The contribution of intellectual capital to financial stability in Indian pharmaceutical companies

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Abstract

Purpose – This research investigates the top five pharmaceutical companies in India to determine whether their financial structures are sound and if they face the risk of bankruptcy, highlighting the potential contribution of intellectual capital (IC) to financial stability.

Design/methodology/approach – The analysis outlines operating ratios, profitability ratios, possibility of bankruptcy (through *Z*-scores) and attractiveness of the financial structure (through the *F*-score), with consequent focus on (IC).

Findings – The financial structure of the selected companies seems stable. Changes in the Indian pharmaceutical scenario, above all, regarding the patent system, will force the companies to consider the impact of IC carefully.

Practical implications – Indian pharmaceutical companies need sustainability and development, with increasing focus on patent issues. To enhance innovation capabilities and overcome international competition, they should redesign their business orientation towards IC, mainly when impacting patents.

Originality/value – Using established approaches for predicting potential bankruptcy, this study focuses on the financial performance of top Indian pharmaceutical companies. IC can support financial stability, and this study provides further perspectives for managing their financial structure, both statically and dynamically.

Keywords Pharmaceutical industry, India, Intellectual capital, Financial performance, Altman *Z*-score, Piotroski *F*-Score

Paper type Research paper

1. Introduction

The global pharmaceutical industry is highly significant for human race, and is expected to grow exponentially, especially considering the tremendous impact of Covid-19 in 2020. The Indian pharmaceutical industry shows currently huge competencies in drug production, resulting as the third largest producer in terms of volume, the first for generic drugs and the first for vaccines (InvestIndia, 2020).

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Indian pharmaceutical companies have approvals from the most important drug regulatory authorities in the world, including the Food and Drug Administration (FDA) in the USA. Many multinational companies have invested in India, stimulating huge expansion and highlighting the country on the global pharmaceutical map (Kodgule, 2012); expectations are high regarding further growth (Ibef.org, 2020).

The Indian pharmaceutical industry is growing rapidly, focusing more on the quality of drugs produced. The government is acting accordingly and considers pharmaceuticals a key sector for the entire healthcare economy of the country (Shukla and Sangal, 2009).

The Indian pharmaceutical sector was valued at 33 billion USD in 2017, and with a compound annual growth rate (CAGR) of 22.40%, it will reach 55 billion USD in 2020, with better growth prospects than the global pharmaceutical market. India exports medicines to over 200 countries, and exports are increasing and likely to exceed 20 billion USD in 2020 (Ibef.org, 2020).

The main strengths of the industry are product line variety, product variation number, low cost and scale manufacturing (Kolte *et al.*, 2019). The main weaknesses emerge from macroeconomic and microeconomic viewpoints. In the former, branded generics account for 70–80% of the retail market (InvestIndia, 2020), local players have a dominant position due to initial investments and expansion abilities and strong competition generates low prices. In the latter, research, innovation and most of all patents are critical issues.

In terms of emerging economies, Lehman (2003) suggested significant potential for pharmaceutical patents in India and Brazil, with a focus on local diseases and affordable costs. Public funding for research and minimum licensing protocols are key aspects in this respect.

Duggan *et al.* (2016) highlighted fundamental changes since 2005, when the introduction of the new patent system in India generated an increase of the number of patents filed. Before the new patent system, most drugs were domestically manufactured and based on molecules patented abroad, generating only a minor increase in the expected profits for Indian firms, which were not oriented to creating new products.

Nevertheless, the Indian regulatory guidelines of 2012 complicated the market for generic drug producers. There is a need for higher skills and enhanced technological competence for producing biotechnology drugs that are still lacking in the Indian generic drug production sector (Chaudhuri, 2015).

To strengthen the sector, the government has launched three major schemes. First is the "National Health Protection Scheme", which is the largest government-funded healthcare initiative in the world and is expected to help about 100 million low-income families in India. Second, "Pharma Vision 2020" is a programme aimed at making India a global leader in end-to-end drug research and manufacturing. Third, online pharmacies are regulated via an electronic platform.

The development of the Indian pharmaceutical sector will also rely on foreign direct investment (FDI), attracting multinational corporations (MNCs) from all over the world. Under certain conditions, in cooperation with the Department of Industrial Policy and Promotion (DIPP), the Indian government is expected to support policies allowing 100% FDI.

Pashkov *et al.* (2016) emphasised that the growth and success of the pharmaceutical industry is dependent on government policy, improvements in public health and support of the state. It is equally essential to increase the availability of medicine, research innovation and drug exports. Currently, global competition for Indian companies requires a business approach towards production efficiency, innovation efficacy and increasingly financial stability. The risk for emerging economies, such as in the airlines industry (Rossi *et al.*, 2019), is that vigorous growth could distract entrepreneurs and/or managers from business fundamentals.

This research investigated the top five pharmaceutical companies in India to determine whether their financial structures are sound and if they face the risk of bankruptcy. In terms

of the potential projections of their financial structure, this study adopts an intellectual capital (IC) perspective, with specific reference to intellectual property (IP) and drug patents as the main proxy parameters.

After a global analysis of the institutional and scientific background, and after presenting the research methods, the investigation focused on the financial performance of the selected pharmaceutical companies, calculating ratios and discriminants. Related discussions on the potential impact of IC on financial stability are presented, with subsequent analysis of research limitations and future directions, followed by consequent focus on scientific and managerial implications.

2. Institutional and scientific background

Considering the vast topic under investigation, a global approach has been adopted to study the scientific literature in the field, which, considering that the pharmaceutical sector is strictly connected to the regulation systems of single countries, has also included institutional profiles. After the initial screening, the analysis was divided into five segments.

2.1 India in the global pharmaceutical sector

The drug industry is continuously undertaking financial burden, mainly due to major new medicines. India is well known for generic drugs and has started collaborations with large pharmaceutical organisations from the USA and Europe (Ibef.org, 2020). These alliances assist drug discovery and innovation, while government regulations concerning drug patenting, clinical trials and final approvals are still being rationalised.

In 2019, Eli Lilly started new associations with Indian companies. It began collaborating with Suven Life Sciences for preclinical trials, research and development of molecules for disorders of the nervous system, and with Tata Consultancy Services for handling clinical trial data and statistical analysis.

Pfizer, GlaxoSmithKline, Novartis and AstraZeneca have invested in clinical research and drug discovery at their prevailing hubs in India. Merck has announced a partnership with Advinus Therapeutics from India, while Amgen has developed a local associate for executing clinical trials (Seshadri, 2014).

The reasons for such collaborations are clear; innovative medicines are continuously emerging, and their research and development (R&D) needs flexible, adaptable and open business models, although pharmaceutical companies are forced to deal with drug patents, threats of generic medicines and lower throughput of financial efforts. Nevertheless, several MNCs operating in the pharmaceutical sector are establishing their own corporate venture capital funds to achieve greater success in their compound pipeline.

In this scenario, rising markets and, most of all, open innovations (Hughes and Wareham, 2010) have expanded the ability to gain advantage in pharmaceutical markets. The availability of technologies and communication systems provides opportunities for developing countries to work with foreign pharmaceutical companies to produce niche molecules and/or advance older drugs.

There are abundant opportunities in developing countries, especially in highly populated countries such as China and India, but environmental enabling on behalf of the institutional actors is indispensable for attracting further investments that could be effective from an IC perspective (Carayannis *et al.*, 2014; Schiavone *et al.*, 2014). Companies with vision to collaborate and strengthen will be more likely to succeed in medicine markets (Ku, 2015).

On the regulatory front, countries like India or Brazil have a grant rate that is lower than most developed pharmaceutical markets, particularly the USA. The Indian grant rate is well known for its numerous and robust protocols (Sampat and Shadlen, 2015).

Chataway *et al.* (2007) highlighted that some developing countries had accumulated scientific, industrial and commercial competencies in the pharmaceutical sector in recent

decades. Despite many obstacles, these countries have developed advantages regarding chemical, biological and drug innovation abilities. Coherently, large pharmaceutical organisations are deliberating novel approaches for retaining the framework of innovation for drug development in India, arguing better opportunities for innovative corporations in developing countries.

Sweet (2010) presented a region-wide depiction of the changes occurring in the field, with a specific focus on Indian pharmaceutical MNCs operating in emerging countries. Companies from developed nations have better competitive advantages in other developing countries. Indian companies play both antagonistic and symbiotic roles, competing and cooperating with other local firms.

Cekola (2007) argued that the R&D traditional model in the pharmaceutical sector is no longer sustainable as costs for drug invention and production have been amplified, while sales have increased at lower rates. India seems to have unique advantages in terms of large patient pool, English-speaking population, well-trained medical professionals and excellent medical infrastructure.

The Indian government has provided protection for foreign investment in clinical trials and the safety of Indian trial volunteers, attempting to capture a share of the value that the national industry adds to R&D models of foreign pharmaceutical MNCs, mostly from the USA. Furthermore, for many diseased Indians, the chance to participate in an investigational trial is a healthcare windfall, because these patients may otherwise have received no healthcare services.

2.2 Issues and challenges in the Indian pharmaceutical industry

Research and development in medicine has enhanced peoples' longevity and productive lives. Due to knowledge needs, technological requirements and subsequent patents for marketable drugs, the pharmaceutical industry functions under a legal oligopoly for patented medicines and under monopolistic competition for branded generic medicines. Thus, the cost of medicines is fundamental.

In India, drug prices have been monitored and controlled since 1995 by the Drug Price Control Orders (DPCO) authority, governed by the National Pharmaceutical Pricing Policy (NPPA). Accordingly, a National List for Essential Medicines (NLEM) has been formulated. These authorities have a mechanism for controlling the prices of essential drugs, above all when patented.

Pharmaceutical companies often also use secondary patents to extend the period of legal monopoly, a serious concern for the price affordability of medicines. In response, several countries have adopted procedures to control the grant of these patents, but the measures to confine the secondary patents have a partial impact in developing countries. Hence, there is a need for specific policies to improve patenting processes, systems and policies, with control of consequent effects, mostly in countries with larger proportions of sick and frail people (Sampat and Shadlen, 2017).

In emerging economies, liberalisation of the World Trade Organization's (WTO) general and specific patent rules have created a promising environment for MNCs to enter related markets for research, patenting and production. India, for example, has attracted many MNCs, but the success of these collaborations is possible only if the government provides support to foreign and local companies (Basu, 2011). On the other hand, pharmaceuticals are an attractive sector for investors across the world, but its progress in emerging markets has been blemished by inferior drugs, red tape and corruption, which can discourage higher investments (Tannoury and Attieh, 2017).

Although mergers and acquisitions (M&A) are a powerful strategy for obtaining larger size, higher market share and faster growth (Meena, 2014), they have not had significant impact on companies' profitability in the Indian pharmaceutical industry. Instead, they may

benefit competitiveness, and thereby increase competition from other firms (Mishra and Chandra, 2010).

Beena (2006) argued that the Indian pharmaceutical sector has experienced consolidation using mergers, acquisitions and alliances. Mergers are dominated by domestic companies, and foreign companies are participating in acquisition and alliances due to the dilution of policy regulations. Most companies have adopted M&A as a market expansion strategy rather than a technology enhancer, enlarging their product profile and reducing their business risk, although the Indian pharmaceutical industry has developed with increasing emphasis on innovation, research and new drug discovery (Rani *et al.*, 2011).

Vyas *et al.* (2013) examined the Indian pharmaceutical sector regarding mergers, acquisitions and technological efforts towards the efficacy of exports. Sahu and Agarwal (2017) highlight that the principal elements of M&A in the industry are export intensity, import, R&D and firm size, and argue that M&A should also have a positive effect on profit margins.

M&A in the pharmaceutical sector provides synergistic gains and complement benefits and offers better reach. It creates advantages derived from intangible asset accumulation, and thus IC, including production techniques, product brands and higher management proficiencies, which positively affect innovation management (Dezi *et al.*, 2018), drug quality, export potentiality and firm internationalisation.

Indian pharmaceutical companies need to generate innovative knowledge through research (Carrillo *et al.*, 2009) to develop new pharmaceutical products rather than just replicating existing molecules and compounds (Sharma and Goswami, 2009). Generic pharmaceuticals have conditioned the business of pharmaceutical invention. Recognising the greater uncertainty of radical innovations, mostly when compared to the business efficiency of generic drug production, innovator companies have discovered incremental innovation to enhance the market life of their existing high-selling products (Dubey and Dubey, 2010).

Mazumdar-Shaw (2018) emphasised that affordable innovation provides means to invent, be flexible and do more with less. It can help developing countries like India in strengthening the healthcare delivery and to confirm that health is available and accessible to every citizen. This result can be achieved by developing support, infrastructure and human capital, a constraint in India, where technology transfer policies and mechanisms in the pharmaceutical industry are weak and must be restructured. Hence, more efficient technology transfer is necessary for the development, competitiveness and success of the Indian pharmaceutical industry (Agarwal *et al.*, 2007).

Regarding the policy background, large-scale deregulation in the 1990s and amendments to the Indian Patent Act (1970) have provided an initial contribution to the current ecosystem, which received a new impetus with the introduction of the patent law in 2005 (Zambad and Londhe, 2014). However, as previously mentioned, the sector is experiencing unprecedented change after it authorised the WTO's agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPs), laying the foundation and setting the minimum standards for protection and enforcement of intellectual property rights (IPR). The WTO's TRIPs agreement is intended to complement IPRs and patent protection around the globe. In India, this agreement has stimulated a sharp increase in clinical trials since 2005 (Sariola *et al.*, 2015).

An analysis of the influence of TRIPs and regional trade agreements (RTAs) on Indian pharmaceutical exports revealed that TRIPs negatively affect exports, whereas they were positively affected by RTAs (Loitongbam, 2016). An in-depth study of pharmaceutical patents granted in India and at the United States Patent and Trademark Office (USPTO) revealed that the situation has become challenging for Indian companies under the product-patent regime, despite the gradual increase in the number of applications and grant of patents. However, the number of firms filing applications is smaller in comparison to the total number of pharmaceutical corporations (Rau *et al.*, 2012).

2.3 Intellectual property in the Indian pharmaceutical sector

Vasa *et al.* (2014) acknowledged that the Indian pharmaceutical industry started developing from the 1960s, growing as a small player until the 1970s. Today, it has emerged as a large industry, and healthcare product suppliers satisfy around 95% of the pharmaceutical needs of the country.

The demand for pharmaceutical products in India is driven by changing demographics, lifestyle-related diseases, increased income of the middle class, government policies, better healthcare infrastructure, aggressive market penetration and adoption of product patents. The Indian pharmaceutical industry has adopted world-class manufacturing techniques to become globally sustainable and competitive, improving quality, decreasing costs, enhancing research capabilities and providing high export potential for Indian medicines.

Nevertheless, as previously mentioned, the sector is facing numerous challenges, the most relevant being connected to patent issues. In the pharmaceutical industry, sustaining market share to ensure profitability primarily requires the firm's ability to obtain patents. Such activity involves considerable investments in R&D and knowledge-building. This reasoning is fundamental from an IC perspective, considering patents, which are IP, as "proxy" parameters for IC capital to enhance the exportation of Indian drugs at higher prices, profitability and financial structure stability.

However, existing policies are not pinpointed towards incentivising patent filings. Other governmental strategies, such as those in China, may guide the Indian government to boost patent filing (Chaudhuri *et al.*, 2019). Some support measures have been implemented in India: pharmaceutical clusters have been promoted with incentives, exemptions and tax-related benefits (Abbott, 2017).

The industry is transforming, aiming at major credibility at the national and international levels because the government is innovating the IP regime. Considering the impact that innovative capabilities could have on the market, policy deliberations can support the development of the sector. Prakash *et al.* (2018) suggested that most patent applications are pharmaceutical, but their clinical conversion in India is lower.

Currently, the Indian pharmaceutical market is still dominated by generic products, and innovation through patent-based business models has a smaller share in its expansion. This is mostly due to split work in each field, lack of a multidisciplinary approach in preclinical and clinical work, insufficient financial support, eclectic interests of the involved sectors and lack of efficient training of employees. Furthermore, there are issues in the product-patent environment. Thus, it is essential to enhance the IPR system in India.

2.4 Financial problems of Indian pharmaceutical companies

Accounting ratios are used extensively in the assessment of financial health and distress of organisations. Beaver (1966) highlighted that cash flow/total debt ratio is a significant predictor of business failure. Altman (1968) adopted a multiple discriminant analysis (MDA) for predicting organisations' bankruptcy and formulated the *Z*-score. Altman's five ratios have outperformed Beaver's cash flow/total debt ratio, and bankruptcy can be predicted even two years before actual failure.

Ohlson (1980) elaborated a model with nine ratios to assess the failure probability, and Fulmer adopted MDA with 40 financial ratios (Fulmer *et al.*, 1984). Nevertheless, Altman (2000) discussed his preliminary research and deliberated the "revised" *Z*-score. He later proposed reliable scores for non-manufacturing industries and emerging markets (Altman, 2002 and 2005).

In contrast to the abovementioned calculations, Piotroski (2000) implemented a fundamental accounting analysis. Calculating his *F*-score, investors can use relevant accounting information to avoid firms with poor financial prospects.

Using a joint application of these formulas, Kolte *et al.* (2018) assessed financial health and predicted the financial distress of a corporation using the *Z*-score to analyse creditworthiness, and the *F*-score to evaluate the strength of financial statements. Similarly, using the *Z*-, *F*- and *M*-scores (Beneish, 1999), Rossi *et al.* (2019) analysed the financial structure of another corporation to determine its financial turbulence and predict its risk of bankruptcy. Analysis revealed that financial instability acts as a bankruptcy predictor (*Z*- and *F*-score), while manipulation of potential earnings reveals financial malpractice in governance and management (*M*-score).

Profitability of companies in the pharmaceutical sector generally has a positive association with the intensity of exports, size of M&A and patent regime. However, there seems to be a negative impact of leverage ratios and operating expenditure on profitability, highlighting the need for efficient financial management (Tyagi and Nauriyal, 2016).

Concerning the Indian pharmaceutical sector, an increase in working capital improves financial performance (Vijayalakshmi and Srividya, 2015), but to maximise the enterprise value, there is need for higher R&D investments, production of cost-effective drugs or both, and these aspects are influenced by the firms' financial structure. Thus, an adequate current ratio should have a positive influence on R&D investments, while an excessive debt/equity ratio should have a negative influence; naturally, the financial instability of pharmaceuticals should have a negative influence on R&D investments (Lee and Choi, 2015).

Dave (2012) examined the relationship between financial management and profitability, finding that these corporations usually do not consider capital structure, inventory turnover and debts as critical variables influencing profitability. They give higher importance to credits and total assets to influence profitability.

The DuPont analysis uses net profit margin, total asset turnover and equity multipliers to evaluate financial standing. For example, with specific reference to Indian pharmaceutical companies, from the DuPont analysis, the financial performance of Cipla is high, followed by Dr Reddy and Ranbaxy (Sheela and Karthikeyan, 2012).

Malik and Kanwal (2018) examined the impact of corporate social responsibility (CSR) disclosure on the financial performance of selected pharmaceutical firms and found that most disclose the information concerning community involvement. There is a positive association between CSR and financial performance, with a mediating role of pharmaceutical company brand equity. This suggests a powerful influence of IC (relational/social capital in this case) on financial volatility, whose reduction, in more general research (Coluccia *et al.*, 2017), is associated with an increasing level of voluntary disclosure.

Finally, Panigrahi and Joshi (2019) found that there has recently been continuous research on financing and investing activities in India, highlighting different strategic choices about the combination of debt and equity to meet the financial requirements for long-term benefits. In this respect, decisions about the capital structure of selected Indian pharmaceutical companies have a lower effect on the investment pattern because they usually use long-term funds to finance both current assets and operational activities.

2.5 IC in the pharmaceutical industry

Intangible resources are considered strategic assets due to their impact on firm value and profitability (Nuryaman, 2015). They are traditionally divided into human, structural and relational capital (Kamukama *et al.*, 2010). Some studies also consider social capital (Asiaei and Jusoh, 2015), although there are numerous possible interpretations (Pedro *et al.*, 2018). Other approaches consider only human and structural capital, as in the case of value-added intellectual capital (VAIC), which is a method to evaluate the impact of IC using various business variables (Pulic, 2000; Campanella *et al.*, 2014).

With an Indian focus, Kamath (2015) analysed the relationship of the fundamental components of IC on one side, with profitability, productivity and market valuation on the

other. Profitability, productivity and market valuation are generally influenced by the overall IC efficiency (Kweh *et al.*, 2014; Cabrilo and Dahms, 2018), whereas human capital has a broader impact on profitability. In a different cultural context, and quite surprisingly, Khalique *et al.* (2015) found an insignificant impact of human capital on organisational performance.

Concerning the pharmaceutical sector, IC is significant (Boekestein, 2006; Mehralian *et al.*, 2012; Chowdhury *et al.*, 2019). Martin *et al.* (2018) argued that regulatory oversight can disturb the product-market environment of the company. The political management capital (PMC) of a pharmaceutical company would describe the firm's expenditure in research and communication to legally and correctly address the political and regulatory context for favourable market access.

IC creates value and sustains competitive advantage (Youndt *et al.*, 2004). Its benefits are generated by intangibles, which may not always be reflected in annual reports, but support financial structure and flow in practice. For pharmaceutical firms, IC efficiency has a significant impact on financial robustness or vulnerability (Aslam and Amin, 2015).

Ala (2013) measured the varieties of vulnerability that pharmaceutical firms could encounter as a result of WTO's TRIPs agreement. In the pharmaceutical sector, the highest level of vulnerability occurs in R&D. Using a cluster analysis, 79.80% of the sample firms in this study showed below-average levels of innovativeness.

It has also been argued that the TRIP transition period (2005–2015) had not been efficiently used by all adhering countries, such as Bangladesh, due to unfocused government policy for pharmaceutical development. From an economic viewpoint, the two countries are tightly linked, patent contrivance seems to be less significant and India has a lower rejection rate for secondary patent applications. The restriction of secondary patents has been more successful in other adhering countries, such as Brazil, with a limited regulatory role, highlighting higher shares of not-granted patents. In general, the effects of drug patents on innovation incentives in developing countries are more difficult to realise (Sampat and Shadlen, 2016).

Abhayawansa and Azim (2014) provided insights on IC reporting practices in the pharmaceutical sector in Bangladesh. The authors examined qualitative characteristics and emphasised implications in corporate value creation and commitment to public communication. IC admission depends on stakeholders' relationships, management intentions and legitimacy of the firms. However, there is no consistent framework for pharmaceutical companies in Bangladesh to adopt IC reporting practices. Only those companies with higher levels of IC are more likely to place higher importance on more contemporary management accounting approaches (Toorchi *et al.*, 2015).

A possible indirect explanation for the IC influence relies on the value of growth along with the differences between the market and book value, putting more emphasis on the powerful connection between IC and knowledge management (KM), mostly in current and future knowledge-based economies (Wiig, 1997). As summarised by Boujelbene and Affes (2013), human capital involves specialised skills, domain knowledge, experience and innovativeness of employees (Madsen *et al.*, 2002; Papa *et al.*, 2018), in all the possible forms (Rodriguez Perez and Ordóñez de Pablos, 2003), whereas structural capital entails firm frameworks and processes to become more innovative, productive and effective, all factors that have a significant impact on the pharmaceutical sector.

Regarding the Indian pharmaceutical sector, although the importance and the growing deployment of the IC are higher in the national industry, studies on its impact on financial aspects are still not significant, being more focused on technological or organisational profiles, thus providing reasons for the current research.

For example, Sharma and Dharni (2017) analysed the relationships of IC disclosure, which included human, structural and relational capital (Calza *et al.*, 2014), whereas organisational

performance includes sales volume, intensity of research, intensity of exports and net profits. Capital disclosure has shown significant variations for Indian pharmaceutical companies, realising a positive relationship between IC disclosures and organisational performance. Nevertheless, IC disclosure increases with the size of the organisations.

Smriti and Das (2017) highlighted IC as strategy for sustainable competitive advantage. Appropriate training, superior incentives and excellent benefits must be provided to the workforce to empower the human capital of Indian pharmaceutical companies. Structural capital stimulates market value and productivity, highlighting the strong value of IC, particularly as technological knowledge (Murray *et al.*, 2016).

Finally, regarding the financial performance of the sector, Kamath (2008) investigated the impact of IC on corporate results, confirming that firm value is generated not only by physical and financial assets but also by intellectual assets. Ghosh and Mondal (2009) found that for Indian pharmaceutical companies, IC has an impact on corporate performance (specifically, profitability), finding effects on productivity, market valuation, financial performance and stability.

3. Research objectives and methodology

To explore the potential influence of IC on the financial structure and stability of the Indian pharmaceutical sector, this study formulates the following research questions (RQs).

RQ1. Are the top five Indian pharmaceutical companies characterised by financial instability?

RQ2. How can IC, with particular reference to IP issues, support the financial structure of the Indian pharmaceutical industry?

This study analysed the top five companies in the field: Sun Pharma, Cipla, Lupin, Dr Reddy and Aurobindo. These were selected on the basis of the available "Net Sales as per the latest Profit and Loss Account" (MoneyControl.com, 2020) to determine the most relevant issues about the possible impact of IC. The primary area of interest is patent issues as IP (the most suitable proxy aspect, in the current and future Indian scenario, potentially concerning human and structural capital), and secondary interests are regulations, sector structure, drug price control and sector innovation, fake drugs and clinical trials (as contextual situations potentially concerning relational capital).

To understand the financial health of the selected companies, a ratio analysis was implemented. To predict the potential of bankruptcy, the *Z*-scores were determined. The *F*-score was calculated to assess the strength of the financial statements from an investment perspective. These operations provided a response to RQ1. Subsequently, specific considerations have been captured for exploring potential IC contributions to the financial stability of Indian pharmaceutical companies, thus providing a response to RQ2.

To integrate theoretical requirements and data analysis, secondary sources have been used, with no control over the variables. This methodology is therefore most suitable for fundamental analysis. Data were collected from annual reports, ValueResearch.com, MoneyControl.com and Stock Exchange databases (NseIndia.com).

4. Analysis methods

Firms' financial statements were investigated to assess different indicators of revenues, expenses, earnings, assets and liabilities. Several ratios were analysed to forecast the company's performance over financial years, highlighting financial capability to overcome short-/long-term debts and generate profit.

Ratios analysis was used as the primary tool. To evaluate the company's performance, various accounting figures were considered to determine ratios to study and compare with competitors to evaluate the company's performance.

(1) The "general" *Z*-score.

As previously mentioned, Altman (1968) generated the following discriminant function:

$$Z = 0.012Z_1 + 0.014Z_2 + 0.033Z_3 + 0.006Z_4 + 0.999Z_5$$

where

Z_1 = net current assets/total assets,
Z_2 = reserves/total assets,
Z_3 = (profit before tax + interest) / total assets,
Z_4 = market capitalisation/total liabilities and
Z_5 = revenues/total assets.

Altman (2000) later derived a more popular model:

$$Z = 1.2Z_1 + 1.4Z_2 + 3.3Z_3 + 0.6Z_4 + 1.0Z_5$$

Scores to assess corporate bankruptcy and cut-off scores are the same. If the *Z*-score is < 1.81, the company is likely to go bankrupt. If the *Z*-score is between 1.81 and 2.99, the company is in a grey zone, whereas companies with a *Z*-score above 2.99 are considered stable. New models were developed for non-manufacturing industries and emerging markets (Altman, 2002, 2005).

(2) *Z*-score for non-manufacturing industries.

$$Z = 6.56Z_1 + 3.26Z_2 + 6.72Z_3 + 1.05Z_4$$

where Z_4 was revised as (net worth/total liabilities). In a further revised model, a constant quantity of +3.25 was added to calculate the *Z*-score for rising economies.

(3) *Z*-score for emerging markets.

$$Z = 3.25 + 6.56Z_1 + 3.26Z_2 + 6.72Z_3 + 1.05Z_4$$

For non-manufacturing industries and emerging markets, if the *Z*-score is < 1.1, the company is likely to go bankrupt. If the *Z*-score is between 1.1 and 2.6, the company is in a grey zone, whereas companies with *Z*-scores above 2.6 are considered stable.

(4) The *F*-score.

Piotroski (2000) proposed a prediction model to judge if a company has a sound mix of financials and opportunities for attracting investments. The *F*-score ranges from 0 to 9, where a low score denotes a risky investment, and vice versa. The *F*-score has been developed for assessing the financial strength of companies from an investment perspective, as shown below.

$$F\_\text{SCORE} = F\_\text{ROA} + F\_\Delta\text{ROA} + F\_\text{OCF} + F\_\text{ACCRUAL} + F\_\Delta\text{MARGIN} + F\_\Delta\text{TURN} + F\_\Delta\text{LEVER} + F\_\Delta\text{LIQUID} + F\_\Delta\text{EQ}.$$

where

F_ROA = EBIT (earnings before interests and taxes)/total assets (1 if positive, otherwise 0),
F_ΔROA = ROA variation (1 if greater than the previous period, otherwise 0),
F_OCF = operating cash flow (1 if positive, otherwise 0),

*F*_ACCRUAL = OCF/total assets (1 if > ROA, otherwise 0).
*F*_ΔMARGIN = gross margin (1 if greater than the previous period, otherwise 0).
*F*_ΔTURN = asset turnover ratio (1 if greater than the previous period, otherwise 0).
*F*_ΔLEVER = debt-equity ratio (1 if lower than the previous period, otherwise 0).
*F*_ΔLIQUID = current ratio (1 if greater than the previous period, otherwise 0) and
*F*_ΔEQ = additional shares issued in the previous period (1 if no, otherwise 0).

The summation measures the *F*-score. If the business scores 7–9, it indicates a sound potential investment, while if it scores 0–2 or even <3, it indicates shaky financial conditions and may not be a good investment opportunity (Piotroski, 2000).

5. Results analysis and findings discussion

As previously mentioned, this study investigated the top five Indian pharmaceutical companies (Sun Pharma, Cipla, Lupin, Dr Reddy and Aurobindo) as per the "Net Sales as per the latest Profit and Loss Account available" (MoneyControl.com, 2020), selected using a judgement-based sampling. The decision about the number to analyse is due, first, to the vastness of the universe (around 3,000 drug companies and 10,500 manufacturing units in 2019 according to India-Briefing.com) and, second, the tendency towards normal distribution that can be associated with five elements (George, 2005; Barile and Metallo, 2002).

5.1 Ratio analysis

The investigation involved operating and profitability ratios. Tables 1 and 2 provide the related calculations.

In addition, Lupin shows the highest current ratio; Cipla, Dr Reddy and Aurobindo show higher short-term solvency. A company with an acid test or quick ratio ≥1 can immediately pay off its short-term liabilities. Cipla, Lupin, Dr Reddy and Aurobindo have higher solvency,

Operating ratios	March 2018	March 2017	March 2016	March 2015	March 2014
Debt-equity ratio					
Sun Pharma	0.34	0.23	0.26	0.24	0.33
Cipla	0.01	0.03	0.09	0.12	0.09
Lupin	–	0.04	0.03	–	0.02
Dr Reddy	0.22	0.20	0.27	0.29	0.29
Aurobindo	0.37	0.34	0.55	0.54	0.70
Interest coverage ratio					
Sun Pharma	4.17	0.92	−0.88	−1.83	5.05
Cipla	168.14	31.28	12.86	12.32	15.22
Lupin	54.97	143.05	160.44	656.45	150.55
Dr Reddy	12.10	28.00	31.34	33.29	32.35
Aurobindo	45.30	49.24	10.47	15.68	6.26
Asset turnover ratio					
Sun Pharma	0.30	0.29	0.28	0.42	0.32
Cipla	0.83	0.82	0.95	0.86	0.90
Lupin	0.65	0.91	1.05	1.21	1.43
Dr Reddy	0.66	0.68	0.72	0.78	0.91
Aurobindo	0.82	0.88	0.97	1.07	–

Source(s): Calculations on data from MoneyControl.com and corporate websites

Table 1. Operating ratios of top five Indian pharmaceutical companies (2014–2018)

Profitability ratios	March 2018	March 2017	March 2016	March 2015	March 2014
Return on assets					
Sun Pharma	82.40	87.58	89.27	109.78	35.77
Cipla	175.30	159.11	149.19	138.12	125.69
Lupin	349.16	327.30	264.39	200.84	155.65
Dr Reddy	710.70	699.92	680.24	624.13	548.41
Aurobindo	170.38	143.99	117.33	183.56	–
Return on net worth					
Sun Pharma	−2.50	−0.10	−4.99	−6.18	−38.99
Cipla	10.40	7.61	12.20	10.65	13.72
Lupin	8.51	21.25	23.76	26.55	33.30
Dr Reddy	4.80	11.93	11.67	15.79	20.71
Aurobindo	18.15	20.23	20.69	28.29	–
Earnings per share					
Sun Pharma	33.03	32.03	31.64	38.71	13.66
Cipla	141.47	133.87	150.83	126.18	116.83
Lupin	46.14	99.34	88.49	75.05	64.95
Dr Reddy	564.12	586.44	598.31	587.56	571.87
Aurobindo	45.57	40.52	41.90	77.07	–
Net profit margin					
Sun Pharma	−6.24	−0.29	−14.09	−18.38	−99.99
Cipla	12.89	9.05	12.06	11.65	14.80
Lupin	13.33	24.87	25.23	24.58	25.99
Dr Reddy	6.05	14.24	13.26	16.77	19.86
Aurobindo	17.65	17.76	17.74	18.73	–

Source(s): Calculations on data from MoneyControl.com and corporate websites

Table 2. Profitability ratios of top five Indian pharmaceutical companies

while Sun Pharma has consistently been showing an acid test or quick ratio less than 1 over the past few years.

Regarding the debt-equity ratio, firms should be generating sufficient liquidity to serve their debt; the highest value was obtained from Aurobindo.

Sun Pharma showed continuous growth in EBIT, which means its economic situation has improved. Aurobindo's EBIT is consistent, while Cipla and Lupin showed a drop in EBIT in the past. The EBIT-to-interest ratio measures the going-concern safety margin. Generally, if it is < 1, the business does not produce enough revenue to serve interest payments. Regarding the interest coverage ratio, all the companies are in good health, although there are some concerns about Sun Pharma.

The asset turnover ratio shows that the operating activity is doing well. For Sun Pharma, it is consistently the lowest, indicating that the company has not been performing at the same levels as the other competitors. Cipla and Aurobindo show high values, suggesting that they are performing better than their competitors. For Lupin and Dr Reddy, the ratio has decreased over the years.

Dr Reddy shows the highest return on assets, while Sun Pharma shows the lowest.

A high return on net worth shows the efficient use of shareholders' money on average. Aurobindo shows consistently high values, while figures for Lupin and Dr Reddy have fallen significantly in recent years; there may be some doubts regarding Sun Pharma.

The earnings per share for Dr Reddy is the highest and its share price is high, while Sun Pharma's earnings per share are the lowest.

A sound net profit ratio indicates that the company is pricing its products accurately. Empirically, a net profit ratio above 10% is considered over-the-average (CorporateFinanceInstitute.com). From Table 2, all the firms except Sun Pharma show over-the-average values, with some concerns about Dr Reddy in 2018, while Aurobindo shows the highest value in 2018.

5.2 Z-score analysis

The likelihood of bankruptcy is evaluated in Table 3, using the *Z*-score based on the revised formula, in Table 4, using the *Z*-score for emerging markets and in Table 5, using the *Z*-score for non-manufacturing industries (assuming the hypothesis that, from an IC perspective, the weight of R&D outcomes for pharmaceutical companies that are exposed to innovation-based competition could be more relevant than the production outputs).

As previously mentioned, a company with a *Z*-score >2.99 is not expected to face financial instability (potentially bankruptcy), whereas a company with a lower *Z*-score may face financial instability (potentially bankruptcy). All the companies under analysis show stable positions. Some issues may occur in some specific years during the period, but further integrated analysis reveals global stability. Hence, the response to RQ1 ("Are the top five

	Z-score (revised formula)					
Company name	March 2019	March 2018	March 2017	March 2016	March 2015	March 2014
Sun Pharma	2.89	2.77	3.77	4.25	4.69	4.93
Cipla	3.39	3.32	3.41	2.93	4.10	3.60
Lupin	2.56	2.51	3.60	3.88	7.30	5.88
Dr Reddy	3.42	2.75	2.96	3.95	4.35	4.08
Aurobindo	3.11	3.22	4.02	3.96	3.95	3.16

Source(s): Calculations on data from ValueResearch.com

Table 3. Revised formula (with respect to the 1968 version)

	Z-score (emerging markets)					
Company name	March 2019	March 2018	March 2017	March 2016	March 2015	March 2014
Sun Pharma	7.85	7.42	8.48	8.65	8.18	9.90
Cipla	8.97	8.47	7.95	6.52	8.02	8.46
Lupin	7.63	7.45	7.84	7.82	9.97	10.30
Dr Reddy	8.16	7.14	6.55	8.62	8.41	8.39
Aurobindo	7.21	7.81	8.08	7.49	7.27	7.22

Source(s): Calculations on data from ValueResearch.com

Table 4. *Z*-score for emerging markets

	Z-score (non-manufacturing industries)					
Company name	March 2019	March 2018	March 2017	March 2016	March 2015	March 2014
Sun Pharma	4.60	4.17	5.23	5.40	4.93	6.65
Cipla	5.72	5.22	4.70	3.27	4.77	5.21
Lupin	4.38	4.20	4.59	4.57	6.72	7.05
Dr Reddy	4.91	3.89	3.30	5.37	5.16	5.14
Aurobindo	3.96	4.56	4.83	4.24	4.02	3.97

Source(s): Calculations on data from ValueResearch.com

Table 5. *Z*-score for non-manufacturing industries

Indian pharmaceutical companies characterised by financial instability?") is "No" for all companies.

5.3 The F-score analysis

A company with an *F*-score of approximately 7 can be judged to have higher financial strength from an investment perspective, whereas if the score is 0–2, the investment proposal would not be attractive. From the calculations in Table 6, financial strength in 2018–2019 is good for Sun Pharma, Cipla and Dr Reddy and sufficient for Lupin and Aurobindo; however, Cipla and Lupin showed some stress in the past, which generally improved in the following years.

From an investment perspective, the selected companies show substantial financial stability. Thus, although some concerns were identified in the past, the response to RQ1 ("Are the top five Indian pharmaceutical companies characterised by financial instability?") is "No" when calculating the *F*-score.

5.4 Calculation notes

The analysis is mainly based on consolidated financial statements, although specific investigations of standalone financial statements have been necessary, and financial years are considered as ending on 31 March. Revenues or sales have been considered as operating revenues, while total assets were taken from ValueResearch.com.

In place of retained earnings, this study considered accumulated reserves and surpluses when dividends to be paid were not provided. While calculating the *F*_ΔMargin, the operating profit is considered, and *F*_ROA is calculated as EBIT, but after adjusting extraordinary items.

The models in question are based on the US-GAAPs (generally accepted accounting principles), whereas the data under analysis are calculated as per IFRS/IndAS (International Financial Reporting Standards/Indian Accounting Standards). Hence, different treatments of accounting items in calculations may lead to slightly different results.

6. Challenges regarding IC in the Indian pharmaceutical industry

Currently, the global pharmaceutical sector has been facing various issues on different fronts, especially since the Covid-19 pandemic in 2020. As growth in developed countries is expected to slow, emerging economies have many potential opportunities: BRIC countries (Brazil, Russia, India and China) are expected to develop their pharmaceutical markets further in the future.

In terms of quantities, India is the third largest producer and supplier of pharmaceuticals in the world (InvestIndia.com, 2020; EuropeanPharmaceuticalReview.com, 2020). Recently, the market has seen the entry of several foreign players as well as the rise of domestic manufacturers. In 2014, the Indian government gave a boost to the government initiative

Table 6.
F-score for top five Indian pharmaceutical companies

	F-score					
Company name	March 2019	March 2018	March 2017	March 2016	March 2015	March 2014
Sun Pharma	7	4	6	4	6	4
Cipla	6	6	5	3	3	5
Lupin	4	5	5	1	5	7
Dr Reddy	7	5	5	5	4	7
Aurobindo	4	5	4	5	4	6

Source(s): Calculations on data from ValueResearch.com, MoneyControl.com and company annual reports

"Make in India", while Indian pharmaceutical companies are increasing capacity, ability and potentiality, thanks to major competences regarding IC. The most relevant issues relating to this provide a response to RQ2: "How can IC, with particular reference to IP issues, support the financial structure of the Indian pharmaceutical industry?"

Regulations. Pharmaceutical approvals are critical in general, especially those from the United States FDA, because the USA is the largest purchaser of pharmaceutical items, and India is a significant exporter (Iipta.com, 2015; CooperPharma, 2018). In this respect, assuming that IC is a synergic system of human, structural and relational capital, Indian pharmaceutical companies' relational capital is essential, more specifically in the form of social (e.g. reputation) or even PMC.

Sector structure. The Indian pharmaceutical industry is hugely fragmented, and the market is overburdened by non-exclusive producers. There are many small-dimension producers, and the usage of modern technology is limited, affecting production quantity and quality and causing reason for concern, since high discontinuity causes fragility, instability and vulnerability. This is unquestionably a serious issue for the sector. Companies need to assemble better organisations and associations to improve operational capacity and deftness (Iipta.com, 2015; CooperPharma, 2018). In this respect, structural capital and relational capital are vital.

Drug price control and sector innovation. For most Indian pharmaceutical firms, profits are too low due to price control and financial benefits are not adequate. Severe governmental rules about fundamental prescriptions have forced them to bring down prices. Profit margins are therefore limited, directly affecting further production of drugs, and, most importantly, R&D, which is highly costly. As a direct consequence, research is scarce, generating poor innovation, especially regarding patents. The Indian government actively supports its pharmaceutical firms, for example, through subsidies (Iipta.com, 2015). In this respect, relational capital (with the government) and structural capital (e.g. regarding R&D) are essential.

Fake drugs. According to the World Health Organization (WHO), around 30% of the drugs sold globally are fake, and these drugs can have significant ramifications for patients. Fake drugs generate quick profits, as they cost less than the genuine item. Unfortunately, fake drugs account for 25% of the market in India (EconomicTimes.IndiaTimes.com, 2019), damaging those Indian companies that act legally; the fake drugs market is dominant in underdeveloped and developing countries. Considering the significant concerns expressed by manufactures and exporters of Indian pharmaceuticals, the WHO and the Indian government have set up specific activities to tackle fake drugs. In this respect, relational or social capital is crucial, especially that concerning the image of the Indian pharmaceutical industry abroad.

Clinical trials. India is a perfect location to perform clinical trials. Given the vast population, there is a large pool of patients and a great number of skilled workforces, as there are specific programmes for revitalising national education and skill development systems from a knowledge economy perspective (Carrillo and Batra, 2009). This has resulted in large numbers of trials being conducted (CooperPharma, 2018). In this respect, (Indian) human capital and (foreign companies) structural capital can be decisive.

Patent concerns. In India, no patents were granted on medicines before 2005, and the generic drugs manufacturing industry therefore flourished. Sector growth helped in the treatment of diseases such as tuberculosis, HIV/AIDS and cancer, making India a target for larger foreign pharmaceutical companies because their business model is mainly based on patent protection, which is essential for drug innovation. The Pfizer case was the key point at which the whole game changed. A judiciary verdict allowed the US pharmaceutical company, probably the largest in the world, to produce a patented vaccine until 2026, consenting to distribute it in India and blocking other manufacturing of such drugs. Currently, a huge number of generic drugs and vaccines are patented in India, prohibiting other manufacturers

from producing them during the patent period, and increasing drug prices, which are becoming unaffordable for the population. Patents are becoming a pattern, and every company, domestic or foreign, wants to adopt this business model. However, considering the economic conditions of the Indian population as whole, Indian pharmaceutical companies should work together in pursuing this purpose, interacting with the government (EconomicTimes.IndiaTimes.com; Ibef.org, 2018; CooperPharma.com). In this respect, relational and social capital and, more specifically, PMC are critical.

The future of Indian pharmaceutical companies regarding IC. The industry is under threat of financial encumbrance due to higher market competition, rising costs and lack of innovation. IC can be a strategic resource for attaining sustainable competitive advantage, providing a positive impact on firm profitability and value, with particular reference to patents. IP is created inside and/or outside enterprises and is based on the organisation's expertise, as a result of the virtuous combination of human and structural capital. It is unique and cannot be replicated by others, creating a competitive advantage in the industry. Assets relating to IC and IP are particularly intangible, but they have a powerful impact on economic/financial performance. The value of the knowledge assets arises in product quality, innovation and marketability. In the context of the Indian pharmaceutical sector, many changes occur in the patent system; however, as previously mentioned, funding for R&D is still minimal, and patents have an inferior grant rate. Thus, there is a need for innovation policies for the growth, development and sustainability of the industry, with the aim of involving critical decision-makers at both institutional and corporate levels (Del Giudice *et al.*, 2017), with governmental policies playing a primary role in reaping the benefits of WTO's TRIPs agreement. In this respect, the appropriate use of structural and relational capital is essential.

7. Research limitations and future directions

The study is based on the theoretical assumption that IC improvement is fundamental for reinforcing companies exposed to knowledge-based competition, such as in the pharmaceutical sector. This study used only secondary data, without investigating managers or decision-makers in the Indian pharmaceutical industry. Subsequent field investigations could provide a better understanding of strategic and operational choices in the sector.

The analysis has focused only on India because it is one of the largest pharmaceutical economies in the world (although so far concentrated on generic drugs); it represents an emerging economy (although nowadays, even more than emerging), and there have been recent investments in innovations in the national patent system. Further research on other large pharmaceutical economies, particularly if emerging, could provide significant robustness to the current results.

The investigation focused only on the top five Indian pharmaceutical companies, which are probably more forward-looking and more robust in terms of resources in general, and capital (financial, intellectual and so on) in particular. Additional analyses expanding the scope of the investigation could better examine various behaviours of Indian pharmaceutical entrepreneurs.

Finally, choosing a specific model for IC appreciation would allow a detailed analysis of its potential contribution to Indian pharmaceutical companies' performance, specifically to its influence on financial stability. This limitation of the current research is due to the explorative nature of the study, particularly considering the substantial novelty, emerging from the literature review, of the relationship between IC and financial structure in the Indian pharmaceutical sector.

8. Scientific and managerial implications

This study investigated the financial dynamics of the top five Indian pharmaceutical companies, emphasising the new approach in which the Indian government has adopted pharmaceutical patents and resulting IP. Although the analysed financial structures seem solid, upcoming challenges in terms of competition will force Indian companies to focus increasingly on IC.

From a scientific viewpoint, while "physiologically" divided into human, structural and relational capital, the strongest evidence regarding IC in the pharmaceutical industry is the knowledge stock deriving from patents in the R&D portfolio, as a proxy variable for a global perspective on pharmaceutical IC. These IPs are the result of the efficient interaction between human and structural capital, although some contribution from relational capital may arise (e.g. collective intelligence in R&D). In this specific context, IC may contribute to financial stability, primarily with patents, which must be carefully considered in an overall IC evaluation.

From a managerial viewpoint, future governance and management of Indian pharmaceutical companies will be increasingly attracted by R&D on innovative molecules, aiming at registering new patents and not relying only on traditional business models for generic drugs. At the same time, further concerns may arise about equality in access to medicines for the vast Indian population, with challenges for entrepreneurs and managers in terms of (contextual) CSR. In this specific context, IC contributes to financial stability, primarily with relational and social capital, which must be considered carefully in an overall analysis of the pharmaceutical market.

9. Conclusion

Indian pharmaceutical companies spend heavily on generic drugs to sustain and grow the value of their business. There are still few instances of M&A, while there seems to be some interest in innovative molecule patents, essential for competitiveness. Companies have been facing problems on various fronts, but there are abundant opportunities for catering to accelerating domestic demand and exports.

The analysis of the financial data of the top five pharmaceutical companies in India revealed the economic nature and performance of the selected companies over the period (2014–2018), highlighting its strengths and weaknesses. As per the bankruptcy prediction models, the values from the *Z*-scores suggest that all the selected companies are financially sound and do not face the risk of bankruptcy or credit default. This study derived the *F*-scores to assess their financial strength from an investment perspective. According to these calculations, from a global perspective, the top five Indian pharmaceutical companies are interesting investments.

The pricing in the Indian market is severely controlled by DPCO, demotivating pharmaceutical companies to invest in R&D. Thus, they traditionally concentrate on generic drug production, exporting these medicines on a large scale. However, opportunities emerging from appropriate investment in IC, mostly when considering patents as IP derived from human and structural capital (and even relational capital, considering R&D networks), represent a central issue and a daring challenge, as some evidence of investments in infrastructure, technology and R&D seem to highlight.

At the same time, India has a massive population with low per capita income. Stricter patent rules mean less access to medicines for a huge proportion of the population living in South Asia with scarce means (roughly every sixth person on Earth is Indian). Affordability of pharmaceutical products is a major challenge in South Asia, often raising the question of life or death.

Is profitability and wealth creation more important than the lives of the poor in South Asia? In truth, many patients die due to lack of costly medication, and new patent regimes should not cost human lives. This will simultaneously constitute the most relevant

opportunity and threat arising from IC governance and management in Indian pharmaceutical companies in the future.

Author's contribution

This paper is the result of the common reflection of all the authors. In the editing phase, the "Introduction", the "Research objectives and methodology" and the "Conclusion" sections were written by Giuseppe Festa. The "Institutional and scientific background" section, the "India in the global pharmaceutical sector" subsection, the "Issues and challenges in the Indian pharmaceutical industry" subsection and the "Results analysis and findings discussion" section (including all the subsections) were written by Ashutosh Kolte. The "Intellectual property in the Indian pharmaceutical sector", the "Financial problems of Indian pharmaceutical companies", the "IC in the pharmaceutical industry" subsections, the "Analysis methods" and the "Research limitations and future directions" sections were written by Matteo Rossi. The "Challenges regarding IC in the Indian pharmaceutical industry" and the "Scientific and managerial implications" sections were written by Luca Marinelli.

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