Journal of Contemporary Issues in Business and Government Vol. 28, No. 04, 2022
https://cibgp.com/

P-ISSN: 2204-1990; E-ISSN: 1323-6903
DOI: 10.47750/cibg.2022.28.04.001

INTELLECTUAL CAPITAL (IC) AND PROPENSITY TO MERGERS AND ACQUISITIONS (M&A) IN THE INDIAN PHARMACEUTICALS AND CHEMICAL INDUSTRY

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ABSTRACT
This study is intended to analyse the various Intellectual Capital(IC) components and other firm specific factors which determines the M&A decision of a firm in the Indian pharmaceutical and chemical industry. Binary logistic regression is used for testing the various Intellectual Capital components such as Human Capital(HC), Structural capital (SC) and Customer capital(CC) and firm characteristics like Firm size, Leverage and Return on Asset on propensity to M&A in these high tech industries. The result shows that IC elements, namely, HC, SC, and CC are the strong determinant of M&A propensity in the pharmaceuticals and chemicals industry in India. In the pharmaceutical industry, the companies which are having less HC (labour intensity) and high SC(R&D and patent) and strong CC(Marketing & distribution Intensity) are more tend to go for M&A. And acquirers in the pharmaceutical industry are larger in size, and their firm performance also good. In the chemical industry, the companies that have higher HC, higher Innovation Capital and higher CC and less experienced companies have more probability of an acquirer. Similar to pharmaceutical acquirers, these acquirers are also larger in size, and they have better firm performance.
KEY WORDS: Mergers and Acquisition ,Intellectual Capital, Human Capital, Research and Development, Logit Analysis

JEL: L65,O34,E24,O3,C25

INTRODUCTION

Rima & Eagle (2007) postulates that growth, synergy, and access to intangible assets are the three main reasons for a firm to go for M&A. Growth can be organic or inorganic. Organic growth takes place gradually by acquiring new assets and technologies and establishinga new line of products,whereas inorganic growth takes place through mergers, acquisitions, amalgamation, and takeovers.Synergy is the added value created by integrating two businesses that would not otherwise be available if they operated alone (Damodaran A,2005). These include operating synergy due to economies of scale and scope, financial synergies, and managerial synergy.M&A can be viewed as a competitive strategy for retaining or acquiring strategic resources, particularly intangibles,becausethe accumulation of these assets

P-ISSN: 2204-1990; E-ISSN: 1323-6903
DOI: 10.47750/cibg.2022.28.04.001

through external growth is faster than internal growth (SeligmannFeitosa et al.,2014).The awareness of the value of knowledge and technology in economic growth has resulted in the move of bricks and motor economy to the knowledge-based economy. Knowledge is important for economic development since it is embodied in people (human capital) and technology (OECD,1996). In recent years, corporate has identified knowledge as the new engine of their success, and they tend to innovate more, relying on new technologies and the skills of the employees rather than tangible assets (Starovic,2005). Vyas et al. (2012) reiterate that technological competence, market know-how, tacit knowledge, and speedy invention, are key company assets for addressing growing competition (Cantwell & Suntangel,2002), particularly in high-tech industries.Pharmaceutical and chemical industries are considered as high-tech industries as per the OECD 2016 classification. This classification is based on the R&Dintensity of the companies.These industries are primarily knowledge driven. This is one of the sectors with high R&D intensity and innovation and these factors play a prominent role in the competition dimension too(OECD 1997).Moreover, these industries have the characteristics of highly skilled scientific and engineering personnel, high R&D investments, large initial investment, and they need a very large global market, near-monopoly. Intrinsically,the pharmaceutical sector stands out because of its knowledge-intensive characteristics. With the quality of manpower, R&D activities, product and process innovation, and intellectual property, it is considered as an innovative and research-oriented industry.M&A are important sources of innovation for all key players in the most technologically oriented industries too.Furthermore, M&A is more important for organisations in areas where competition is based on technology than in industries where competition is not based on technology (Link,1988).

Resource Dependence motives are an important factor for acquisition decisions in the high-tech industry. R&D-related assets, or lack of them, determine a firm's acquisition decision (Das & Kapil,2015).In the pharmaceutical industry, companies that have high R&D to sales and which have an inadequate number of drugs approval are more likely to go for the international merger, and domestic mergers are attracted to firms with less R&D intensity and smaller drug portfolios (Nayak,2015).Inthe Indian pharmaceutical industry, R&D intensity is positively related to M&A (Vyas et al.,2012, Santhosh Kumar, 2017). Mostly, the studies taken R&D factor in M&A decisions in High tech industries. But in High tech industries, other IC elements are also very much important. Sivakoumar(2015) opined that Intellectual Capital (IC)plays an important role in the market value of the companies in high tech industries, and Intellectual Capital elements like HC, Innovation Capital, and Relational capital are positively related to the market value of the high tech industries in India.Moreover, Das & Kapil (2015) found a negative relationship between Tobin's Q, a method to measure IC (Kaldor,1966; Tobin,1968)and R&D intensity in Indian hightech industries,he noted that the intangibility of these companies' assets is not reflected by their R&D investment, and that there are likely other variables that contribute to their intangible assets. Thus, this study analyzesthe IC characteristics which can influence the propensity to M&A in pharmaceutical and chemical industries in an emerging economy like India. The studies take into account various IC factors and other firm-specific factors which determine the M&A decision of an acquiring firm in a selected high-tech industry, namely the pharmaceutical and chemical industry.

M&A IN PHARMACEUTICAL AND CHEMICAL INDUSTRIES

The pharmaceutical industry has become one of the most developed sectors in recent times, and it ranks 3rd worldwide for production by volume and 14th by value (IBEF, 2022). The program advancement of science and technology, in general, has been one of the factors that

P-ISSN: 2204-1990; E-ISSN: 1323-6903
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have stimulated the growth of this sector. Globally, the Indian chemical industry is the 4th largest producer of agrochemicals, and it holds 14th rank in exports and 8th rank in imports at the global level (IBEF, 2022).

Table I. Trends in M&A

	PHARMACEUTICALS		CHEMICALS	
YEAR	**TOTAL DEALS**	**CAGR%**	**TOTAL DEALS**	**CAGR%**
2000	14		7	
2001	13	-3.64	10	19.52
2002	22	16.26	16	31.73
2003	11	-5.85	14	18.92
2004	14	0	15	0
2005	34	15.94	28	25.99
2006	33	13.03	33	24.80
2007	31	10.45	38	23.55
2008	34	10.36	26	15.70
2009	15	0.69	16	8.62
2010	21	3.75	17	8.40
2011	19	2.58	18	8.19
2012	12	-1.18	15	6.04
2013	10	-2.37	8	0.96
2014	21	2.74	19	6.88
2015	31	5.09	18	6.08
2016	32	4.98	19	6.05
2017	22	2.54	17	5.05
2018	17	1.03	17	4.78
Total	**406**		**351**	

Author's calculation from Bloomberg data.

Table I shows the M&A deals count and percentage of Compound Annual Growth Rate by the pharmaceutical and chemical industry in India from 2000 to 2018. Both pharmaceuticals and chemical companies are very actively participating in M&A. There wasa total of 406 deals that occurred in the pharmaceuticals industry. Whereas in the chemical industry aggregate deal count was 351. The year 2005 was a remarkable year in terms of M&A in these industries. Indian patent act amendment 2005 made Indian Patent laws in conformance with the World Trade Organization TRIPS agreement. According to the patent act 1970, only process patent was granted. But the amendment of the patent act 2005 could grant product patents for inventions related to food, drugs, and chemicals. This law forced Indian companies to invest more in R&D and innovation and target the contract manufacturing market. Due to this, pharmaceutical and chemical companies started to do more mergers and acquisitions deals and form other alliances with domestic and foreign firms. In 2009, there had a shrink in M&A deals in these industries as this was the global recession time, and Indian M&A also affected this recession slightly. But India could manage it very well, and this is evident from the upcoming years' M&A deals. The Indian economy was moving in a slow phase from 2011to 2012. M&A was also less during this time. From 2014 onwards, M&A deals are again started rising, and still,this phenomenon continues.

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REVIEW OF LITERATURE

M&A's drivers or reasons are diverse and complicated, and no single technique can fully explain them (Vyas et al., 2012).The researchers in the field of M&A have touched on different motives of M&A, and these coined different theories of M&A.Trautwein(1990) has classified M&A motives or theories into six.The first motive can be synergy, which is explained through efficiency theory. The efficiency theory was developed by Fama (1990) regarding the capital market, i.e., a market is said to be efficient if the stock price changes with the availability of information to the general public. This theory was then developed for M&A transactions. Wolfe et al. (2011) write that by doing M&A, the company will get benefits in the form of skilled manpower, better technology, access to promotion, and product development. Sing & Montgomery (1987) was termed these benefits as synergies, and Seth (1990);Hubbart& Patiala (1990)have pointed out that companies will gain benefits by integrating two firms, producing advantages that would not be available to these firms running on their own. And these synergies are operating, financial, and managerial synergies.

The monopoly theory of classical economic theory of monopolization states that companies commit to horizontal M&A in order to establish market strength, limit competition, and get entry to a new market that was previously impossible for them.Trautwein (1990)says that a conglomerate M&A can allow a firm to achieve market power in three ways. Firstly,a company can cross-subsidize its products. Secondly, the company can limit competition in multiple markets at the same time. Finally, the company can use concentric acquisition by market leaders to prevent new entrants from its markets.

The valuation theory states that mergers are planned and performed by managers who have unique knowledge of the target organisations and the potential benefits of integrating them (Steiner, 1975; Holderness and Sheehan, 1985; Ravenscraft and Scherer, 1987).From this point, the decision of M&A will reflect the increase in the shareholder value.

According to the Empire building theory of M&A, merger serves the personal interest of management; thereby, they own utility instead of their shareholder value(Trautwein 1990). There has a conflict between the owners and the management of a company, and it will reflect on the firm value. You et al.(1986) found that merger results are influenced by the share of ownership of management and the number of inside directors.

The process theory states that mergers are the result of a complex decision-making process. The judgment or decision-making is based on the incomplete information or restrictive information processing capacity of individuals. Power (1983) reported that mergers and acquisitions are not a fully logical decision because of a lack of planning, political factors, varied process participants, and a lack of agreed-upon acquisition criteria.The disturbance theory states that M&A are prompted by economic events and trends that happens in periodic waves. These macro-economic shocks or disturbances create uncertainty, and this necessitates a company to consider the possibility of an acquisition (Gorts,1969).

Intellectual Capital And Its Components

Resource-Based View (RBV) of the firm describes the firm as a unique collection of resources,competencies, and capabilities. Resources are defined as tangible and intangible assets that a firm may control and employ to develop competitive strategies (Barney & Clark,2007).Tangible resources are the assets which can be seen and measured in an organization (Hitt et al.,2008). Information, people, innovation and reputationin front of customers and suppliers are examples of intangible resources, and these are nonphysical asset (Hitt et al.,2008). Knowledge-Based View is the outgrowth of RBV.It focuses on knowledge as the strategically most important resource of the firm(Conner & Prahlad,1996). Knowledge became the core factor in a firm. This Knowledge or Knowledge capital is otherwise known

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as Intellectual Capital(IC).Kenneth Galbraith coined the term "intellectual capital" in 1969 (Bontis,1998), believing that it encompassed more than pure intellect and included intellectual action.Ulrich (1996) regarded IC as an individual-level construct i.e., IC is the knowledge and skills of an employee in the organization. Rastogi(2002);Mouritsen et al. (2002) have viewed IC as an organization-wide knowledge resource that can make an organization capable of taking action. Bouty, I (2000); Keenan &Aggestamet al.,(2001)have considered IC as something that can create value in the future or has the potential to create value, according to a different perspective than individual and organizational levels of analysis. Edvinson (2000) defined IC as the future earning potential of an organization's employees derived from human capital and employee potential.Barney (1991) had a resource-based view on IC andaccording to Barney (1991), firm resources can either be: physical, human, or organizational. Based onthese approaches, various authors have given differing definitions for Intellectual Capital. IC, according to Bontis (1996), is absurd, but once it identified and utilised, it can give a new resource base from which an organisation can compete and win.

Researchers identified three broader elements of IC, namely, Human Capital, Structure Capital, andCustomer Capital or Relational capital (Sveiby, 1997; Roos and Roos, 1997; Stewart, 1997; Sullivan, 1999; Edvinson, 2000; Bontis, 2000,2002; Kavida and Sivakoumar, 2009). Human Capital (HC) comprises the knowledge and skills of the human beings in the organization. HC is defined by Bontis (1998) as individual tacit knowledge. And Lynn (1998) defines HC as the raw intellect, skills, and expertise of Human actors in an organisation. Structural Capital (SC) is simply the organizational support factors or the resources to the Human Capital. SC is defined by Edvinson and Malone (1998) as anything that fosters employee productivity or gets left behind at the office, therefore, can be traded.SC comprises a mechanism and structure of the organization that supports employees in their performances also overall business performances (Bontis, 1998). Roos et al. (1997) describe SC as "what remains in the company when employees go home for the night" Customer capital is the capital outside the boundary of an organization. That is knowledge linked to the marketing channel and customer relationships that a company develops in the course of business activities. Bontis (1999) define Customer capital as the capital which represents the potential of an organization due to the external firm intangibles. A number of researchers have done measurements of IC, and also they tried to analyze its impact on firm performance. Bontis(2000), Firer S et al (2003),Chen et al(2005), Starovic et al(2005); Kamath et al (2007,2008), Choudhury(2010), Sharabati et al(2010), Clarke(2011), Wang(2011);Alipour et al(2012);Vishnu et al(2014)etc. and these studies found IC as a value-creating asset for the companies.According to Villalonga (2004), the more the intangibility of a firm's resources, as assessed by Tobin's q, the more the firm's competitive advantage.

Determinants Of M&A

Determinants of M&A and thereby prediction of M&A participation of companies have been started in the M&A study literature in the mid of 20th century when Monroe and Simkowitz (1971) has studied inter-firm differences in M&A by comparing acquired and non-acquired companies' financial characteristics and found that acquired firms were lower in size, Price Earnings ratio and Dividend PayoutRatio. In the light of Monroe and Simkowitz's study, Stevens (1973) has studied firms' financial characteristics, which can be differentiated among acquired and non-acquired companies, and found that financial aspects of the company are explicit choice variables that can immediately indicate the acquisition's non-financial reasons, regardless of the motives for the merger.Castagna and Matolcsy (1975) have studied financial ratios as predictors of acquisition and found that acquired companies were characterized bylower profits, higher dividends, and unstable earnings. Stewart et al. (1982) used probit

P-ISSN: 2204-1990; E-ISSN: 1323-6903
DOI: 10.47750/cibg.2022.28.04.001

model regression to find out the financial and product market characteristics that can be differentiated among acquired and non-acquired, and the result shows that financial variables play more role in acquisition than product market variables. Agarwal &Sensarma(2007)studied industry-level determinants of the merger in India, and their results suggested that industry concentration, growth opportunity, and cash flows are the significant factors influencing Indian firms' merger activity. Arpita (2013) found that earnings volatility and business group affiliation is the major factors which affect merger and acquisition in the Indian automobile, FMCG, and pharmaceutical industry.

Determinants of M&A in High tech industry were studied by a number of researchers in light of the resource dependency theory of M&A. High tech industries are primarily knowledge driven, one of the sectors with high R&D intensity and innovation, and these factors play a prominent role in competition dimension too (OECD 1997). Licensing, key technology partnerships, and mergers and acquisitions are the tools for the companies in this industry to adopt technology (Vanhaverbeke and Dysters,1997). The key reasons for acquisition, according to Hitt et al. (1991), are the choices between doing R&D and buying R&D. And his analysis found a relationship between own R&D and acquisition that was substitutive. This has been agreed by other researchers (Christensen and Bower, 1996; Blonigen and Taylor, 2000). Wagner (2008) found that the determinants of the acquisition were firm size, financial conditions, and geographical origin of firms rather than R&D and other technological characteristics in European High tech industries. Kumar (2009) confirmed that emerging countries like India used M&A for more strategic reasons like obtaining technology and knowledge. Danzon et al. (2007) studied the determinants of merger and acquisition in the pharmaceutical industry and found that determining factors of merger and acquisition vary according to the firm size, and large firms go for a merger in response to the excess capacity due to the anticipated patent expiration. Nayak (2015) studied determinants of cross border merger and domestic merger in the pharmaceutical industry and found that companies that have high R&D to sales and an inadequate number of drugs approval are more likely to go for the international merger. Domestic mergers are attracted to firms with less R&D intensity and smaller drug portfolios. In the Indian pharmaceutical industry, R&D intensity is positively related to M&A(Santosh Kumar Sahu 2017; Vyas, Narayanan, and Ramanathan 2012). And further, firm size, foreign affiliation, and import intensity are the major factors of the merger in the Indian pharmaceutical industry (Santosh Kumar Sahu 2017; Vyas, Narayanan, and Ramanathan 2012).

Ali et al. (2004) studied the effects of patent count on cross-border and domestic merger and found that firms that have more patenting ability tend to be acquired by domestic firms than international firms.

In summary, the past empirical research founds intangible assets components like R&D and patents, and other firm characteristics affect the propensity to M & M&A by a firm in the high-tech industry. But no other studies have taken all the components of intangible assets, i.e., Human Capital, Structural Capital, and Customer Capital, in determining the M&A of a firm. The present study analyses the effects of various components of Intellectual capital and other firm characteristics on M&A of firms in Indian high tech industries, namely pharmaceuticals and chemical industries.

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HYPOTHESIS DEVELOPMENT

This section presents the hypothesis adopted in this study concerning various independent variables such as IC elements (human capital, Structural capital, and Customer capital) and other firm traits like firm size, leverage, and ROA.

EFFECT OF INTELLECTUAL CAPITAL (IC) ON M&A PROPENSITY.

The IC can be Human Capital, Structural Capital, and Customer Capital, and these three capital has their own peculiarities. Overall, these three contribute to IC. This section explains the hypothesis development for each component of IC to the propensity to M&A.

Human Capital

The transition from the Bricks and Motor economy to a Knowledge-based economy resulted from recognizing the role of Knowledge and Technology in economic growth. Knowledge, as it is incorporated in people (Human Capital) and technology, is critical to economic development (OECD,1996). Human Capital is measured through two variables, namely, Labour intensity and the number of employees(Wen-Ying Wang 2006).In the present concept or Intangible asset Concept, employees are treated as an investment, not as a cost. People contribute their knowledge and capacities, and their involvement is measured by the market operations of enterprises and reflected in the firm's worth (Ante Pulic,1992,1997,1998).Being an High tech industry, HC is important for both pharmaceutical and chemical industry. Lack of HC or Strength of HC influences the M&A decision of the firms is this industry.

H1: human capital influences the propensity to M&A in the pharmaceutical and chemical industry.

Structural Capital

According to Bhumika et al. (2009), China and India had faster growth rates in patents granted between 1992 and 2007.From the preliminary analysis of the patent count of pharmaceutical and chemical industries, found that, the firms in the pharmaceutical industry have a greater number of patents.The patent count is recognised as an indicator of innovative quality and the presence of intangible assets also (Harzing,2002; Das & Kapil,2015;(Wagner 2007). Ali (2004) recognized in his study that companies with efficient Intellectual Property (IP) management are potential targets for acquisitions by other companies with more efficient IP management. Hall &Ziedonis (2000) postulates that high-tech industries in which firms actively acquire and accumulate large portfolios of patents to trade them later. Blonigen& Taylor (2000) found that high-tech companies either invest in in-house R&D or get technology from outside sources by purchasing innovative companies. He also discovered an inverse association between electronic and electrical equipment companies' R&D intensity and acquisition activity.Desyllas& Hughes(2005)postulates that the acquirers in the high-tech industry have immense accumulated knowledge and low R&D intensity. In Indian high-tech industries like computer and electronics, IT, Telecom, media, professional scientific and technical services, R&D intensity, and patentsare not influencing the acquisition decision (Das & Kapil,2015). But in the pharmaceutical industry, acquirers have high R&D intensity in India (Santosh Kumar Sahu 2017; Vyas, Narayanan, and Ramanathan 2012). The firm's age reflects the amount of experience it has accumulated over time.According to Vyas et al., (2012), a firm's capacities and capabilities developed over time enable it to make proper investment decisions and compete effectively in the market. According to Marshall (1920), older firms benefit from learning, which results in greater performance.Younger businesses, on the other hand, are free of bureaucratic inertia.Therefore, they are more flexible to adjust changing economic environment. Duflos& Pfister (2008) found that acquiring and target

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DOI: 10.47750/cibg.2022.28.04.001

firms in the pharmaceutical industry are younger than the sample average, and these firms treat M&A as a means to grow faster. Thus, the past studies found a positive and inverse relationship between SC (R&D intensity and patent count) and M&A in high-tech industries.
H2: structural capital influences propensity to M&A in pharmaceutical and chemical industries.

Customer Capital

Indian pharmaceutical companies spent heavily on marketing as they spent on R&D, and these companies are making sustained marketing efforts to secure the market share. Therefore, an unidentified intellectual asset lies in marketing expenditures(Kavida and Sivakoumar, 2009).Customer Capital is the knowledge or intangible asset embodied in a company's marketing and distribution channel. Moreover,Advertisement Intensity can be used to measure product differentiation, and these diversified product and marketing skills enhance firms' competitiveness in global and domestic markets. Since CC is a critical asset for these companies to their success, the lack of these assets may force companies to be acquired by the companies that have this asset in abundance. In addition, Vyas et al. (2012) opinioned that M&A is viewed as a way for companies to achieve the scope of economies and expand their product line. Thus, CC influences the propensity to M&A in the Indian pharmaceutical and chemical industry.
H3: customer capital influences propensity to M&A in pharmaceutical and chemical industries.

Other Firm Characteristics

The study also includes other firm characteristics such as firm size, leverage, and Return on Asset as independent variables to test the relationship between firm characteristics on the propensity to M&A.

Firm Size

The transaction cost of takeover and M&A increases with firm size(Palepu,1987; Powell,1997). So a firm will try to acquire small-sized firms. Thus acquiring company may be larger in size, whereasthe target company will be smaller in size.Size is measured through the natural logarithm of total assets(Ali et al., 2000; Das & Kapil,2015;T Kamaric,2016).
H4: Firm size influences propensity to M&A in pharmaceutical and chemical industries.

Financial Leverage

Myer (1977) postulates that firms having higher leverage will cause under-investment. The study of Andrade & Stafford (2004) showed M&Ahad inverse relation with leverage. Desyllas& Hughes (2005) found that high leverage restricts managers from undertaking investment activity.
H5: FL influencesthe propensity to M&A in the pharmaceutical and chemical industries.

Return On Asset

The study of Marris (1964) suggested that the resources frominefficient managers can be transferred to efficient managers through mergers. The underperforming management might increase the probability of being acquired to use managerial synergies. Thus firms with efficient management have more likelihood of being an acquirer. The principal measure of their efficiency is firm performance.
H6: ROA influencesthe propensity to M&A in the pharmaceutical and chemical industries.

RESEARCH METHODOLOGY

Journal of Contemporary Issues in Business and Government Vol. 28, No. 04, 2022
https://cibgp.com/

P-ISSN: 2204-1990; E-ISSN: 1323-6903
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This section presents the sample, dependent and various independent variables and the analytical model used to arrive at the result.

Sample

The study uses pooled cross-section data for the year starting from 2000 to 2018 for the listed companies inthe pharmaceutical and chemical industries.The companies whose data are missing for any of the selected years and have anomalies are eliminated. Since the study includes the entry and exit of the companies from the listing, the number of companies in each year is different, and it varies from year to year, and it ranges from 40 to 100. The companies in the pharmaceutical and chemical industries are identified according to the Bloomberg Industry Classification System (BICS).

The data collected from various secondary sources and data includes three sets of data, namely, M&A data, firm-specific data, and patent data. M&A data is collected from the Bloomberg database M&A portal. Firm-specific data is collected from the Bloomberg database FA portal and CMIE prowess database. Patent data is collected from the patent search database available from eSpaceNet of the European Patent Office (EPO) and the website of ipindiaservices.gov.in.

M&A data is screened by certain criteria such as only the completed M&A during the calendar year 2001 to 2018, either acquirer or target company is listed in the Indian stock exchange (BSE or NSE), and either acquirer or target company is in pharmaceuticals and chemical industry. And eliminated the deals where target company is in the financial sector (Danzon, Epstein, and Nicholson 2007).

The companies whose data are missing for any selected period are eliminated. The final dataset is arrived at by taking all the listed companies from 2001 to 2018 and classifying these companies to acquirers and non-acquirers by looking at M&A data for each year, then taking their past one year value of firm-specific variables from 2000 to 2017.

Dependent VariableAndIndependent Variables

The dependent variable used is the occurrence of acquisition.It is a binary dependent variable expressed 0 and 1(if a firm undergoes M&A, it takes the value 1; otherwise, it takes the value 0). The details of various independent variables are shown in Table I.

Table II: Variable Definition

Variable type	Variable Name	Definition/ Calculation	Symbols used
Dependent Variable	M&A Occurrence	MA=1 for firms undertaking M&A activity, otherwise 0.	MA
Independent variables:	Human Capital (HC): No. of Employee	Natural log of number of employees	LN
	Labour intensity	Ratio of wages and salaries to net sales	LI
Intellectual Capital:	Structural capital (SC): Firm Age	Difference between incorporation year of the firm and year of study.	Age
	R&D intensity	Ratio of research and development expenditure to average total asset	RDI
	Patent Count	Number of patents applied by the organization	PC
	Customer Capital (CC): Growth rate in sales	Year on year growth rate in sales expressed in percentage	SG

P-ISSN: 2204-1990; E-ISSN: 1323-6903
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	Marketing & Distribution expenses to net sales	Ratio of marketing, distribution and advertisement expenditure to net sales	MDI
Other factors	Firm Size	Natural log of total asset	Size
	Financial Leverage	Total debt to total equity	FL
	Return on Asset	Ratio of net income to total asset	ROA

Model Development

In order to analyze IC and other firm traits on the propensity to M&A in the pharmaceutical and chemical industry, Binary logistic regression is done. Moreover, the binary logistic model is the model in which the dependent variable is the odds ratio, which hasthe linear function of regressors (Gujarati 2003).Similar earlier studies also used this model to analyzethis relationship (Das and Kapil 2015; Madhuri Agrawal 2007; Vyas, Narayanan, and Ramanathan 2012).

The following model is used to analyze the relationship between IC elements and other firm characteristics in the propensity to M&A in the pharmaceutical and chemical industry.

Model 1: Pharmaceutical Industry

$$P(MA)=\alpha_{it}+\beta_1 LN_{it}+\beta_2 LI_{it}+\beta_3 Age_{it}+\beta_4 RDI_{it}+\beta_5 BPC_{it}+\beta_6 SG_{it}+\beta_7 MDI_{it}+\beta_8 SIZE_{it}+\beta_9 FL_{it}+\beta_{10} ROA_{it}+\mu_{it}$$

Model 2: Chemical Industry

$$P(MA)=\alpha_{it}+\beta_1 LN_{it}+\beta_2 LI_{it}+\beta_3 Age_{it}+\beta_4 RDI_{it}+\beta_5 PC_{it}+\beta_6 SG_{it}+\beta_7 MDI_{it}+\beta_8 SIZE_{it}+\beta_9 FL_{it}+\beta_{10} ROA_{it}+\mu_{it}$$

Where; MA is the dichotomous variable 0 or 1 for the occurrence of M&A; LN is the natural logarithm of no of employees; LI is Labour Intensity; Age is the no of years of existence of the company from its incorporation year; RDI is the Research and Development intensity; PC is the counts of patent applied; SG is the growth rate of sales; MDI is Marketing and Distribution expenses to sales;size is firm size denoted by the natural logarithm of total asset; FL is financial leverage; ROA is Return on Assets of the companies; μ_{it} is the error term: i^{the} company; t is the time.

RESULTS

Descriptive Statistics

The Table III. shows the descriptive statistics for the various variables used in the pharmaceutical and chemical industry model. In the pharmaceutical industry, the companies are quite experienced as the average age of the companies is 32.42, and the maximum age is 116. That Standard deviation is also quite large. It shows that the sample varies from new entrants to high experienced firms. R&D spending by the companies in the pharmaceutical industry is not much but it has a substantial number of patent counts.

Table III. Descriptive statistics of variables used in the study

Descriptive Statistics

Variables	Pharmaceuticals					Chemicals				
	Min	Max	Mean	SD	VIF	Min	Max	Mean	SD	VIF
MAL	0	1	0.254	0.43		0.00	1.00	0.08	0.28	
LN	4.481	9.358	7.087	1.24	2.481	4.35	8.43	6.09	1.01	2.000
LI	0.010	0.505	0.103	0.08	1.250	0.03	0.50	0.06	0.04	1.277
AGE	2	116	32.42	17.9	1.382	7.00	97.00	34.73	16.29	1.218

P-ISSN: 2204-1990; E-ISSN: 1323-6903
DOI: 10.47750/cibg.2022.28.04.001

RDI	0.001	0.058	0.019	0.016	1.529	0.00034	0.05	0.0048	0.01	1.122
PC	0	70	3.599	9.085	1.461	0	22.00	0.09	0.87	1.033
SG	-15.9	34.64	10.65	12.35	1.179	-0.22	7.00	0.15	0.41	1.060
SDI	0.004	0.098	0.051	0.032	1.372	0.0044	0.10	0.04	0.03	1.133
LT	4.925	11.41	8.609	1.472	2.590	4.93	10.25	7.54	1.46	2.042
DE	0	163	64.71	56.45	1.475	0	315.00	74.46	70.81	1.159
ROA	-4.526	17.331	7.607	6.145	1.574	-3.28	17.33	4.65	5.43	1.235
Observations (N)	516					975				

There is a huge variation in DE ratio among companies in the pharmaceutical industry, and there are high leveraged and less leveraged companies. In the chemical industry, also firm age and DE havea high average. And SD is also high for these variables. It shows the ununiformed variation in terms of age and leverage among the sample.VIF shows the value for multicollinearity among independent variables. In both industries, all the variables hada VIF value of less than four. So there is no multicollinearity diagnosed among the independent variables in both the industries.

Result Of Binary Logit Regression

Table IV: Summary of Result of Binary logit regression

Variable	**Model 1**		**Model 2**	
	Pharmaceuticals		**Chemicals**	
	Co- eff: b_i	**P value**	**Co- eff: b_i**	**P value**
HC: LN	-0.149	0.439	-0.032	0.863
HC: LI	-10.631***	0.000	8.446***	0.006
SC: Age	0.005	0.604	-0.023**	0.010
SC: RDI	21.757**	0.024	35.458*	0.087
SC: PC	0.135***	0.000	0.248*	0.063
CC:SG	0.008	0.539	0.631***	0.003
CC: MAI	17.746***	0.002	12.808***	0.005
Size	0.568***	0.001	0.349***	0.009
FL	0.003	0.320	-0.001	0.534
ROA	0.061**	0.046	0.079***	0.001
Constant	-7.066***	0.000	-6.002***	0.000
Omnibus model fit test	229.377***	0.000	67.852***	0.000
No of Observation	516		975	

Note: ***, **, * denotes significance at 1% 5% and 10% respectively.

Table IV shows the variables' name, beta coefficient, and probability value of significance of Binary logistic regression for both the models. The result shows that the Omnibus model fir

P-ISSN: 2204-1990; E-ISSN: 1323-6903
DOI: 10.47750/cibg.2022.28.04.001

test has a higher value and is significant at a 1% level of significance for both the models. Therefore results can be interpreted meaningfully. In model 1, the independent variables like RDI, PC MAI, size, and ROA have a significant positive influence on the propensity to M&A in the pharmaceutical industry. Whereas LI has a significant negative impact on the propensity to M&A. In model 2, independent variables like LI, RDI, PC, SG, MAI, Size, and ROA have a significant positive influence on the propensity to M&A in the chemical industry. But the age of the firm shows a significant negative influence on the propensity to M&A.

DISCUSSION

Intellectual Capital AndPropensity To M&A

M&A are treated as competitive action by the corporatesto retain or create strategic resources, like intangibles.Because it is a shorter way for the accumulation of such resources rather than internal growth. (SeligmannFeitosa et al, 2014). Intellectual Capital (IC) is measured through the three main components of IC, namely Human capital (HC), Structural Capital (SC), and Customer Capital (CC). Each component of IC is measured through different proxies of variables (See Table I, Variable definition for the detailed view). The following section explains the impact of HC, SC, and CC on the probability of M&A by an organization in the high-tech industry.

HC expressed in terms of LI and LN are shown negative relation to the probability of M&A in the pharmaceutical industry. But only LI shows statistically significant. In the pharmaceutical industry, companies with less labour intensity have more propensity to M&A., Even though the pharmaceutical industry is characterized by more skilled employees. LI is negatively related to M&A.Santosh Kumar Sahu (2017) has also found a similar result in determinants of Indian pharmaceutical M&A study. In the chemical industry, HC measured through LI and LN has contradicting results. LN shows an insignificant negative relation to the propensity to M&A in the chemical industry. At the same time, LI is a strong factor that positively influences the M&A propensity in the chemical industry.

Structural Capital (SC)- is simply the organizational support factors or the resources to the Human Capital. Edvinson and Malone (1998) define SC as everything that supports employees' productivity or everything that gets left behind at the office, therefore, can be traded. SC can be further represented as a combination of innovation capital, organizational capital, and organizational procedures (Edvinson and Malone,1997).SC is measured through three variables, namely age of the firm, R&D intensity, and Patent count. Age shows the experience of a company in the industry. An experienced firm can enjoy a number of advantages over a new entrant. In the pharmaceutical industry age of the firm shows an insignificant positive relation to the propensity to M&A. Whereas in the chemical industry the company which are newly entrant or less aged have more propensity to M&A. RDI and PC, otherwise known as innovation capitalfound as the strong determinant of M&A in pharmaceutical and chemical industry. RDI and PC show a significant positive relation to the propensity to M&A in both these industries. Asa high-tech industry, R&D and patents have a critical role in the success of these two industries, and this innovation capital creates competitive advantages for these industries. The relation between M&A and Innovation Capital is evident from the higher coefficient value for these variables. The companies in these industries which are lacking innovation capital might struggle to survive alone in the industry, and these companies might be acquired by strong innovation capital having companies. The studies (Blonigen and Taylor, 2000; Dessyllas and Hughes, 2005;Ornaghi,

P-ISSN: 2204-1990; E-ISSN: 1323-6903
DOI: 10.47750/cibg.2022.28.04.001

2009) found that R&D intensity is negatively related to the propensity to M&A. But our result is contradictory to these studies. Our findings suggest that acquisitions complement in-house R&D, and that when pursuing M&A in high-tech industries, the firm acquires significant absorptive capacity (Cohen and Levinthal, 1989). This is confirmed by Vyas et al.(2012);Santosh Kumar Sahu (2017) in the case of the Indian pharmaceutical industry.

Customer capital is the capital outside the boundary of an organization. That is knowledge linked to the marketing channel and customer relationships that a company develops in the course of business activities. CC is measured through sales growth and Marketing and distribution intensity. In the Pharmaceutical industry and chemical industry, customer capital is a strong determinant of M&A probability, and the companies in these industries have higher MAI having more chances to go for M&A. The pharmaceutical industry has more or less inelastic demand, and the distribution channel for this industry is mostly through medical representatives, which is different from other industries. The customers for the chemical industry are mainly industrialists such as automakers, manufacturers, and agricultural companies. Thus, these industries have a strong customer capital and a well-defined marketing route. This is evident from the higher coefficient of MAI in both industries.

Other Firm-Specific Factors And M&A

The result shows that firm size is a significant factor thatpositively influences to propensity to M&A in the pharmaceutical and chemical industries. A company thatis larger in size will have resources in abundance, and they reap synergies of economies of scale and scope(Vyas et al.,2012).These findings are consistent with other studies like Lubatkin (1986), Mishra and Chandra (2010), and Dessyllas and Hughes (2005). In our study, we could not find a significant relationship between financial leverage and M&A propensity. ROA, a firm performance measure as well as a representative of the efficiency of management, shows a significant positive impact on the probability of M&A in pharmaceutical and chemical industries. Integration after the M&A is a complex and difficult task. Only efficient management can do this well. The companies which are having better performance have more chance of being an acquirer in these industries.

CONCLUSION

The goal of this study is to add to the prevailing literature of M&Aand determinants of M&A by adding a component called Intellectual Capital that influences a firm to go or not to go for M&A in the high tech industries like the pharmaceutical and chemical industry in India. The three elements of IC, namely, Human capital, Structural capital, and customer Capital, and other firm characteristics such as firm size, leverage, and ROA, are taken as independent variables to study their relationship with the propensity to M&A using the binary logit model. The result of the test shows that IC elements, namely, HC, SC, and CC are the strong determinant of M&A propensity in the pharmaceuticals and chemicals industry in India. In the pharmaceutical industry, the companies which are having less HC (labour intensity) and high SC(R&D and patent) and strong CC(Marketing & distribution Intensity) are more tend to go for M&A. and acquirers in the pharmaceutical industry are larger in size, and their firm performance also good. In the chemical industry, the companies that have higher HC, higher Innovation Capital and higher CC and less experienced companies have more probability of an acquirer. Similar to pharmaceutical acquirers, these acquirers are also larger in size, and they have better firm performance.

M&A is one of the most significant strategies for Indian companies to grow internationally, and they are vigorously doing so. Companies, particularly smaller firms, should be encouraged to participate in domestic and cross-border M&A from a policy standpoint.The

P-ISSN: 2204-1990; E-ISSN: 1323-6903
DOI: 10.47750/cibg.2022.28.04.001

technological nature of these industries should be considered vigorously, and more M&A will make these industries do technology transfer and R&D collaboration. Hence necessary fiscal measures can be taken to motivate smaller firms to make R&D collaboration and open innovation through M&A.

The present study considered only two high-tech industries, namely the pharmaceutical and chemical industry. Further studies can be taken for other high-tech industries, and that can make more comparisons and generalizations. Moreover, the studies can be extended to other emerging countries subject to data availability. Furthermore, the influence of IC components on other strategic investment choices such as strategic alliances, joint ventures can also be studied.

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