Electric vehicles in the business processes and sustainable development

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Abstract

Purpose – The study aimed at analyzing operations managers' perception of the use of electric vehicles (EVs) in business processes and its impact on overall business process cost (BPC) and sustainable development (SD).

Design/methodology/approach – The present study adopts the triangulation approach which is a combination of quantitative and qualitative methods. The data was collected using structured and scientifically tested questionnaires from the industrial managers working in the industries in the Mysore region of Karnataka. Descriptive statistics, factor analysis and structural equation models were employed to analyze and interpret the data.

Findings – The findings revealed that the usage of EVs in Business Processes significantly impacts the BPC ($b = 0.851$, $t = 8.037$, $p < 0.01$) and it is also the usage of EVs in business processes can significantly impact SD ($b = 0.889$, $t = 7.923$, $p < 0.01$). Thus, the adoption of EVs in the business process offers many benefits to business organizations such as minimized operational costs, an eco-friendly business model, more tax incentives, less BPCs, a low-emission footprint and a contribution towards SD at large.

Practical implications – Many business organizations operating in the present time show interest in employing EVs in their business processes. Hence, before introducing EVs in industries on a large scale, it becomes imperative to obtain the perception of industrial managers who have already experienced its impact. This study may help industrial organizations to understand the impact of EV on various aspects of the business and to design a business model which would help in achieving SD goals.

Originality/value – The use of EVs in the daily life of human beings and business activities is gaining importance because of the various positive impacts. Therefore, it is necessary to understand industrial managers' opinions regarding the use of EV in business activities.

Keywords Electric vehicles in business, Business processes, Business cost, Electric vehicles and environment, Sustainable development, United Nations Sustainable Development Goals (UNSDGs)

Paper type Research paper

1. Introduction

A series of functions, such as procurement, manufacturing, marketing, logistics and others, are collectively responsible for making a business organization (Sezen, 2005). The integration of

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these activities is called the "Business Processes" (Zelbst *et al.*, 2010; Green *et al.*, 2012). However, business processes and logistics activities are infamous for their unsustainable environmental impact. Transportation and the related activities used in business processes are causing severe effects on the environment. The severity of the impact is such that it is higher than the Gross Domestic Product (GDP) level of countries across the globe (Aronsson and Huge Brodin, 2006). To achieve multiple objectives such as minimizing the negative impacts of business transportation, improving business processes, minimizing cost and achieving environmental sustainability, one of the keys would be the use of Alternative Fuel Vehicles, also referred to as Electric Vehicles or EVs (Pernestål *et al.*, 2020; Tyagi and Vishwakarma, 2022). Further, business organizations can also use EVs as a potential medium for enhancing air quality and energy security and resolving natural resources problems at large [4].

The concept of "Environmental sustainability" stresses balancing the three P's, namely, People, Profit and Planet. This balance can be primarily observed by inducing EVs during business (Ao Dos Santos *et al.*, 2014). In the context of "people", business concerns should take necessary measures to avoid accidents with large business logistics vehicles and mitigate the harmful impacts of emissions on the health of local people.

In the context of "profit", a business should minimize costs. EVs can support the business by reducing the costs associated with transportation, maintenance and other logistics functions [1]. Further, adopting alternative fuel vehicles during the business process enables a business to claim various subsidies, tax incentives and other benefits offered by government and municipal authorities [2],[6]. This can have a dual effect of minimizing the overall business process costs (BPCs) and maximizing profits.

In the context of "planet", using alternative fuel vehicles in business positively impacts CO2 emissions and the conservation of scarce natural resources (Sunderlin, 1995; Sridhar, 2012; Quak and Nesterova, 2014). This balancing act would undoubtedly assist in protecting natural resources and thereby conserving the environment for the future generation. Further, adopting EVs in business operations is a necessary step for a business organization towards fulfilling its corporate social responsibility [3].

To balance business and environmental performance, a firm should adopt various green initiatives such as EVs, green supply chains, green marketing and green advertising strategies, among others, in their business process. These strategies will help the firm to improve operational performance and contribute to sustainable development (SD) at large (Smith, 2010; Kushwaha and Sharma, 2016). The efforts of business organizations towards contributing to SD certainly help them gain a competitive advantage and sustainable leadership in the market. However, they need to design a sustainable supply chain by inducing various means and ways, such as E-vehicles for logistics, eco-friendly production processes and many more (Barratt and Oke, 2007; Sen, 2009). Further, using EVs in business improves the health and safety of employees as it ensures better surroundings and improved air quality by minimizing NO2 emissions and other pollutants [5], [6]. In addition, the use of EVs in business processes also leads to making an organization a sustainable organization and helps to gain sustainable leadership in the environment in which it is operating.

This paper focuses on analyzing the use of EVs in business processes and its impact on overall cost and SD. The rest of the paper is organized as a literature survey, theoretical framework, hypothesis development, methodology, data analysis, discussion, conclusion, limitations and scope for further research.

2. Earlier studies and literature gap

The present study is unique and is considered exploratory, as the related literature on the current topic was found to be scarce. The focus is on analyzing the impact of EVs on BPC by

considering the perception of operations managers. The summary of earlier studies is presented as follows:

Logistics is an important component of the business process, and in terms of costs, it represents a significant contribution to business costs along with the cost of goods sold (Ballou, 1997). In a study by Napoli *et al.* (2021), it was noted that freight transport across the globe is witnessing a considerable increase and along with this carbon dioxide emissions are also increasing.

Carbon emissions from freight transport in India are projected to increase by 400% to around 1200 million tonnes in the next couple of decades (Dias, 2022). This fact stresses the need to switch to an environment-friendly approach to logistics and transportation activities. The logistics sector has been infamous as the largest contributor to greenhouse gas emissions (Juan *et al.*, 2016). Thus, according to the studies by Barratt and Oke (2007), Sen (2009), Rahman *et al.* (2015) and Jain (2022), it has been suggested that to avoid such emissions and reduce energy consumption, and to contain environmental degradation, switching to alternative fuel vehicles is the need of the hour. The business houses should also take a step towards incorporating the objective of reducing emission costs and attempting to find a trade-off between economic and environmental goals (Juan *et al.*, 2016). In this respect, electrification is a key tool in minimizing emissions from vehicle use in business. Juan *et al.* (2016) in their study mentioned that modern cities, to improve air quality and emissions, have been encouraging fleets of vehicles to adopt alternative fuel vehicles.

Mohammed *et al.* (2020) noted that the shifting of focus on alternative fuel vehicles, the initiatives and efforts encouraging their adoption is ultimately aimed at reducing carbon emissions and our reliance on fossil fuels. Switching to alternative fuel vehicles or EVs is also expected to have a drastic effect on a country's GDP.

However, the infrastructure for implementing alternative fuel vehicles or EV in developing countries like India is inadequate, as compared to Western countries. The major infrastructure facilities required to use alternative fuel vehicles are related to establishing charging stations and service centres in public places which are easily accessible. Further, Serohi (2022) noted that the research competencies needed to enable switching to alternative fuel vehicles are also inadequate. In contrast, as noted by Dias (2022), there has been intensive research on Internal Combustion Engine vehicles, and improvements are done over the years which have reached a point of saturation. Thus, there is much scope for research and improvements in alternative fuel vehicles and EV, particularly concerning battery technology, faster charging and other new-age technologies. Further, the study also opined that the use of EVs and alternative fuels in business logistics leads to better employment opportunities, a better natural environment, better health of the community, and faster economic growth and productivity.

In addition to research and efficiency building, support from the Government is necessary to assist business organizations in the adoption of EVs and avoid the usage of fossil fuel-based vehicles during their manufacturing activities (Melton *et al.*, 2016). In this respect, the Government of India along with the state governments is taking initiatives and promotional measures to encourage the acceptance and development of EVs in the country. For instance, through its flagship scheme called Faster Adoption and Manufacturing of (Hybrid and) EVs (FAME) and other similar schemes, India is promoting electric mobility. The Government in India also expressed an opinion that the improvement in the use of EVs can cause a fall in the usage of petrol and thereby result in cost reduction. Further, due to this, the logistics cost which is around 16 to 18% of the GDP in the country is expected to reduce to 10% in another five years (Narayan and Luthra, 2022).

Along with governmental support promoting the adoption of EVs, business organizations should also make efforts towards adopting EVs in their operations.

In their study, Smith (2010) and Kushwaha and Sharma (2016) stressed that business organizations should also be involved in the innovation and development of green strategies to be adopted along the supply chain. There is a need for structural changes in business functions that contain matters relating to minimizing the negative environmental impact and overall costs to the organization (Aronsson and Huge Brodin, 2006). This is because, though the upfront costs relating to EVs are higher, the cost over the lifetime of an EV is lesser. A report by Mecalux (2022) suggested that the last mile delivery, which is considered to be the costliest and most polluting stage, can be optimized by switching to electric trucks. This is possible because EVs can help reduce logistics costs by eliminating the use of fossil fuels and thus reduce the burden of transportation and logistics costs on the selling price of the products.

It may be noted that among the various decisions involved in business operations, the mode of transportation selection is crucial. The various regulatory norms, such as carbon caps, carbon tax and fuel norms, must be considered thoroughly before finalizing the mode of transportation. The scarcity of resources, the high negative impact of industrial emissions on the environment and the higher cost of transporting business resources pave the way for adopting a new business model, which should incorporate alternative fuel vehicles in the business process. Such a model would certainly minimize the overall BPCs in terms of fewer repairs and maintenance expenses, high tax incentives, government subsidies and less environmental taxes (King, 2008; Mai and Schlesinger, 2011; Nieuwenhuis and Wells, 2012).

On the other hand, sustainable business operations must be undertaken to mitigate the ill effects of climate change and avoid the negative impact of business operations on profit, people and the planet at large. Therefore, an integrated view of a business's economic, environmental and social performance is needed to tackle the present vulnerable situation (Seuring, 2004; Carter and Liane Easton, 2011; Pernestål *et al.*, 2020; AmaroVerneque *et al.*, 2021).

Another study by Palak *et al.* (2014) noted that efficient transportation minimizes the overall negative environmental impact and cost to the company. Adopting Full Battery Vehicles in business logistics is one of the structural changes in the supply chain. It can assist in mitigating the adverse environmental effects of carbon emissions (Tran *et al.*, 2012). Designing new business models considering sustainability is also a necessary part of the Environmental, Social and Governance (ESG) framework. EV-based business models could contribute to the sustainability of both business and the environment at large (Vasileiou and Morris, 2006; Vachon and Klassen, 2007; Jiao and Evans, 2016; Juan *et al.*, 2016).

Adopting alternative fuel vehicles in various aspects of the economy can pave the way for SD. However, adopting these vehicles in business processes requires more research support and technological advancement. Further, the usage of these vehicles can help to cut the overall fossil fuel import in the future and can assist in strengthening the economy at a more significant rate (Malik *et al.*, 2018; Narayan and Luthra, 2022). Business organizations would certainly gain many advantages by transitioning to EVs as it minimizes the overall organizational cost and maximizes productivity. Furthermore, it enhances the environmental concern and organizational reputation at large (Handfield *et al.*, 1997; Esty and Winston, 2009) [5].

The review of the literature revealed that past studies have attempted to emphasize only the wide significance of adopting EVs in business operations to achieve sustainability in the long run. However, the majority of earlier literature focused on the use of EVs only in the logistics industry and not in all other industries in a conceptual way (Smith, 2010; Kushwaha and Sharma, 2016; Narayan and Luthra, 2022). No studies have tried to evaluate EV adoption from business and industry perspectives. That is, empirical evaluations of the significance of EVs in the business house and their impact on profitability and sustainability should be

studied. So, the present study is intended to examine the perception of operations managers on the impact of EVs on BPCs and SD. The present study is thus focused on the use of EVs in any type of business house and their impact on overall BPCs and SD.

3. Research questions

Research questions show the direction for any research activities. The following research questions were framed based on the review of earlier studies and the literature gap identified:

(1) What are the costs and benefits of using EVs in business?

(2) What is operations managers' perception of the impact of EVs on business processes?

(3) How does the usage of E-vehicles impact SD?

4. Research objectives

From the literature gap and the analysis of conceptual aspects pertaining to the title of the paper, the following objectives are framed:

(1) To conceptually analyze the cost and benefits of using EVs in business processes.

(2) To analyze the perception of operations managers on the impact of EVs in the business process.

(3) To evaluate E-vehicle usage and its impact on SD.

5. Theoretical framework and hypotheses development

Designing a business model that strives to balance business processes and SD is an essential aspect of the contemporary business world (Mohan Das Gandhi *et al.*, 2006; Lamptey *et al.*, 2021; Dias, 2022). Such a business model certainly brings many opportunities and helps gain a huge market competitive advantage. Many strategies and methodologies can be induced in business processes to trade off between environmentally friendly operations and SD contribution of business (Pernestål *et al.*, 2020). The adoption of EVs in business processes is one of the most feasible ways to achieve this.

The use of EVs in the business process certainly alters the functions of business and minimizes the overall cost through different ways, such as

(1) Lower running cost of vehicles.

(2) Minimization of maintenance cost of fuel-based vehicles.

(3) Increased tax incentives on the use of EVs.

(4) Lowered environmental tax burden.

Reducing such costs contributes to minimizing the overall BPC (Nieuwenhuis and Wells, 2012; Pernestål *et al.*, 2020; Tyagi and Vishwakarma, 2022). Hence, it is hypothesized that ***(H_1)*** the use of EVs minimizes overall BPCs.

On the other hand, EVs used in the business process also help to undertake several other environmentally friendly activities, which in turn would contribute to SD at large (Vasileiou and Morris, 2006; Vachon and Klassen, 2007; Jiao and Evans, 2016; Juan *et al.*, 2016; Jain, 2022). Further, the adoption of EVs in business operations also helps a firm to enjoy sustainable leadership in the market.

Environmental benefits of using EVs in the business process may include the following:

(1) Reducing the carbon footprint of the organization.

(2) Improving employees' health and safety through ensuring better air quality and minimizing exposure to NO2 and other pollutants.

(3) Compliance with environmental regulations.

(4) Reduced exploitation of natural or non-renewable energy in a significant manner.

These environmental aspects of the use of EVs in the business process help to carry the business function in a sustainable way and in turn, it makes the company a sustainable organization [6], [7]. If business organizations operate across the globe and initiate EVs in their process, then it certainly supports the achievement of sustainable goals set by various international bodies. By this, it is hypothesized that ***(H_2)*** the use of EVs in the business process significantly contributes to SD (Figure 1).

6. Research methodology

6.1 Research design

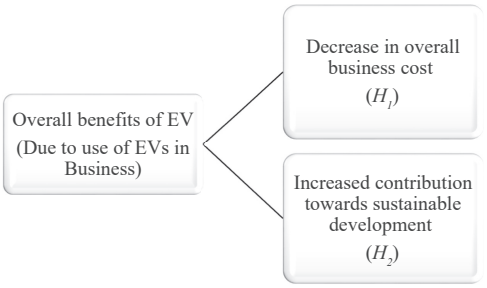
The present study combines quantitative and qualitative approaches, also known as the triangulation approach. This method uses multiple techniques to develop a comprehensive understanding of particular research issues in the most scientific manner (Patton, 1999; Cooper *et al.*, 2006; Tashakkori and Creswell, 2007). The quantitative data were collected through a well-structured questionnaire and qualitative data were collected through a focused group interview. Descriptive analysis is conducted to describe the managers' perception and inferential analysis is used to test the hypotheses.

6.2 Study population

Managers of operations of firms were selected as a study population. Here, the researcher collected the opinion of firms' managers to understand the cost and benefits of using EVs in business processes and their role in SD. Full-time operations managers who oversee the operations of the organizations are considered for the study. These managers are the right persons who have proper knowledge of business processes.

6.3 Instrument development

Since there is no standard measurement instrument in the published literature to measure the impact of EVs usage in Business Processes and on Sustainable Development through the cost



Source(s): Authors compiled

Figure 1.
Conceptual model

and benefits involved, researchers developed a questionnaire with a systematic and scientific procedure. They tested the validity and reliability of the tool developed.

(1) **Item generation**

With the help of previous studies and Focus Group studies, the researcher developed items to measure predetermined constructs, namely, *Business Process Cost (BPC)*, *Business Process Benefits (BPB)* and *Sustainable Development (SD)* from the managers' perception view. A focused group discussion was conducted among academicians, manufacturing staff, industrialists and accountants, and auditors. Each focus group consisted of five expert members (see Appendix). Open-ended questions were asked like, "What do you think of the use of EVs in the business process?" "Does the use of EVs reduce process cost?" and "How use of electric vehicles helps in SD?". The opinions were recorded and later conducted content analysis to generate a few items for constructs. In the initial stage, the researcher identified seven items for BPC, six for BPB, and five for SD. Later, after getting an expert opinion, it was reduced to five items in each construct. Table 1 shows the pool of items and the source used to develop the item.

6.4 Sampling procedure

To finalize the sample size, the two-step formulae method is followed. A pre-survey was conducted to find the population proportion in the first step. The researchers visited 100 organizations to find out whether those organizations used EVs during their business processes. Out of these 100 randomly visited organizations, only 9 were using EVs. Therefore, the population proportion for the current study is 9%. Based on population proportion, formulae are used to find sample size (Krejcie and Morgan, 1970). The final sample size derived is 138.

6.5 Type of data and data collection process

The present paper employs both primary and secondary sources of information. Secondary sources of information are gathered from published sources such as newspapers, survey reports published by the government ministry and other published academic research articles. The secondary sources were used to write literature and to develop a conceptual framework. The primary source of information is collected through a structured research questionnaire from the operations managers working in select firms in various industrial zones of Mysore city and collected primary data were used in the discussion part. A structured questionnaire was formulated after reviewing related literature and focused group discussions with the various experts (see Appendix). The structured questionnaire was distributed and administered to the operations managers of selected 150 organizations from the sample frame of 236 organizations that are using EVs in their business operations. The sample frame was prepared as per the information gathered from the regional transport office, Mysore. Out of the questionnaires distributed, 147 filled questionnaires were collected from the managers. Out of the received questionnaires, 144 were completed questionnaires. Accordingly, 138 completed questionnaires were randomly selected for further analysis as per the sample size determined.

6.6 Statistical tools used

Descriptive statistics such as Percentage, Mean and Standard deviation were used to describe the sample profile and managers' perceptions. Exploratory Factor Analysis is used to identify the factors representing perception and Confirmatory Factor Analysis was conducted to verify whether the identified items perfectly represent the factors. Cronbach's Alpha test, Composite reliability (CR), Average Variance Extracted (AVE) and Fornell and Larcker test

Factors	Items	Source/Support
Business Process Benefits (BPB)	The use of EVs minimizes overall mobility (both people and products) costs to the organization. (BPB1)	[1], [6]
	Repairs and maintenance costs of EVs are less than that of petrol and diesel alternatives. (BPB2)	[1], [6]
	Tax exemption, incentives and subsidies provided by the Government reduce the overall cost of business. (BPB3)	Focused Group, [1], [6], [7]
	The overall maintenance cost of EVs is less, and the initial cost is high. (BPB4)	[6], [7]
	The use of EVs helps in adopting eco-friendly green business operations. (BPB5)	Malik *et al.* (2018), Pernestål *et al.* (2020)
Business Process Cost (BPC)	The use of electric vehicles in business organizations minimizes overall costs. (BPC1)	[5], [6], [7]
	The initial investment in electric vehicles is high, but businesses can get depreciation benefits. (BPC2)	Focused Group [6]
	Due to the use of electric vehicles, the overall consumption of fuel is minimized. (BPC3)	Focused Group [6]
	Overall working capital requirements for businesses will be minimized after introducing electric vehicles. (BPC4)	[6], [7]
	Tax incentives and other benefits allowed by the Government on the use of electric vehicles positively impact the overall business process costs. (BPC5)	[4], [5], [6], [7]
Sustainable Development (SD)	Due to the use of electric vehicles in business logistics, carbon emission levels can be minimized. (SD1)	Sunderlin (1995), Sridhar (2012), Quak and Nesterova (2014), [4], [5]
	Using electric vehicles in business processes positively impacts the natural environment in which the business operates. (SD2)	Focused Group, Pernestål *et al.* (2020), [4]
	The use of electric vehicles maximizes the triple-bottom-line performance of the business. (SD3)	Pernestål *et al.* (2020), Tyagi and Vishwakarma (2022)
	The use of electric vehicles in business processes minimizes the exploitation rate of non-renewable energy. (SD4)	Focused Group [5]
	The adoption of electric vehicles for business processes is one of the sustainable business practices as it preserves non-renewable energy for future generations. (SD5)	[5]

Table 1.
Pool of items and their source/support

Source(s): Authors compiled

were conducted to test the validity and reliability of the instrument. Further, Structural Equation Model (SEM) was used to test the hypotheses and confirm the developed model.

6.6.1 Exploratory factor analysis. Exploratory Factor Analysis was used as a dimension-reduction technique to determine each item's factor loading. This allows the researcher to decide whether to retain or remove a particular item for further analysis (Fabrigar and Wegener, 2011; Cureton and D'Agostino, 2013). Therefore, the researcher conducted EFA, and the result is tabulated in Table 2.

The minimum factor loading criteria was set to 0.50 (Onwuegbuzie and Leech, 2005). Since the factor loading of each item is greater than 0.5, all items under each factor significantly

Factors	Items	1	2	3
Business Process Benefits (BPB)	BPB1	0.766		
	BPB2	0.745		
	BPB3	0.850		
	BPB4	0.720		
	BPB5	0.848		
Business Process Cost (BPC)	BPC1		0.771	
	BPC2		0.874	
	BPC3		0.818	
	BPC4		0.815	
	BPC5		0.829	
Sustainable Development (SD)	SD1			0.741
	SD2			0.822
	SD3			0.804
	SD4			0.745
	SD5			0.854

Source(s): Authors compiled

Table 2.
Construct and loadings

represent the respective constructs. Further, the Kaiser–Meyer–Olkin Measure of Sampling Adequacy showed 0.828 (accepted level greater than 0.7) and Bartlett's test of Sphericity showed p-value lesser than 0.001. This indicates that the correlation matrix is statistically significant.

6.6.2 Confirmatory factor analysis. The measurement models were tested using the structural equation modelling technique. IBM SPSS Analysis of a Moment Structures (AMOS) 24 was used to assess the goodness of fit, CR, convergent, and discriminant validity. Confirmatory Factor Analysis is a technique used to confirm items or factors which perfectly represent constructed factors (Hoyle, 2000; Fabrigar and Wegener, 2011; Brown and Moore, 2012; Cureton and D'Agostino, 2013). From the result of confirmatory factor analysis, all items perfectly fit each construct they represent (loading greater than 0.5). Later, fit indices are calculated to know the model's overall fit. The result of fit indices and the respective threshold levels set by Brown and Moore (2012) are tabulated in Table 3.

The table of fit indices exhibits that the fit indices of the model are acceptable for the three considered factors. Even though the p-value is less than 0.01, the sample size is good enough to ignore the limitation. Therefore, it was concluded that the three-factor model fits the data well.

6.6.3 Reliability and validity analysis. The CR coefficient was calculated for each factor to evaluate the internal consistency of items measuring the construct. Table 4 shows the CR and

Fit indices	Threshold level	Value
X^2/df		277.799/87
P	Insignificant	0.000
CMIN/df	≤5	3.193
SRMR	≤0.08	0.06
RMSEA	≤0.06	0.05
CFI	≥0.90	0.92
TLI	≥0.90	0.95
PGFI	Range of 0.50	0.70

Source(s): Authors compiled

Table 3.
Fit indices

AVE. Since CR coefficients are greater than 0.6, measures in the study are reliable (Hair *et al.*, 2012).

The opinion of experts in the industry and academia was taken to check the questionnaire's content validity; later, the AVE determined the convergent validity of the measures. If the average variance is greater than 0.5, then it establishes convergent validity (Fornell and Larcker, 1981). Since the AVE in respect of all three factors is greater than 0.5, it can be concluded that all measures showed convergent validity. According to Fornell and Larcker (1981), the diagonal values (square root of AVE) should be greater than vertical values (inter-correlation). Since all diagonal values (shown in italics values in Table 3) are greater than vertical values, this indicates the discriminant validity between the construct measures.

7. Sample profile

Questionnaires were distributed among the various operations managers working in the organization to know their perceptions of the use of EVs in business processes and their impact on the BPC and SD. Out of the total 150 managers selected for the data collection process, the researchers considered the perception of 138 managers as per the sample size determined. Among them, a majority of 47% were Production supervisors, 31.9% were Operations managers and 21% were Functional foremen. Researchers attempted to collect information from different industry categories and were able to collect data from the Manufacturing industries (59.4%), Service (20.3%) and Trading industries (20.3%). The experience of managers showed that while 37.7% have 10–14 years of experience, nearly 40% of them had an experience of more than 15 years in the industry. The sampling distribution shows that managers have adequate experience to give proper input regarding the study, and the researchers have covered the three sectors of the industry (Table 5).

	CR	AVE	MSV	ASV	BEN	BPC	SD
BEN	0.891	0.62	0.4624	0.442225	*0.787401*		
BPC	0.912	0.676	0.4225	0.4225	0.65	*0.822192*	
SD	0.895	0.631	0.9604	0.442225	0.68	0.65	*0.794355*

Table 4.
Validity measures

Source(s): Authors compiled

Demographic profile parameter	Categories	Frequencies	Percentages
Nature of industry	Manufacturing	82	59.4%
	Service	28	20.3%
	Trading	28	20.3%
	Total	138	100%
Designation	Operations manager	44	31.9%
	Production supervisor	65	47.1%
	Functional foremen	29	21%
	Total	138	100%
Experience	5–9	32	23.2%
	10–14	52	37.7%
	15–19	43	31.2%
	20 above	11	8%
	Total	138	100%

Table 5.
Demographic profile

Source(s): Authors compiled

8. Analysis and discussion

This section of the paper deals with analyzing and interpreting the collected data. The analysis has been classified into two parts based on the study's objectives. In the first part, the descriptive analysis and *t*-test have been employed to explain the managers' perception of the benefits of EVs on various aspects of business processes and SD. In the second part, an SEM was generated through AMOS and was used to test the relationship between variables.

8.1 Managers' perception of benefits of EVs on business process

The Industrial managers are the real observers and experienced persons who experienced the industrial working environment. In the case of new methods, technologies and resources employed in the business process, the impact of such new inducements is primarily observed by them, and their observation provides valuable input for modifications and further improvements. The employment of EVs in the business process is one such technological inducement. Therefore, the perception of industrial managers serves as a valid input for the present research. This section of the paper deals with the descriptive analysis of managers' perceptions of the benefits of EVs on business processes.

Table 6 shows the managers' perception of the benefits of EVs on business processes. The managers agreed that using EVs minimizes overall mobility costs, for both people and products, to the organization (M = 3.34), and the use of EVs helps adopt eco-friendly green business operations (M = 3.37). Further, the managers agreed that tax exemption, incentives and subsidies provided by the Government reduce the overall cost of business (M = 3.38), and repairs and maintenance costs of EVs are less than that of petrol and diesel alternatives (M = 3.25). The managers also agreed that though the initial cost of EVs is high, the maintenance cost is low (M = 3.25). The overall mean and standard deviation are 3.32 ± 1.19, which shows that managers agreed that the usage of EVs has positive benefits on their business process. One sample *t*-test was conducted to know the significance of the opinion given by managers' and the result shows a significant *p*-value of less than 0.01, which indicates that the opinion given by the respondent managers is statistically significant. Thus, it is clear that the use of EVs offers more benefits than fuel-based vehicles and business organizations can reap its benefits for their efficient performance (Pernestål *et al.*, 2020; Tyagi and Vishwakarma, 2022; Dias, 2022, [8]).

8.2 Managers' perception of the impact of EVs on BPC

The primary intention behind the use of EVs is to minimize the overall BPC [4], [5], [6], [7]. The actual impact of EVs on BPCs is witnessed by the managers working in the industry in which

	N	Mean	SD	t	Sig.
The use of EVs minimizes overall mobility (both people and products) costs to the organization	138	3.34	1.093	3.595	0.000
Repairs and maintenance costs of EVs are less than that of petrol and diesel alternatives	138	3.25	1.256	2.372	0.019
Tax exemption, incentives and subsidies provided by the Government reduce the overall cost of business	138	3.38	1.197	3.621	0.000
The overall maintenance cost of EVs is less, and the initial cost is high	138	3.25	1.241	2.297	0.023
The use of EVs helps in adopting eco-friendly green business operations	138	3.37	1.180	3.588	0.000
Overall	*138*	*3.32*	*1.19*	*3.10*	*0.000*

Source(s): Authors compiled

Table 6. Managers' perception of benefits of EV on business process

EVs are induced. So, by keeping this aspect in mind, the perception of managers on the impact of EVs on BPCs is analyzed. The descriptive analysis of their perception is presented in this section.

Table 7 shows that the managers agreed that the use of EVs in business organizations minimizes overall cost (M = 3.61) and agreed that due to the use of EVs, overall fuel consumption is minimized (M = 3.37). Further, managers also agreed that the initial investment in EVs is high. However, businesses can get depreciation benefits (M = 3.32), and tax incentives and other benefits allowed by the Government on the use of EVs positively impact the overall BPCs (M = 3.31). The managers agreed that the overall working capital requirement for the business would be reduced once the EVs are introduced (M = 3.29). The overall mean and standard deviation are 3.38 ± 1.27, indicating that managers agreed that using EVs positively impacts BPCs. One sample *t*-test was conducted to know the significance of the opinion given by managers' and the result shows a *p*-value less than 0.01, which exhibits that the opinion given by the respondent managers is statistically significant.

8.3 Managers' perception of the impact of EVs on SD

The primary reason for adopting EVs is that it is environmentally friendly and eliminates the consumption and exploitation of non-renewable natural resources. Further, it reduces carbon emissions (Sunderlin, 1995; Sridhar, 2012; Quak and Nesterova, 2014; Dias, 2022) and promotes green business operations (Malik *et al.*, 2018; Pernestål *et al.*, 2020; Jain, 2022). This, in turn, impacts on SD. Therefore, some survey questions have been framed to gather the perception of managers on the impact of EVs on SD. This section deals with the descriptive analysis of their perception regarding the impact of EVs on SD.

Table 8 shows that the managers agreed that using EVs in business processes minimizes the exploitation rate of non-renewable energy (M = 3.44) and positively impacts the natural environment in which the business operates (M = 3.40). Further, managers agreed that using EVs maximizes the triple-bottom-line performance of the business (M = 3.36) and that carbon emission levels can be minimized due to using EVs in business logistics (M = 3.33). Also, they agreed that adopting EVs for business preserves non-renewable energy for future generations (M = 3.25). The overall mean and standard deviation are 3.36 ± 1.19, indicating that managers agreed that using EVs in the business process helps SD. One sample *t*-test was conducted to know the significance of the opinion given by managers' and the result shows a *p*-value less than 0.01, which exhibits that the opinion given by the managers is statistically significant.

	N	Mean	SD	t	Sig.
The use of electric vehicles in business organizations minimizes overall costs	138	3.61	1.264	5.657	0.000
The initial investment in electric vehicles is high, but businesses can get depreciation benefits	138	3.32	1.261	2.969	0.004
Due to the use of electric vehicles, overall consumption of fuel is minimized	138	3.37	1.273	3.409	0.001
Overall working capital requirement for businesses will be minimized after introducing electric vehicles	138	3.29	1.268	2.685	0.008
Tax incentives and other benefits allowed by the Government on the use of electric vehicles positively impact overall business process costs	138	3.31	1.296	2.790	0.006
Overall	*138*	*3.38*	*1.27*	*3.502*	*0.002*

Source(s): Authors compiled

Table 7.
Managers' perception of impact of EVs on business process cost

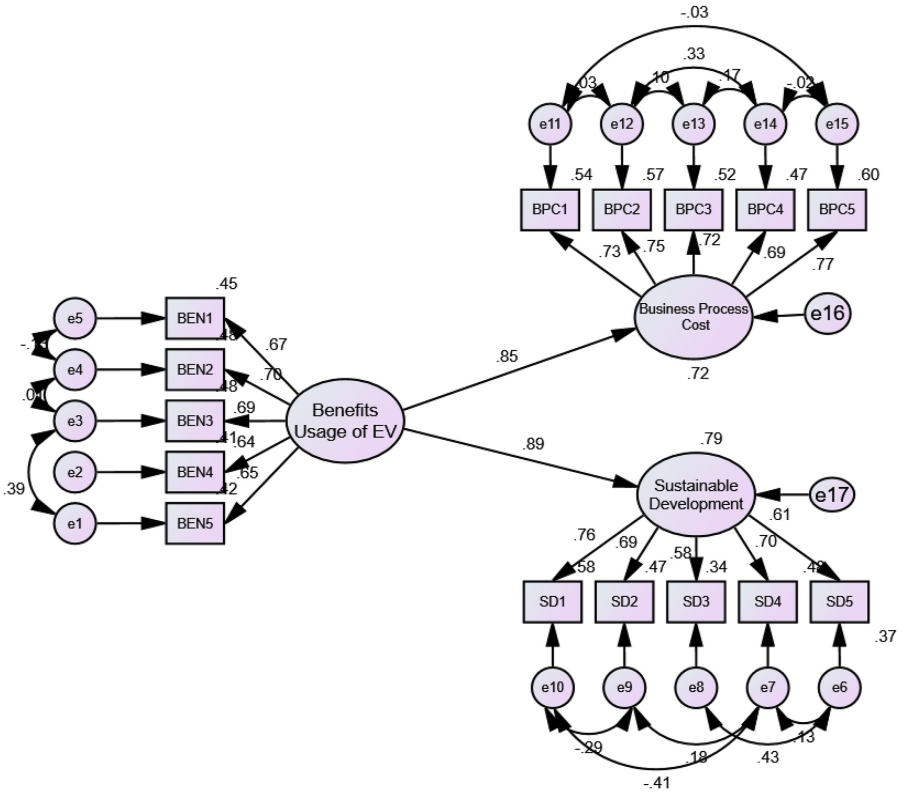
	N	Mean	SD	T	Sig.
Due to the use of electric vehicles in business logistics, the carbon emission level can be minimized	138	3.33	1.216	3.219	0.002
The use of electric vehicles in business processes positively impacts the natural environment in which business operates	138	3.40	1.231	3.762	0.000
The use of electric vehicles maximizes the triple-bottom-line performance of the business	138	3.36	1.193	3.510	0.001
The use of electric vehicles in business processes minimizes the exploitation rate of non-renewable energy	138	3.44	1.313	3.956	0.000
The adoption of electric vehicles for business processes is one of the sustainable business practices as it preserves non-renewable energy for future generations	138	3.25	1.237	2.340	0.021
Overall	*138*	*3.36*	*1.24*	*3.36*	*0.000*

Source(s): Authors compiled

Table 8. Managers' perception of impact of EVs on sustainable development

8.4 Structural model assessment

An SEM (see Figure 2) generated through AMOS was used to test the relationships between variables. A good fitting model is accepted if the value of the CMIN/df is <5, and the goodness-of-fit indices (GFI) (Hair *et al.*, 2010), the Tucker and Lewis (1973) index (TLI) and



Source(s): Author compiled

Figure 2. Tested model

the Confirmatory fit index (CFI) (Bentler, 1990) are >0.90 (Hair *et al.*, 2010, 2012). In addition, an adequate fitting model is accepted if the AMOS computed value of the standardized root mean square residual (SRMR) <0.05 and the root mean square error approximation (RMSEA) is between 0.05 and 0.08 (Hair *et al.*, 2010). The fit indices for the model shown in Table 6 lie within the acceptable range: CMIN/df = 2.402, GFI = 0.980, TLI = 0.954, CFI = 0.922, SRMR = 0.04 and RMSEA = 0.052.

The Squared Multiple Correlation estimated that the Benefits in Usage of EVs explain 72.4% of the variance in BPC. In other words, the error variance of BPC is approximately 27.6% of the variance in BPC itself. Likewise, Benefits in the Usage of EVs explain 79% of the variance in SD. In other words, the error variance of SD is approximately 21% of the variance of SD itself.

The Notes for the Model showed a Chi-square value of 730.168 (d. f = 304) with a probability value less than 0.01, which indicates that the model's covariance structure is significantly different from the observed matrix of the data. If the Chi-square p-value is <0.05, then the model is considered ill-fitting. However, since the sample size is large, it can be ignored.

The study evaluated the impact of EV usage on BPC (H1) and SD (H2). Table 9 shows that the Usage of EVs in Business Processes significantly impacts BPC (b = 0.851, t = 8.037, p < 0.01), and it also exhibits that the Usage of EVs in Business Process Significantly impacts SD (b = 0.889, t = 7.923, p < 0.01). Therefore, the researchers accept both hypotheses at a 1% significance level.

9. Practical implications for policy formulation

Several studies in their outcome (Liu *et al.*, 2020; O'Neill, 2020; Aktar *et al.*, 2021) reported that industries and transportation contribute more than 60% to carbon emissions. In addition to this, industries are facing huge costs on transportation due to an increase in diesel rates and employee retention problems due to health and safety matters. Though literature proved the benefits of EVs in the business process, the adaptation of EVs in business is in the hands of top management. Therefore, this study helps to identify the management perception (especially the Operations Manager) about the use of EVs in the business process. These industries are already using EVs in the business process and enjoying cost-reduction benefits. Further, they are significantly contributing to SD and getting a reputation from the government by allowing less carbon into the environment. The findings of the study help the managers of other firms to understand the benefit of EVs in the production process and sustainable environment. It also helps the government to understand the importance of EVs in the business process and they can bring more subsidies or other incentives to organizations for the use of EVs in the industries. The model developed by researchers helps

Hypothesized relationship	Standardized estimates (b)	t-value	p-value	Decision
Usage of EVs in Business Process significantly impact Business Process Cost (H_1)	0.851	8.037	0.000	*Accept* H_1
The usage of EVs in Business Process significantly impact Sustainable Development (H_2)	0.889	7.923	0.000	*Accept* H_2
R-Square				
Business Process Cost	0.724			
Sustainable Development	0.790			
Model fit				
CMIN/df = 2.402, GFI = 0.980, TLI = 0.954, CFI = 0.922, SRMR = 0.04 and RMSEA = 0.052				

Source(s): Authors compiled

Table 9. Estimates and fit indices

society to understand the impact of EVs on BPC and Benefit and their contribution to SD so that they can implement the use of EVs in their daily life too.

10. Conclusion

The purpose of the present research was to examine whether the use of EVs in the business process reduces the overall cost of operations and impacts SD at large. A self-constructed research instrument was used to evaluate the perceptual impact of EVs on BPCs and SD. The observations made during descriptive and inferential analysis revealed that the usage of EVs in the Business Process significantly impacts the BPC ($b = 0.851$, $t = 8.037$, $p < 0.01$), and it is also revealed that the usage of EVs in the business process can significantly impact SD ($b = 0.889$, $t = 7.923$, $p < 0.01$). These outcomes are consistent with the outcomes of (Smith, 2010; Palak *et al.*, 2014; Kushwaha and Sharma, 2016).

Finally, the study found that the adoption of EVs in the business process offers many benefits to business organizations such as minimized operational costs, eco-friendly business model, more tax incentives, less BPCs, low-emission footprint and contribution towards SD at large (Pernestål *et al.*, 2020; Tyagi and Vishwakarma, 2022). These results of the study add to the rapidly expanding field of research on the current topic and it also serves as one of the foundational research on EV-based business models.

The major limitation of this study is that it was only focused on BPCs and SD and not focused on other aspects such as challenges involved in the adoption of EVs and their maintenance. Further, the study focused only on the perception of operational managers and not focused other experts. A further study could focus on these aspects to expand the research on the current topic and to build strong theoretical models which may support business organizations to reform their existing business model with the help of EVs.

Further, continued efforts are needed to make use of an EV-based business model to a larger extent. In the near future, environmentally friendly business models like EV-based models will become the solutions to changing business and environmental needs to reach SD goals (Malik *et al.*, 2018; Pernestål *et al.*, 2020; Jain, 2022).

Thus, the present study concludes that there is always a need to employ new methods and technologies in business operations to reap the benefits both in the context of business and the environment at large. The use of EVs in business would eradicate many logistic challenges such as the high cost of fuel, large emission footprint and higher environmental tax, among others (Sunderlin, 1995; Sridhar, 2012; Quak and Nesterova, 2014). Therefore, it may be concluded that EVs will be the primary source for business transportation in the near future and would offer many tangible and intangible benefits such as simplifying the business process, minimizing the overall logistics costs, improving profitability and contributing to SD at large. Thus, adopting EVs in the business process would help promote green business initiatives by preserving natural resources and regulating the harmful effects of carbon emissions. In the long run, these initiatives would serve all the business stakeholders, including the owners, employees, consumers, society, Government and the environment. Further, the outcome of this study may also become an input to the business organizations operating across the globe to redesign their business model with the help of EVs.

Notes

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Appendix

Sl. no.	Focus group	Background	Members
1	Academicians	Operations Management, Sustainable Development, Innovations in Business, Accounting, Finance and Cost Management	5
2	Manufacturing staff	Operations, Production and Supply Chain Management	5
3	Industrialists	Manufacturing and Service	5
4	Accountants and Auditors	Taxation, Costing, Finance and Cost Management	5
Total			*20*

Source(s): Compiled by the researchers

Table A1. Details of focus group interview

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