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Case Research

IloT and Machine Learning Technology - A case of Investment of TVS Motors Limited (India)

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Abstract: *Automobile sector in India is gearing for sharing mobility, electric, smart and connected vehicles. Indian two-wheeler makers are either acquiring or investing in electric, IloT and AI startups to compete in new scenario. This paper presents a brief overview of Indian two-wheeler industry and investment strategies of two-wheeler producer TVS Motors Private Limited in the context of emerging scenario and recent investments in startups. The paper analyses TVS's recent investments in electric vehicle, shared mobility (renting), IIOT and AI startups. It is concluded that TVS Motors is, in the first place, investing to be at the forefront of electric, smart, shared and connected vehicles market. The second reason is to overcome the limitation of internal innovation in new segments in terms of required time, needed knowledge and possibility of being the first mover in the new markets.*

Keywords: *Industrial Internet of Things (IIoT), Machine Learning, TagBox, TVS Motors, Scooters, Motor Cycles*

IloT i tehnologija mašinskog učenja – studija slučaja ulaganja TVS Motors Limited (Indija)

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Apstrakt: Automobilski sektor u Indiji priprema se za usluge deljenja mobilnosti, električna, pametna i konektovana vozila. Indijski proizvođači dvotočkaša ili nabavljaju ili ulažu u električne, IIoT i AI startapove kako bi se takmičili u novom scenariju. Ovaj rad obuhvata kratak pregled indijske industrije dvotočkaša i investicione strategije proizvođača dvotočkaša TVS Motors Private Limited u kontekstu novog scenarija i nedavnih ulaganja u startapove. U radu su analizirane nedavne investicije TVS-a u električna vozila, deljenu mobilnost (iznajmljivanje), IIOT i AI startapove. Zaključeno je da TVS Motors, na prvom mestu investira kako bi bio na čelu tržišta električnih, pametnih, deljenih i konektovanih vozila. Drugi razlog je prevazilaženje ograničenja internih inovacija u novim segmentima u pogledu potrebnog vremena, potrebnog znanja i mogućnosti da bude pokretač na novim tržištima.

Ključne reči: Industrijski internet stvari (IIoT), Mašinsko učenje, TagBox, TVS Motors, Skuteri, Motocikli

1. Introduction

TVS Motor, India is part of \$8.5 billion TVS Group. It is using its Singapore unit to invest in digital technology startups focused on the automotive and fintech industries (Joseph, 2019). Traditional automakers except Hero and Tata Motors have neither invested in building an Electric Vehicle (EV) manufacturing ecosystem nor in any fundamental research in EV technology. But to meet the government's 2030 (all-EV) goal, companies need to follow innovative ways to acquire expertise. The one way could be investment in startups, acquiring and merger of EV technology companies (Daswani, 2017). It is needed for the purpose of reduction of oil imports and carbon dioxide emissions. According to FICCI and Rocky Mountain Institute, India's shift to shared, electric and connected mobility could help it to save up to \$300 billion in oil imports and nearly one giga tons of carbon dioxide emissions by 2030 (Daswani, 2017). Navigant Research mentioned that global e-bike sales are expected to grow from \$15.7 Billion in 2016 to \$ 24.4 billion in less than a decade. These numbers suggest there is a need to reduce carbon dioxide emission and create new EV eco-system.

Kasser et al. (2018) reported that automotive industry has been talking about four disruptive and mutually reinforcing major trends. These are autonomous driving, connectivity, electrification, and shared mobility. These trends are expected to fuel growth and will lead to a changes from traditional to disruptive technologies based innovative business models. Artificial intelligence is a key technology for all four changes. Many automobile companies have adopted the route by investing AI and AI related startups to survive and grow in the presence

of four trends in coming years. Ranjan (2018) mentioned that automobiles are getting more connected and smart. Automakers have their task at hand to compete in future. To be competitive, automakers are investing in startups that innovate new technologies not only for assembly lines, but also in startups which are developing technologies for connectivity, autonomous driving, mobility etc. However, the major technologies are Artificial Intelligence and Internet of Things.

IBEF (2019) mentioned that India is gearing up for electric vehicles and reported that (i) Avan motors (<https://www.avanmotors.com/>), an electric scooter startup announced in December 2018 that it plans to have total sales of 100,000 units of its brands Xero, Xero+in, TrendE, in the next two to three years, (ii) China's leading Electric Vehicle (EV) company, Sunra, is planning to enter into Indian markets and set up a factory in Bengaluru, Karnataka, (iii) local arm of Finland based energy company Fortum India is planning to install about 720 charging facilities for electric vehicles by 2020 in seven cities in India, and (iv) EV motors (<http://www.ev-motors.com/>) in partnership with DLF, ABB India and Delta Electronics is also planning to invest US\$ 200 million to set up 6,500 electric vehicles (EV) charging stations in the next five years. They launched PlugNgo, first public electric vehicle charging outlet in Delhi in November 2018.

Indian automobile industry is striving to be smart and connected and it is embracing electric vehicles. In this context, research paper presents the strategies of TVS Motors of creating ecosystems to meet these challenges by either investing in digital startups or developing partnership with the startups. The paper is divided into six sections including introduction. It is followed by research methodology in section 2 and analysis of two companies from Indian two-wheeler industry in section 3. Select sales statistics of two producers of two-wheeler and motorcycle and scooter models is presented in section 4. Financial analysis of TVS Motors is discussed and analysed in section 5. Acquisition or investment in technology (IIOT, Artificial Intelligence (AI), and Electric vehicles) startups is analysed in section 6. The last section presents the possible answers to research propositions and questions.

2. Research Methology

2.1. Context of the Study

Researchers in the past highlighted the swift in technology innovation strategies of established corporations. The terms such as open innovation vs traditional internal innovation of big corporation have created interest among academics. Few of these are listed in the context of research objectives of this paper.

Chesbrough (2003) called present era as an era of open innovation and supported his statement by mentioning innovation strategies of large corporations like DuPont, IBM and AT&T which are competing by doing the most R&D in their respective industries v/s strategies of Cisco and Lucent. He reported that Cisco acquired needed technologies from the outside, usually by partnering or investing in promising startups (some, ironically, founded by ex-Lucent veterans).

Lee et al. (2010) suggested business model for open innovation for SMEs by creating value networks. They suggested different modes of collaboration for exploration (R&D) and exploitation (commercialization). Romulo de al (2015) mentioned that R&D center of a Chinese multinational subsidiary in Brazil is making innovation in partnership with other companies (startups), universities, and research institutions. It is adding more partners in its ecosystem to make open innovation a reality.

Prashantham (2017) discussed the lessons learned by Bayer and BMW partnering program with startups. He mentioned the Grants4Apps program of Bayer and Garage program of BMW. He named three lessons that ensure fitting with partnering goals, span boundaries externally and within, and make interface to the interface. Picken (2017) identified four stages of life cycle of an entrepreneurial venture. These are startup, transition, scaling and exit. He also identified eight hurdles of the transition stage. These are setting a direction and maintaining focus, positioning products/services in an expanded market, maintaining customer/market responsiveness, building organizational and management team, developing effective processes and infrastructure, building financial capabilities, developing appropriate culture, and managing risk and vulnerabilities. Cooperation with big companies will help startups to overcome many hurdles.

Prashantham and kumar (2019) built perspective of MNCs partnering with startups based on the notion of "division of entrepreneurial labour" of Buckley and Prashantham (2016). They analysed three dimensions of partnering, i.e., capability, connectivity, and contextuality. Hyoungh et al. (2019) advocated that absorbing innovation through cooperation strategies can complement internal research and development for new technology development. They emphasized that startups are good candidates for successful cooperation for innovations, but their technology positions are difficult to assess. Riepe and Kristina (2019) analysed the startups' demand for non-financial resources from their corporate venture capitalists. They concluded that it is hard to detect and quantify demand for non-financial resources based on public data. However, it

depends on specific characteristics of the startups. Not much is reported in the literature about innovation strategies of automakers in India.

Very recently, a significant number of experts from automotive sector, as well as news releases of corporations from this sector and reports of marketing and research agencies in digital media, reported the shift towards investment made by automakers in disruptive technologies in India. However, foray of the automotive industry in new disruptive technologies had received little attention in information technology research related to Indian automaker's market. This fact suggests that more attention in information systems/ information technology research in the automotive industry is needed, with specific reference to disruptive technologies. As the Indian automotive industry is one of the largest industries and has taken initiatives in investing in disruptive technologies, authors decided to conduct research on the subject by connecting data from different sources.

2.2. Research Approach

Research approach of the present study can be termed as exploratory cum descriptive. It is based on primary, as well secondary data. The secondary data was collected and collated from different Internet sources - websites of Altizon Systems Pvt. Ltd., TagBox, TVS Motors and their competitors, market research companies, investors websites, public domain data aggregators, etc. Two methods of secondary data analysis are used in this article. These are trend analysis and content analysis. The trend analysis is done for quantitative data with respect to financial performance data, sales data and manufacturing data. Content analysis of data is carried out to draw inferences about different investment deals and to support the following propositions with respect to TVS motors investments. The propositions are evaluated on 1 to 10-point scale where "1" means proposition is not true with respect to investment by TVS Motors in startups and "10" means absolutely true about investment or acquisition of startups by TVS Motors.

Proposition / Research Question 1: TVS motors Limited is investing in startups to expand its global footprint.

Proposition/ Research Question 2: TVS Motors Limited is following mix model of growth (Organic + Inorganic).

Proposition/ Research Question 3: TVS Motors Pvt. Ltd is investing in startups to innovate and develop new product which is not possible internally with existing know-how.

Proposition/ Research Question 4: TVS Motors Pvt. Ltd is investing in startups to improve existing products & services.

Proposition/ Research Question 5: TVS Motors Pvt. Ltd is investing in startups to compete in EV segment.

The last three propositions are very similar to open innovation models suggested by Lee et al (2010) and Chesbrough (2003). Primary data was collected in the form of personal discussion with employees of two vehicle producers in Natinal Capital Region, New Delhi. The discussion was centered around application of disruptive technologies and growth of production of electric vehicles which need additional infrastructure and energy.

3. Two-wheeler Industry in India

The two-wheeler industry in India is divided into four segments. These are (i) scooter (engine size varies from 50 CC to 250CC), (ii) mopeds (a light motor cycle with an engine capacity of not more than 50 CC), (iii) motorcycles (engine size 250 CC+), and (iv) electric wheelers. The other differentiating factors are wheel size, speed, ability to ride on highways, legal age to ride, and motorcycle license required (Padway, 2019). The industry is known for fluctuation in demand on quarter to quarter basis (Balachandar, 2016). According to Society of Indian Automobile Manufacturers (SIAM) sources, India has taken over China on the basis of overall sales during 2016 and has become number one market in the world (Bora, 2017). Indian and foreign two-wheeler companies in India are also concentrating on exports. The major importing countries of Indian wheelers are: Vietnam, Thailand, Indonesia, Middle East, Latin America and African nations, where two-wheelers business is exhibiting colossal potential (Shukla, 2017). Latin America and African nations are facing inflation and devaluation of their currencies which in turn impacts Indian two-wheeler industry (Shah, 2017a).

3.1. Two-wheeler clusters in India

Republic of India is a federal union comprising 28 states and 9 union territories, for a total of 37 entities. The states and union territories are further subdivided into districts and smaller administrative divisions. Two-wheelers are manufactured in 10 states and these areas are called two-wheeler clusters. Details of these 10 clusters are given in the following table 1.

Table 1: Two Wheelers Clusters in India – Indian and Global Players

Indian State	Manufacture & Number of Units Manufactured during 2018	Indian or Global	Year of Setup	Listed
Andhra Pradesh	Hero Motocorp Limited (7,587,130) (https://www.heromotocorp.com)	Indian	1984	Yes (BSE & NSE)

Gujarat	Honda Motorcycle and Scooter India Pvt. Ltd.	Global	2016	Not Listed
Haryana	Hero Moto Corp Limited,	Indian	1984	Yes
Haryana	Harley Davidson, India (12,000) (https://www.harley-davidson.com/in)	Global	2009	Not Listed
Haryana	Suzuki Motorcycle India Private Limited (https://www.suzukimotorcycle.co.in/)	Global	2006	Not Listed
Haryana	Honda Motorcycle and Scooter India Pvt. Ltd. (HMSI) (6,123,886) (https://www.honda2wheelersindia.com)	Global	1999	Not Listed
Haryana	India Yamaha Motor Pvt. Ltd (https://www.yamaha-motor-india.com/)	Global	1965	Not Listed
Himachal Pradesh	TVS Motor Company Limited (http://www.tvsmotor.com)	Indian	2007	Yes (BSE & NSE)
Madhya Pradesh	Mahindra Two Wheelers Limited (MTWL) (http://www.mahindratwowheelers.com/)	Indian	2008	Yes (BSE & NSE)*
Rajasthan	Hero Motocorp Limited	Indian	2014	Yes (NSE & BSE)
Rajasthan	Honda Motorcycle and Scooter India Pvt. Ltd. (HMSI)	Global	2011	Not Listed
Uttarakhand	Hero Motocorp Limited	Indian	2008	Yes (BSE & NSE)
Uttarakhand	Bajaj Motors Limited	Indian	2007	Yes (BSE & NSE)
Karnataka	TVS, Motor Company Limited	Indian	-	Yes (BSE & NSE)
Karnataka	Honda Motorcycle and Scooter India Pvt. Ltd. (HMSI)	Global	2013	Not listed
Tamil Nadu	TVS Motor Company Limited	Indian	1978	Yes (BSE & NSE)
Tamil Nadu	Royal Enfield India (846,000) (www.royalenfield.com)	Indian	1955	Yes (BSE & NSE)*
Tamil Nadu	India Yamaha Motor Pvt Ltd	Global	2014	Not Listed
Maharashtra	Piaggio Vehicles Pvt. Ltd. (PVPL)	Global	-	Not Listed
Maharashtra	Aprilia (https://www.aprilia.com/in_EN/)	Global	-	Not Listed
Maharashtra	Benelli (https://india.benelli.com/)	Global	-	Not Listed
Maharashtra	India Kawasaki Motors Pvt. Ltd	Global	2009	Not Listed
Maharashtra	Ktm-Sportmotorcycle India Private Limited	Global	2012	Not Listed
Uttar Pradesh	India Yamaha Motor Pvt Ltd	Global	1984	Not Listed

3.2. Production and sales of two-wheelers in India

The data with respect to production and sales (Export & Domestic) of two-wheeler manufacturers in India is given in table 2. It is evident from the data that production and installed capacity are increasing over the years as well as domestic sales. However, export had taken a dip during 2016-17. The first half of FY 2019-20 recorded decline in the domestic sales as reported by all manufactures and given in the last two rows of Table 2.

Table 2: Two wheeler Sales (Domestic & Export) and Production in India (in Million Units)

Year	No of Units Sold	No of Units Exported	No of Units Produced
2010-11	11.77 [1]	1.532000 [2]	13.40 [5]
2011-12	13.41 [1]	1.947000 [2]	15.40 [5]
2012-13	13.80 [1]	1.956378 [2]	15.70 [5]
2013-14	14.81 [1]	2.083938 [2]	16.90 [5]
2014-15	15.98 [1]	2.299493 [2]	18.50 [5]
2015-16	16.46 [1]	2.481193 [2]	18.60 [5]
2016-17	17.59 [1]	2.339000 [3]	19.92 [5]
2017-18	20.20 [1]	2.810000 [4]	23.20 [6]
2018-19	21.18 [1]	3.320000 [6]	24.50 [6]
2018-19 (H1)	11.568498 [7]	1.723280 [7]	
2019-20 (H1)	9.696733 [7]	1.793957 [7]	
Sources: [1]: https://www.statista.com/statistics/318023/two-wheeler-sales-in-india/ [2]: Melwani and Sitlani (2017), [3]: Shah (2017b), [4]: Parikh (2019), [5]: Team Fintapp (2017). [6]: https://www.marklines.com/en/report/rep1872_201906 , [7]: Vijayraghvan (2019) http://www.siamindia.com/statistics.aspx?mpgid=8&pgidtrail=11			

3.3. Installed capacity of Major Manufacturers of Two-Wheelers in India

Installed capacity data for three years starting with 2006 is given in Table 3. It is evident that capacity for manufacturing of two-wheelers in India has increased substantially. All major manufacturers increased their installed capacities. Hero Motocorp has maximum installed capacity of 11 Million units. This includes the capacity of new plant in Andhra Pradesh. HMSI is the second largest producer with a capacity of 6.4 million units. HMSI is further augmenting its production capacities. In terms of capacity, Bajaj Motors Limited is at third place, followed by TVS Motors Company Limited at fourth place. Installed capacity as per the data given by Society of Indian Automobile Manufacturers (SIAM), was 26.14 million during 2015-16 and 27.51 million during 2016-17.

Table 3: Installed capacity of two wheeler manufacturer in India (2006-2019)

Manufacturer	Capacity (in Million units)		
	2006	2013	2019
Hero MotoCorp Limited	3.2	7.0	11.0 (Annual Report 2019)
Bajaj Motors Limited	2.8	4.5	5.4 (Annual Report 2019)
TVS Motor Company Limited	2.0	2.5	4.0 (capitalmarket.com)
Honda Motorcycle and Scooter India Pvt. Ltd.(HMSI)	0.5	0.6	6.4 (Annual Report)
Piaggio Vehicles Pvt. Ltd. (PVPL)	0.7	1.0	3.80 (Gonsalves (2018))
Mahindra Two Wheelers Limited (MTWL)	0.5	0.4	0.75 (Dalvi (2019))
Royal Enfield India	0.0	0.2	0.825 (Narsimhan (2017b))
Suzuki Motorcycle India Private Limited (SMIPL)	0.3	0.5	0.75 (Website of SMIPL)

Harley-Davidson, India	0.0	0.0	0.012 (Nadar (2018))
India Yamaha Motor Limited	-	-	0.90 (Yamaha News (2019))
BENELLI	-	-	0.004 (ET Bureau (2019))
Source	Raj and Leena (2012)		

3.4. Two-Wheeler Market Share of Key Manufacturers in India

It is evident from the data given in table 4 that there are four major manufacturers of two-wheelers in India. These manufacturers account for 90% production of two-wheelers. The market share of Hero Moto Corp Limited and Baja Auto Limited is reducing during seven years, i.e., from FY 2010 to FY 2016. Share of TVS Motor Company limited is almost static. On the other hand, share of HMSI and others is increasing continuously during the same period. The data with respect to FY 2017 and FY 2018 is given in the next section.

Table 4: Two-wheeler market share (%) of Key Manufacturers in India

Manufacturer	FY2010	FY2011	FY2012	FY2013	FY2014	FY 2015	FY 2016
Others	5.2	6.6	6.8	7.6	8.7	9	11
TVS Motor Company Limited	14.5	15.1	14.1	12.8	11.8	13.2	14.0
Bajaj Auto Limited	19.1	20.5	19.1	17.9	14.2	11.1	11.0
Honda Motorcycle & Scooter India	12.7	13.2	14.9	18.9	24.0	26.61	27.0
Hero MotoCorp Limited	48.1	44.7	45.2	42.9	41.3	40.2	37.0
Source: https://www.statista.com/statistics/538376/two-wheeler-market-by-manufacturer-india/							

4. Select Statistics of two-wheeler industry and TVS Motors Private Limited

Having commenced operations in 1877, TVS Motor Company initially did its business in three sectors, i.e., automobile, finance and insurance. Since 1955, TVS began shifting its focus on automobile sector. The company gained worldwide recognition during the 1980s when it collaborated with Suzuki Motors to release two-wheeler models, i.e., Suzuki Samurai, Suzuki Shogun and Suzuki Fiero. So far as the scooter market is concerned, TVS's Scooty brand is among the best performers over the past two decades. Scooty, as a brand, remains the most preferred scooter among working women and college girls. Jupiter and Wego are two other scooters manufactured by TVS, and both doing substantially well in the Indian market. This section presents the data of sales

and market share of TVS Motor Company limited along with its competitors. In addition, the section also presents the data with respect to popular brands/models of motor cycles and scooters of different manufactures in India.

4.1. Select Yearly Statistics of TVS Motor Company limited & its Competitors

This section presents statistics of TVS Motor Company Limited with respect to number of units sold, market share in percentage, rank of TVS two-wheelers in scooter and motor cycle segment vis-à-vis others. The data referring to domestic market share is given in table 5. It is evident from the data given in Table 5 that Bajaj Auto Limited has gained market share from HMSI. The major looser was Mahindra Two Wheelers Limited (Nangia, 2019).

Table 5: Domestic Market Share of two wheeler manufacturer in India

SN	Brand	FY 2018		FY 2019		% Change over 2018
		No of Units	Share (%)	No of Units	Share (%)	
1	Hero MotoCorp	7,382,718	36.55	7,612,775	35.94	3.12
2	HMSI	5,775,287	28.59	5,520,617	26.06	-4.41
3	TVS Motor Company	2,875,466	14.24	3,136,552	14.81	9.08
4	Bajaj Auto Limited	1,974,577	9.78	2,541,320	12.00	28.7
5	Royal Enfield	801,229	3.97	805,273	3.80	0.5
6	India Yamaha Motors	792,812	3.92	804,682	3.80	1.5
7	Suzuki Motorcycles	501,203	2.48	668,787	3.16	33.44
8	Piaggio Vehicles	68,169	0.33	77,775	0.37	14.09
9	Mahindra Two Wheelers	14,752	0.07	4,004	0.02	-72.86
10	India Kawasaki Motor	1,799	0.009	3,115	0.01	74.51
12	Others	12,105	0.06	6,510	0.03	-46.2
	Total	20,200,117	100.00	21,181,390	100.00	4.86

4.2. Select Monthly Sales of Top Models of Two-Wheeler Manufacturers

Sale data of top 10 motorcycle models and top 10 scooter models for the month of February for four years (2016-2019) is presented in Table 6 and Table 7. It is evident from the data given in Table 6 that top slots are occupied by Hero Motocorp, HMSI, Baja Auto and TVS Motors Company limited. Royal Enfield entry in the top slots is an exception.

Table 6: Top 10 Motorcycles Models units sold in February 2016, 2017, 2018, 2019

February 2016		February 2017		February 2018		February 2019	
Model	Units	Model	Units	Feb2018	Units	Model	Unit

Hero Splendor	189,314	Hero Splendor	208,571	Activa	247,377	Splendor	244,241
Hero HF Deluxe	106,572	Hero HF Deluxe	121,902	Splendor	238,722	Activa	205,239
Hero Passion	81,656	Hero Passion	69,763	HF Deluxe	165,205	HF Deluxe	184,396
Hero Glamour	60,883	Honda CB Shine	66,402	CB Shine	82,189	CB Shine	86,355
Honda CB Shine	58,433	Bajaj Pulsar	53,932	TVS XL Super	71,391	Pulsar	84,151
Bajaj Pulsar	47,208	Royal Enfield Classic 350	40,768	Glamour	66,064	TVS XL Super	75,001
Bajaj CT 100	42,924	Hero Glamour	39,288	Jupiter	63,534	Passion	67,374
Bajaj Avenger	30,162	Bajaj CT 100	26,886	Passion	61,895	Platina	53,044
Royal Enfield Classic 350	26,888	Bajaj Platina	22,590	Pulsar	60,772	Jupiter	48,688
Honda Livo	23,001	Honda CB Unicorn	19,986	Classic 350	48,557	Access	48,265
Source: Society of Indian Automobile Manufacturers (SIAM)							

It can be inferred from the data given in Table 7, that, in the scooter segment, top 10 slots are occupied by the scooter models of Hero Motocorp, HMSI, TVS Motors Limited, Suzuki, and Yamaha. TVS Jupiter model of TVS Motors is occupying second slot for all four years. Honda Activa of HMSI is the top model among all manufacturers for the period of four years taken into consideration.

TVS motors has become the second largest scooter maker in India by sales of 12,41,366 Units which represents 12.94% increase in relation to previous year. Company's market share increased to 18.52% in 2018-19 from 16.36% in 2017-18. TVS Motors is the only two-wheeler manufacturing company which has shown growth in market share in both, motorcycle and scooter segments, a feat which is unique as all the other major participants in the sector recorded growth in one segment, but declined in another.

Table 7: Top 10 Scooters Models units sold in Feb 2016, 2017, 2018, 2019

February 2016		February 2017		February 2018		February 2019	
Models	Units	Models	Units	Models	Units	Models	Units
Honda Activa	210,028	Honda Activa	217,098	Honda Activa	247,377	Honda Activa	205,239
TVS Jupiter	47,712	TVS Jupiter	51,817	TVS Jupiter	63,534	TVS Jupiter	48,688

Hero Maestro	42,851	Hero Maestro	32,421	Honda Dio	41,556	Suzuki Access	41,556
Hero Duet	31,456	Suzuki Access	26,795	Suzuki Access	39,061	Honda Dio	45,017
Yamaha Fascino	17,034	Yamaha Fascino	22,287	Hero Maestro	35,165	Hero Destini 125	24,018
Hero Pleasure	13,849	Honda Dio	21,463	Honda Grazia	23,620	TVS Ntorq	16,370
Suzuki Access	12,189	Hero Duet	18,353	Hero Duet	18,065	Hero Pleasure	15,264
Honda Dio	10,243	Yamaha Ray	17,279	Hero Pleasure	16,893	Yamaha Fascino	14,939
Honda Aviator	9,045	Hero Pleasure	10,958	Yamaha Fascino	12,908	Yamaha Ray	11,700
Yamaha Ray	7,357	Honda Aviator	10,211	Yamaha Ray	12,777	Hero Maestro	10,223
Source: Society of Indian Automobile Manufacturers (SIAM), Shah (2017c))							

5. Financial Analysis of TVS Motors Private Limited

This section presents financial parameters of TVS Motors Private Limited. These parameters are reserves & surplus, long term borrowings, fixed assets, positive debt financial signaling; ROCE and ROE; payback period and retained earnings; Dividend Payout ratio, Retention Ratio and Return on Equity; Return on Equity (ROE) Ratio, Price to Earning(P/E) ratio, Price to Book Value (P/BV) Ratio, Retention Ratio; and Net Profit Margin. The data related to financial performance is given in Table 8 and Table 9.

5.1. Reserves and Surplus

The only movement in the retained earnings of the company pertains to the annual transfer of the profit balance into the account and the payment of the dividend to the shareholders along with the dividend tax payments. There have been no other transactions in the retained earnings of TVS Motors. With the above observation, it can be said that the company is heavily using its debt funds while not using its own funds in order to function. Also, TVS motors uses debt funds and its subsidiaries in order to make investments in AI and IIOT startups and other technologies.

Table 8: Financial Growth Parameters of TVS Motors Pvt. Limited

Items	Financial Year ending (₹ Millions)				
	Mar 19	Mar 18	Mar 17	Mar 16	Mar 15
	12 months	12 months	12 months	12 months	12 months
Reserves and Surplus	32,998.1	28,329.1	2,3608.2	19,108.3	15,978.5
Long Term Borrowings	7,091.2	3,176.2	4687.6	4,942.3	5,189.8
Fixed Assets	28,365.4	25,030.0	2,0461.5	17,505.5	14,189.9

5.2. Pecking Order Theory and Positive Debt Financial signaling

According to the Pecking Order theory, the management has asymmetric information of the company which the public investors do not (Myers and Majluf, 1984). So, with the use of debt funds in capital structure, the management sends a positive debt financial signal to public at large that the board has confidence in profitability of its projects and the current share price of the company is undervalued.

From the analysis of the Balance sheet of the company, it can be seen that there is a steady increase in the fixed assets of the company with no withdrawal from the reserves of the company. TVS motors use debt heavily in order to fuel its operations and asset acquiring rather than use the internal source of funding i.e. reserves and surplus balance. As an observation, it can be said that the company is confident in its ongoing and upcoming projects and believes strongly that they shall generate returns which should not only pay off the interest expenses, but should provide positive benefits for the financial health of the company and also add value to the shareholder's wealth at large.

Table 9: Key financial ratios per share of TVS Motors Limited

	March 2019	March 2018	March 2017	March 2016	March 2015
Book Value [Excl Reval Reserve]/ Share (₹)	70.46	60.63	50.69	41.22	34.63
Net Profit/Share (₹)	14.11	13.95	11.75	10.30	7.32
Net Profit Margin (%)	3.68	4.37	4.59	4.40	3.44
Return on Networth / Equity (%)	20.02	23.00	23.17	24.98	21.14
Return on Capital Employed (%)	24.06	19.48	18.27	18.55	14.73
Return on Assets (%)	8.00	9.22	9.45	9.88	7.55
Total Debt/Equity (X)	0.41	0.36	0.45	0.39	0.56
Asset Turnover Ratio (%)	217.57	210.73	205.52	224.23	219.32
Current Ratio (X)	0.78	0.68	0.77	0.81	0.90
Quick Ratio (X)	0.49	0.43	0.43	0.51	0.54
Dividend Payout Ratio (NP) (%)	0.00	23.66	21.28	35.44	25.95
Dividend Payout Ratio (CP) (%)	0.00	15.65	14.04	23.90	18.01
Earnings Retention Ratio (%)	0.00	76.34	78.72	64.56	74.05
Approximate Rate 1 US\$	₹70.00	₹64.00	₹ 66.00	₹66.40	₹62.50

5.3. Return on Capital Employed (ROCE), Debt to Equity Ratio and Return on Equity (ROE)

Return on capital employed (ROCE) ratio shows how much the company is earning profit for each unit of Capital invested, being debt and Equity. It is best advisable that the ROCE rate must be at least double the interest rate prevailing at the time. When a company consistently does not get a ROCE which is in excess of returns from safer alternatives, like bank FD or Government Bonds, the capital employed by the company is better off getting re-deployed elsewhere because the company is losing money in such scenario. TVS Motors has ROCE ratio of 24.06% which is significantly above the average interest rates currently prevailing in the market.

TVS Motors has a debt to equity ratio of 0.41 as on year ending March 2019. In comparison to its peers in the industries, TVS Motors is a heavily leveraged company. TVS has a history of entering into financing scheme with banks for every upcoming model. However, the said ratio is well within the prescribed limit. As per the limit as prescribed in the industry, as long as the ratio lies below 0.70, it should not pose a threat to the solvency of the company.

On the other hand, return on equity (ROE) ratio shows how much earnings is generated on each unit invested of equity only. There has been a decline in the ROE ratio since March 16. ROE for financial year ending in March 2019 was 20.02% in comparison to Indian auto industry which was near about 19%. This means that the company is steadily decreasing the use of the shareholders' funds and more relying on the borrowed funds.

In the given scenario, ROCE has been increasing and surpassed the ROE in March 2019. This means that company has made intelligent use of debt to reduce the overall cost of capital. A negative impact of the same is that the company is rewarding its lenders and bankers more than the shareholders. However, as long as both the ratios are above 20% and the difference between them is not large, so as the present case, it is considered to be acceptable. In summary:

- (a) Retained earnings opportunity cost for not investing the same in safe alternatives such as government securities - 7% (average)
- (b) Return on Capital Employed - 24.06% (March 2019). The same has been well above the interest rate, and growing.
- (c) Return on Equity - 20.02% (March 2019). The same has been well above the interest rate and industry ROE.

It can be concluded that TVS Motors is very efficiently using the leverage affect to increase the worth of the shareholders. Also, the various investments made by the company are steadily adding value to the company.

5.4. Payback period and Retained earnings

A reverse ratio of Return on capital employed is Payback Period. With ROCE ratio increasing over the period of past five years, being 24.06%, it means that the total payoff period for the company is also increasing with taking debt with longer time periods. The current ratio of 24.06% shows that the company has a payback period of a bit above two years on average.

It can be interpreted that the company is maintaining such volumes of retained earnings as a safety measure in case it does not earn enough cash profit. Also, the balance sheet does not show any cash reserves to support the growing financial expenses since it can be clearly seen that the Return on capital employed is increasing and being more than the current interest rates, which means that TVS motors is focusing on using debt to facilitate better performance.

5.5. Dividend Payout ratio, Retention Ratio and Return on Equity

The company follows a policy of steady dividend payouts of 25-30% for many years. When the dividend ratio is lower than the retention ratio, the investors see this as a positive sign since majority of the investors invest in order to create long term wealth and investors seeking regularly high dividend income represent extreme minority. When a company ploughs back its profit, it is seen as a signal that the company has many investment options and has confidence for sustaining profit and growth.

Return on Equity (ROE) for the company is 20.02% for year ending March 2019. It means that the company earns 20% on every one unit of shareholders' funds which it has invested. There has been a decline in the ratio since past years, but 20+ ratio is considered a healthy ROE. Also the same is still much above the Risk free investment options.

As long as the investor doesn't find better option of investing somewhere else and earning more than 20%, he would want the company to reinvest the profits back into the business and not give or increase dividends to the shareholders.

5.6. Return on Equity (ROE) Ratio, Price to Earning(P/E) ratio, Price to Book Value (P/BV) Ratio, Retention Ratio

PE (price to Earning) ratio of the company is 33.30 times. However, that of the Indian Auto Industry as per Nifty figures is 19.68 Times. TVS Motors is overvalued based on the earning compared to the Indian Automotive Industry.

Book value of the share of the company is Rs.70.46 resulting into a Price to book value (PB) Ratio to be 6.58 times which is double of that of the Industry which is 3.39 times. Again, this shows that the Price of the Company is Highly overvalued, almost double the amount.

Assets turnover ratio of the company is increasing steadily, showing that the company doesn't have any ideal assets lying over and it is using the assets increasingly well over the years to generate revenue for the company.

Ideally, a higher ROE creates more confidence in the eyes of the shareholders that the company shall earn higher returns on the investors' money, thus creating higher PE ratio. However, in spite of declining ROE, the company has higher P/E ratio in comparison to its competitors in the industry showing that the investors are willing to purchase the share of TVS motors at a higher price than its actual worth based upon its reported earnings. One of the reasons for the same is the company's higher Retention ratio and stable dividend policy and also increasing Return on capital employed and Assets turnover ratio in comparison to the other producers in Indian automotive Industry, thus creating a trust that the company performs well.

5.7. Net Profit Margin

The Profit per share is increasing every year for the company because of the increase in the core operations undertaken by the company. However, the Net Profit Margin which signifies how much control the company has over its operating cost has been reducing every year because of the Interest expenses of the heavy debt and the depreciations expenses of additional asset acquisitions done during last two years. The increase in the profit margin not only happens with the increase in revenue, but also in reducing the cost, where the company is failing.

6. Acquisition of Startups by TVS Motors

This section presents the brief overview of acquisitions conducted by TVS Motors during the recent years. It is evident from the data compiled in Table 10 that during 2019, all acquisition conducted by TVS Motors were in the domain of IIoT, Big Data Analytics and AI.

Table 10: Investment by TVS Motors in the Recent Years

Year	Company Invested	Type of company.	Amount of investment	Source of Funding	Source
2016	Carcrow technology Pvt. Limited	Car service start up	\$0.5million (₹.34 million)	Angel round led by TVS group	Singh (2016)
2017	Axiom Research Labs Private Limited, Delhi	It was not acquired but TVS group chairman was part of second round of funding along others			Tom (2018)
2017	Ultraviolette Automotive Pvt. Limited	Electric bike maker	\$700K (₹ 50 Million)	TVS Motor Pvt. Ltd.	Daswani (2017)
2017	Ultraviolette Automotive Pvt. Limited	Electric bike maker	\$700000+\$862,000 (₹ 60 Million)	TVS Motor Pvt. Ltd.	Kotecha (2017), Daswani (2017), Sunkara (2018)
2017	Condivisions solutions Pvt. Ltd	Online Renting of Bikes	₹ 15 Million (\$234,000)	TVS Motor Pvt. Ltd	Narasimhan (2017), Pitchiah (2017a)
2018	Condivisions solutions Pvt. Ltd	Online Renting of Bikes	₹ 5 Million	TVS Motor Pvt. Ltd.	IIFL(2018)
2019	Altizon Systems Pvt. Ltd.	IIoT	\$7 Million (₹ 490 Million)	Series A funding round led by TVS motors	Joseph (2019)
2019	Altizon Systems Pvt. Ltd.	IIoT	\$ 2.5 Million	TVS Motor Pvt. Ltd.	Pitchiah (2019)
2019	TagBox- Supply chain IIoT and ML platform	IIoT, AI, Supply chain management.	\$3.85 Million (₹266.9 Million)	Series A funding round led by TVS motors	Chandrashekhar (2019).
2019	Scienaptic Systems Inc	Big Data Analytics	\$7 Million	Series A funding	Panday (2019)

6.1. Carcrew Technology Private Limited (<https://www.carcrow.in/>)

Carcrow was setup in 2016 with headquarters in Mumbai. It has raised US\$ \$0.5million (₹.34 million) in an angel round led by TVS group (Singh, 2016). It is a platform for after sale services and spare parts segment of US\$ 15 billion worth automotive industry (Singh, 2016). Carcrew offers an online repair marketplace that provides customers all car related service requirements

(Naseer, 2018). Its product and services includes car cleaning to maintenance, running repair to breakdown services, and supply of spare parts and accessories. Its average ticket size for services during 2016 was between ₹4,000 (US\$ 55) to ₹5,000 (US\$71).

Carcrow has raised a total of \$2.5 million in funding over three rounds. Their latest funding was raised on Jan 1, 2019 from a Venture - Series Unknown round. Carcrow is funded by five investors. White Unicorn Ventures and TVS groups are the most recent investors. The other three investors are Punit Goyal (co-founder: Blu Smart mobility), Ketan D. Kothari (GM: Consumer, Edmodo), and Rajesh Agrawal (Founder: Chief Architect of TRAQR technologies). Carcrow is actively using 31 technologies for its website (<https://www.crunchbase.com/organization/carcrow>)

Hector (2018) reported that TVS backed Carcrow has acquired Delhi-based ClickGarage in a stock-and-cash deal. The ClickGarage was launched during 2015. It was run by Sui Generis Innovations Pvt Limited. With this buyout, Carcrow aims to build a Pan-India network of workshops and equip them with high-end technology infrastructure, standardized processes and spare parts supply.

6.2. Ultraviolette Automotive Pvt. Limited (UAPL)

Ultraviolette was founded in December 2015 with a self-funded capital of \$77.5K by promoters. Sunkara (2018) and Praveen (2018) reported that Bengaluru-based UAPL is building a high performance electric motorcycle with smart features such as onboard diagnostics, preventive maintenance, battery packs, over-the-air upgrades, and ride customization in the 200-250cc segment. UAPL is confident that new motorcycle will outperform traditional bikes in the same segment. According to TVS, "Electric doesn't make any economic or commercial sense now. TVS focus will be only on BS-VI. UAPL is focusing on increasing the emission efficiency of the TVS products. UAPL will use investment for product engineering and expansion of research and development (R&D) facility and future R&D manpower. To be specific, company will use funding for development of high-end electric powertrains, battery modules and connected technology. It has reported a total revenue of \$5K (₹0.32Million) in 2016-17, shooting up from \$480 (₹31,570) in 2015-16 (Daswani, 2017). With this investment TVS Motor's stake in USPL has gone to 25.76% according to a stock-exchange filing by TVS. TVS had earlier invested ₹ 50 million (\$0.78 million) in Ultraviolette in December 2017 for a 14.78% stake (Daswani, 2017).

6.3. TagBox (<https://www.tagbox.in/>)

TagBox was founded in 2016. It is headquartered at Bengaluru. Its products are AssetLens and BoxLens. It solves problems of (i) end-to-end traceability of every SKU or batch, (ii) temperature compliance for cold chains, (iii) physical damage of fragile goods, (iv) spoilage of environmentally sensitive goods, (v) theft and preferage of high value goods, and (vi) general inefficiencies like delays, turnaround time (TAT), and breakdowns. TagBox is working with Retail, Pharma, F&B, Dairy and Glass companies in India and Asia Pacific (APAC) region. TVS Motor Company has invested \$3.85 million (about ₹266.9 Million) in TagBox, a machine learning platform company as part of its Series A funding round led entirely by TVS Motor Company and its Singapore-based subsidiary TVS Motor (Singapore) Pte. Limited³ (Ganguly, 2019). Further, Doshi (2019) mentioned that as per TVS Motor stock-exchange filing, it had invested ₹112 Million (\$1.61 million) and remaining \$2.25 million is invested by its Singapore unit.

TagBox will use the funding from TVS motors for product innovation, research & development and to expand its global footprint. TagBox will also invest in its BoxLens and AssetLens platforms. In addition, TagBox may develop additional predictive analytics and automation solutions with TVS funding (Chandrashekhara, 2019). TVS Motor plan is to create another vertical in digital domain. TVS Motors thinks that TagBox's IoT solutions in the supply chain and logistics space are unique blend of IoT, Machine Learning and close-loop AI. TVS Motors believes that TagBox solutions will help it in monitoring, predicting and preventing SKU health risk in its supply chain.

TVS Motors invested in TagBox because (i) TagBox solutions have impacted bottom line impact for Fortune 1000 companies by improving their supply chain processes, (ii) TagBox delivered ROI from its IoT based predictive insights solutions for leading Retail, E-commerce, Pharma, F&B, Dairy and Manufacturing companies in India and APAC, (iii) TVS Motors plan to leverage TagBox solution to improve its supply chain, and (iv) at the same time partner with digital startups to create wealth. Indian Angel network (IAN) Fund invested ₹35 Million in TagBox during October 2017 and IAN Fund exited the company

³ TVS Motor (Singapore) Pte. Limited, headquartered in Singapore is a wholly owned subsidiary of TVS Motor Company. It is focused on the automotive and fintech industries with portfolios intended to address business challenges with analytics, artificial intelligence, augmented reality, internet of things, machine learning and virtual reality.

after receiving the 3X return within 18 months of investment (Ganguly, 2019; Doshi, 2019).

6.4. Altizon Systems Pvt. Ltd (<https://altizon.com/>)

Altizon Systems Pvt. Ltd is an industrial IoT company. It was launched in 2013. It has presence in India (Pune) and with wholly owned subsidiary in Scotts Valley, California, USA. It enables use machine data to drive business decisions, digital transformation in enterprises by accelerating smart manufacturing initiatives, modernizing asset performance management, and developing new business models for service delivery (BS Reporter, 2019). It has three offerings, i.e., (i) Datonis IIoT platform (Cloud based PaaS) for visualizing, processing, and analyzing IoT generated data in real time, (ii) Datonis manufacturing intelligence, an enterprise application that integrate data from plant floor systems to provide insights, and (iii) Datonis edge to enable smart IoT connectivity for devices for connecting and exchanging data with IIoT platform. These products cater to the need of automotive, FMCG, Steel, and Energy industry (Pitchiah, 2019).

Pitchiah (2019) reported that it has raised \$7 million (₹490 Million) in its Series A round of funding led by TVS Motor Company (Singapore) Pte., Ltd., a subsidiary of TVS Motors Company limited. It is further mentioned that existing investors The Hive, Wipro Ventures, and Lumis Partners also participated in the round. As per separate disclosure with stock exchange, TVS Motor has disclosed that it had acquired a minority stake (14.14%) in US-based industrial (IoT) firm Altizon Inc and Altizon Systems Pvt. Ltd, with an investment of over \$2.5 million. With this investment TVS can utilize the technology offerings of Altizon for its growth (Joseph, 2019).

6.5. Condivisions Solutions Pvt Ltd (<http://www.rentongo.com/>)

Condivisions Solutions Pvt. Ltd was founded in 2012. In December 2015, RentOnGo raised an undisclosed amount through angel funding (Narasimhan, 2017). Its headquarter is at Bengaluru. It has presence in Bengaluru, New Delhi, Hyderabad, Mumbai and Pune as per its website. The website lists products provided by vendors under 15 categories such as: vehicles (cars), electronics and appliances, furniture (both home and office), medical supplies, costumes, events and wedding supplies and adventure gear, among others. Consumers can search for products or browse through products of their interest and also find out the vendor that rents products in their locality through the website (Pitchiah, 2017a, 2017b). The company reported revenues of ₹3.1million in FY17, ₹1.5 million in FY16 and ₹0.3 million in FY15 (IIFL, 2018).

Its competitors are Rentomojo, Rentalwala.com, Rent₹cash, Furlenco, REntsher, PayREntz, Allovoision, CityFurnish, and Quikr.

The two-wheeler and three-wheeler maker invested ₹15 million (\$234,000) in Condivision Solutions. It is as per TVS Motors stock exchange filing. TVS Motors mentioned that this investment is from the futuristic perspective on the emerging pay-by service model (Pitchiah, 2017a, 2017b). Again in 2018, TVS Motors acquired 5.6% additional stake in Condivisions for ₹5 million. Such way, it has raised its stake to 29.6% (IIFL, 2018).

6.6. Scienaptic Systems Inc

Scienaptic Systems Inc. was set up in 2014. It recorded revenue of \$2.86 million for 2018-19, up from \$ 1.51 million during 2017-18 (Team VCC, 2019). Scienaptic Systems Inc reported several marquee Fortune 100 enterprises as its clients (PR Newswire, 2019). TVS Motors Private Limited signed a definitive agreement to invest \$7 million in New York big data analytics startup. The strategic investment in startups is made through its wholly-owned subsidiary TVS Motor (Singapore) Pte Limited. It is a part of series-A funding. The company, in its filing to the BSE, mentioned that the closing of the investment is subject to obtaining necessary regulatory approvals (Panday, 2019). Scienaptic Systems is a big data analytics startup and designed a unique platform called Ether using its proprietary machine learning and artificial intelligence algorithms. This solution will help TVS to improve risk and credit assessment and monitor evolving fraud patterns among other benefits. This investment is part of TVS Motor's Singapore-headquartered subsidiary which aims to leverage the benefits of big data analytics, artificial intelligence (AI), augmented reality (AR), internet of things (IoT), machine learning (ML) and virtual reality (VR) technologies with a focus on the automotive and fintech industries (Pandey, 2019).

7. Result and Suggestions

Based on the secondary data given in earlier sections and primary data collected from select group of employees of middle level management, this section presents possible answers to propositions and research questions.

Proposition / Research Question 1: TVS motors Limited is investing in startups to expand its global footprint.

Most of the two-wheeler producers in India are targeting export markets in selected countries. TVS Motors are also exporting two-wheelers. Added

features in the existing brands will certainly enhance the acceptability of its two-wheelers in the export segment. However, it is difficult to establish that investment in disruptive technology and electric vehicles startups is made to expand global footprint. Discussion with the select group of employees indicates that shared mobility, smart & connected vehicles, and move towards electric two-wheelers is aimed more for domestic market and to fulfill vision 2030 of automobile sector. It is more to reduce oil import and carbon dioxide emission. However, they support the view that it will help in expanding global footprints. The proposition can be rated as "4" on 1 to 10 points scale.

Proposition/ Research Question 2: TVS Motors Limited is following mix model of growth (Organic + Inorganic).

TVS Motors is bringing new models every year through internal innovations. But in case of disruptive digital technologies, rental & improvement in other customer services and electric vehicles, it is investing in startups. The employees also suggest that, by investing in startups, TVS Motors is reducing the risk of internal innovation failures and also using best of breed technologies developed by startups. Most of the biggies of information technology are following similar strategies (Singh, 2019a). Similar strategies are followed by small and medium enterprises (SME) as far as information technology is concerned (Singh, 2019b). This proposition can be rated as "8" on 1 to 10 points scale.

Proposition/ Research Question 3: TVS Motors Pvt. Ltd is investing in startups to innovate and develop new product which is not possible internally with existing know-how.

This proposition / research question has been supported in the literature, as well as by data collected and analysed in earlier sections. TVS Motors did not have expertise in disruptive technologies. Acquiring / hiring needed knowledge and skills and then developing or embedding disruptive technologies could be a long route, while investing strategically in new startup with right product portfolio will be a shorter route. In addition, it may mitigate risk of internal innovation failure. The similar views were expressed by employees of automotive industry. Majority of them also stated that two-wheeler / automobile producers need to have very strong team of different functional areas. This team will oversee future innovations (internal or external) integration. To mention, SAP acquired business objects due to initial internal innovation stagnation of Netweaver (Singh and Nayeem, 2011). This proposition can be rated as "9" on 1 to 10 points scale.

Proposition/ Research Question 4: TVS Motors Pvt. Ltd is investing in startups to improve existing products & services.

The automakers including two-wheeler makers are adding new features in the existing products and services. All new models of four-wheelers in India have features such as voice messages referring to seat belt, service dates, status of fuel, camera assisted parking etc. New software supported or disruptive technologies supported features are added on daily basis. Two-wheeler manufactures are in line with four-wheelers in adding new features. To mention five technologies, i.e., Fuel Injection Technology, Slipper Clutch, Ride-By-Wire, Traction Control, and Internet of Things Enabled Two Wheelers (IoT) (Finserv Markets, 2019). TVS motors plan to compete in the same space by adding new features in the existing products and services. Similar views were expressed by the sample of employees. However, they expressed the view that Internet of Moving Things (IoMT) is possible with the support of law enforcing organization or by bringing changes in the existing law in the context of IoMT. Based on the data presented in different section, the proposition can be rated as "8" on 1 to 10 points scale.

Proposition/ Research Question 5: TVS Motors Pvt. Ltd is investing in startups to compete in EV segment.

As mentioned earlier, Government of India is encouraging or facilitating the production of electric vehicles with a view to reduce oil imports and carbon dioxide emission. As per the government policy, the goods and services tax council decided to reduce taxes on electric vehicles to the lowest slab of 5% from 12%. The tax on electric vehicle chargers has also been reduced to 5% from 18%. This is the reason why many auto makers are looking at electric vehicle startups. For example, Hero Motocorp invested ₹1800 millions (US\$ 27 Million) in Ather Energy, a Bengaluru-based startup as part of its electric vehicle projects (ElectronicB2B.com, 2019). TVS motors is investing in electric vehicle startups with the similar objectives. Similar views are expressed by the sample of employees. However, they mentioned that it may take a bit more time for electric vehicles to hit the roads in large numbers. This proposition may be rated as "10" on 1 to 10 points scale.

Conclusion

Based on the data and its analysis presented in the paper, it can be concluded that two-wheeler industry in India (TVS Motors in particular) is gearing itself towards electric two-wheeler market by investing in electric vehicle startups,

which is in line with Government of India's mission for the two-wheeler segment. Furthermore, two-wheeler industry is embracing disruptive technologies such as big data analytics, artificial intelligence, IIoT, IoMT to make shared mobility, smart & connected automobile, and development of electric vehicles a reality in the near future. This is evident from investments made in technology startups by automakers in India (Singh, 2020). It is in line with an open innovation model. As far as TVS Motors is concerned, it is evident from its recent investments in AI and IoT disruptive technologies. Similar investments are made by other automakers in India.

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