Dabur Pharma	1816.0	8.50	2149.94	9.02	2689.04	10.00	651	0.37	75	0.04**
3.	Dr. Reddy's	2260.48	12.99	2977.87	18.29	2539.44	11.89	2927.97	7.56	3334.47	9.85
4.	Glenmark	3716.20	9.67	4868.40	9.04	4669.1	7.49	5137.3	6.09	6591.0	4.63
5.	Lupin	4600	4.00	8361	7.20	10802	6.70	14214	7.20	19337.0	7.60
6.	Nicolas Piramal	5586.0	3.90	10844	7.80	9115	6.50	10740	6.70	3528*	1.90*
7.	Ranbaxy***	3807.9	-	6826.8	-	15297.2	-	9748.6	-	4657.4	-
8.	Sun	10768	12.80	11598	11.60	16149	12.50	18827	11.30	14439	6.10
9.	Torrent	396.7	8.90	673.2	14.30	873.6	12.88	1121.4	12.95	1131.7	11.67
10.	Zydus Cadila	8820.0	7.52	10320	9.17	13950	10.66	15600	10.39	NA	NA

Table 4: Amount of expenditure on Research and Development by a few top Indian Pharmaceutical Companies during last 5 years.

* Does not include expenditure for NCE R&D as the R&D activities related to NCE are demerged.

** Probably R&D declined due to takeover by another company

*** The financial year is considered from January to December and the figures in the table are for previous year ended in December (e.g. in the column 2003-2004 the data is till December 2003)

Source: Compiled from various Annual Reports of the companies

Institution	Pre 95 Patents	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Total
CSIR	47	9	10	18	25	36	37	58	120	133	127	117	122	859
RANBAXY LABORATORIES LIMITED	7	1	1	2	5	4	4	8	7	8	11	7	12	77
DR. REDDY'S RESEARCH FOUNDATION	0	0	0	1	2	7	7	3	7	1	0	0	2	30
DABUR RESEARCH FOUNDATION	0	0	0	0	0	1	3	5	5	6	1	2	3	26
PANACEA BIOTEC LIMITED	0	0	0	1	1	4	2	3	2	1	0	NA	NA	14
ORCHID CHEMICALS & PHARMACEUTICALS LTD.	0	0	0	0	0	0	0	0	2	5	6	5	1	19
UPIN LABORATORIES LIMITED	0	0	1	1	5	2	1	1	0	0	0	NA	NA	11
DR. REDDY'S LABORATORIES LTD.	0	0	0	0	0	0	0	0	0	7	3	5	7	22
TORRENT PHARMACEUTICALS LTD	0	0	0	0	0	0	1	3	1	3	0	0	1	9
USV LIMITED	0	0	1	0	0	0	0	1	2	1	2	1	0	8
BIOCON INDIA LIMITED	0	0	0	0	0	0	0	1	0	4	1	4	0	10
DEPARTMENT OF SCIENCE & TECHNOLOGY	0	0	0	0	0	0	0	0	3	1	2	0	0	6
AUROBINDO PHARMA LIMITED	0	0	0	0	0	0	0	0	2	0	3	1	3	9
WOCKHARDT LIMITED	0	0	0	0	0	0	0	0	0	3	2	2	4	11
SUN PHARMACEUTICAL INDUSTRIES LTD	NA	NA	NA	NA	NA	NA	NA	NA	2	2	0	1	4	9

Table 5: US patents granted to Indian pharmaceutical companies in the last decade

N/A: Not Available

Source: Janodia et al. (2008)

CONCLUSION

Research and Development is a long and risky business with a huge amount at stake and the chances of success are less. Further, it takes a long time to develop and commercialize a new drug. With challenges posed by the Trade Related Aspects of Intellectual Property Rights (TRIPS) Agreement, Indian pharma companies have geared up themselves. The amount spent on R&D has increased among Indian pharmaceutical companies in recent years and many companies are actively involved in basic research to come out with new drugs. Increase in budget for R&D shows that Indian pharma companies are committed to R&D activities.

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