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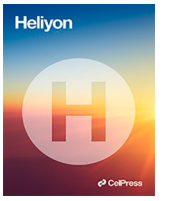

Research article

Analysis of environmental and socioeconomic impacts of industrial parks in Ethiopia

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ABSTRACT

To promote sustainable industrialization, Ethiopia began implementing industrial park development in 2015 as a better policy approach. The study sought to investigate the positive and negative economic, social, and environmental impacts of the country's industrial parks with a purposively selected representative sample size. It used an approach with mixed methods of data collection, analysis, and presentation. With a set of the identified impact indicators from the relevant literature, data were collected through questionnaires, key informant interviews, observation, and review of official documents. By using IBM SPSS Version 26, the quantitative data strand was set into descriptive analysis. Results with a higher average level of respondents' agreement on the survey items were discussed, interpreted, and triangulated with the qualitative analysis. Thus, the study revealed the overall positive environmental (66.8 %), economic (71.4 %), and social (73 %) impacts and the overall negative environmental (65.8 %), economic (66.7 %), and social (65.2 %) impacts of the currently operating industrial parks of the country. From the findings, the paper concluded that even though the parks generate significant positive sustainability impacts, they also generate undeniable negative impacts. To this end, it suggested strategic measures that can maximize the overall positive impacts of industrial park development while minimizing its negative impacts within the country's context. Lastly, by recognizing the study's limitations, the authors indicated future research directions that need deep and multi-level investigations.

1. Introduction

With the emergence of Industrial Revolution, some countries (e.g., England, Germany, and Japan) started implementing the concept of industrial park to foster manufacturing activities in a demarcated area. Presently, it is getting attention as a better approach to fostering industrialization within the notion of sustainability [1–3]. In this regard, the frequently used definition of an industrial park is "a collection of manufacturing and/or service companies operating together in a delineated area aiming at achieving collective and individual objectives of the economic, environmental, and social benefits" [4–6].

The well planned and successful industrial parks development could play a vital role in promoting balanced regional development that can accelerate sustainable industrialization and systematic urbanization [7,8]. As a policy tool, it has a significant contribution to addressing the negative environmental and socioeconomic impacts of manufacturing sector, especially in developing countries [9–11]. Supporting this, experiences around the world (e.g., in China, Vietnam, Singapore, and South Korea) indicate that fostering sustainable

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industrial parks development has become a significant vehicle that could provide a competitive environment for the takeoff of an economy's industrial sector [12,13]. Thus, it can be used as a suitable tool to implement the approaches, policies, and economic reforms that can accelerate sustainable industrialization by introducing green manufacturing technologies, fostering a transparent legal framework, encouraging feasible fiscal incentives, and applying modern management practices and effective governance mechanisms [14,15]. However, global trends and empirical evidence show that there are mixed results of failure and success when investigated based on the specific contexts of the host countries [16,17]. Substantiating this, a significant number of studies so far conducted in different countries have identified that industrial parks have never been free from challenges and generating negative impacts [14,18,19]. Failing to manage the selection and implementation of contextual policy frameworks and implementation strategies could worsen the related negative socio-economic and environmental impacts [20–22]. Therefore, it is rational conducting a country-specific investigation of industrial park development to suggest a way forward for maximizing its overall positive economic, environmental, and social impacts in Ethiopia [23–25].

In 2015, the country started industrial park development as a better policy approach to realize the goals of sustainable industrialization. According to the Proclamation No. 886/2015 [26], the regulatory objectives are planning, designing, developing and operating industrial parks; enhancing their contribution to building industrial and technological infrastructures; encouraging the private sector involvement; building local economic competitiveness; creating sufficient job opportunities; and overall realizing the sustainability objectives of the country's industrial development. Thus, it can be undertaken by any private, public-private, or public enterprise.

To build a competitive business environment, the country is trying to implement streamlined regulatory procedures that create access to land and basic infrastructure, one-stop-shop platform to deliver efficient administrative services, and provide aftercare services to investors in all industrial parks. Currently, with apparel and textiles, leather and leather products, pharmaceuticals, and agro-processing industries, it hosts 24 industrial parks in which 237 active companies are operating (www.ipdc.gov.et). As of 2022, the official reports show that the companies have generated more than 118,000 employment and a total of USD 311.5 million in exports. Besides, they are contributing to minimizing the economic, social, and environmental challenges of resident urban areas [27–29]. Hence, insights from the official reports and empirical studies show that the parks are significantly contributing to minimizing the sustainability challenges of its industrialization [8,28].

Nevertheless, empirical evidence and a substantial number of previous studies showed that the current regulatory framework of Ethiopia's industrial parks development is experiencing irrefutable challenges and limitations, including the lack of related contextual standards and guidelines; knowledge gaps and inadequate experience; overlapping responsibilities regarding the designing, developing, and operating of industrial parks; weak coordination of government institutions at different levels; poor legal frameworks and procedures for location decisions and land acquisition; and failure to define the pertinent objectives based on the principles and framework of promoting sustainable industrial parks [14,28–30]. These challenges and limitations are triggering the Parks to generate unwanted negative environmental, economic, and social impacts. Accordingly, it needs to strategically address the challenges so as to maximize the pertinent positive impacts. However, the overall related positive and negative impacts are inadequately studied to the country's best context.

Among a few previous studies, Tesfaye [30] investigated the institutions and role of state actors for implementing industrial parks development program in the country and thus revealed inadequate capital for technology transfer; incompetent business environment for the non-resident small and medium enterprises; and inefficiency of existing Parks to meaningfully support sustainable local socio-economic development. Another study by Azmach [31] assessed the legal and regulatory frameworks regarding industrial park development, thus identifying issues that need reform. Moreover, the work of Aynalem [32] has endeavored to investigate the potential opportunities and challenges of industrial parks development in Ethiopia from the perspectives of key stakeholders through comparative analysis of the domestic context against the selected experiences of other countries. While these studies add value to the growing body of knowledge on industrial park development considering the country's specific context, they focused only on limited aspects of the process when seen within the framework of the basic sustainability dimensions industrial parks development. Thus, there is a huge research gap concerning the overall positive and negative impacts of Ethiopia's industrial parks development. Besides, the country lacks an appropriate strategy framework that can boost the pertinent overall positive economic, social, and environmental impacts amid the emerging global dynamism combined with the internal and external determining factors of the parks' success. Therefore, the study sought to contribute to filling this gap by investigating the positive and negative environmental, economic, and social impacts of the country's industrial parks by using the purposively selected representative sample. Therefore, its specific objectives are:

a. Investigating the positive and negative environmental, economic, and social impacts of Ethiopia's industrial parks
b. Recommending the contextual strategic measures that could enhance and sustain the overall positive impacts of industrial parks development in the country

The subsequent part of this paper covers five sections. It begins with a review of relevant literature. The succeeding section presents an overview of Ethiopia's industrial parks development. The third section reports the study area description, overall methodological approach used, and ethical concerns. The fourth section briefly discusses the study's main findings and related implications. The last section presents the main conclusions, suggested strategic measures, limitations of the present study, and future research focus areas.

2. Literature review

2.1. The need for sustainable industrialization

Industrialization enables countries to achieve structural economic transformation to high productivity and strong competitiveness [20,33]. It has a paramount contribution to realizing a country's sustainable development [8,34]. In support of this, the 2030 agenda of Sustainable Development underlines the need for promoting inclusive and sustainable industrialization [35,36].

Accordingly, SDG[1]9 is set in light of the process and stated as *"building resilient infrastructure, promoting sustainable industrialization, and fostering innovation"* [33]. It has been noted from experiences across the world that when a suitable industrial policy is implemented within their specific context in the presence of an efficient institutional setup, countries can achieve the sustainability objectives of industrial development [11,37,38]. Hence, countries need to promote inclusive and sustainable industrialization to achieve the objectives of structural economic transformation.

2.2. Industrial parks development for promoting sustainable industrialization

From the very concept of sustainability, an industrial park development could be explained by balancing the essential dimensions (economic, environmental, and social) of the process in all stages [39–41]. In other words, its successful implementation can meaningfully contribute to achieving the objectives of sustainable industrialization, urbanization, and regional development [9,42,43]. Thus, as regional and urban planning tool, industrial parks can accelerate systematic urbanization, pioneer the formation of new cities, and support balanced regional development [44–46]. As an industrial development policy approach, it can encourage entrepreneurship and provide economic advantage to modernize the manufacturing sector, enhance productivity and profit by decreasing costs of production, improve the quality of products, upgrade skills, promote labor quality, encourage the use of green manufacturing technologies, and thus promote sustainable industrialization [47,48].

2.3. Sustainability impacts of industrial park development

Since developing countries with emerging economies strive to achieve sustainable industrial outputs, there is an insistent need to promote efficient resource consumption to meet their social development and environmental safeguard objectives [8,33,49]. The relevant literature insights and empirical evidence show that industrial park development and operation can significantly promote sustainable industrialization, thus creating significant positive environmental, economic, and social impacts [25,50]. However, several studies revealed that the process is not free from generating negative impacts [51–53].

There are various factors that determine the overall impacts of the country's industrial park development. These may vary across countries because of the differences in their contexts.

Thus, it is difficult to get uniform criteria framework with common indicators applicable to all countries for investigating industrial park development impacts [14,54,55]. For this study, the authors used a contextual and flexible set of indicators compiled from the relevant literature based on their relevance, specificity, measurability, sensitivity, data availability, and stakeholder input. Accordingly, Table 1 displays that a total of 19 indicators categorized under the themes of industrial parks' positive economic, environmental, and social impacts; and 16 indicators categorized under themes of the relevant negative impacts were selected for collecting and analyzing the quantitative data set.

3. Overview of industrial parks development in Ethiopia

To achieve structural economic transformation and become a middle-income country, Ethiopia has committed to promoting sustainable industrialization as an engine of its development. However, the main challenges of the country's industrialization include inadequate raw material supply, insufficient investment capital, poor production technologies, insufficient skilled labor, institutional inefficiency, poor trade facilitation systems and logistics, and natural resource depletion and environmental pollution (www.ipdc.gov.et). Indeed, deep structural economic transformation to more productive sectors is the only way to address and tackle the prevailing problems and challenges of the country. To this end, the country started undertaking industrial parks development with the key objectives, including "enhancing the contribution of the manufacturing sector to the national economy; improving the resilience and sustainability of economic growth; and generating foreign direct investment and enhancing exports; increasing foreign exchange reserve; diversification of finance sources for investment of state-owned enterprises; and moving the country's industrialization from state-led to private-led" [14,59,60].

According to the 2022 official report of IPDC,[2] 4 Agro-processing Industrial Parks owned by the National Regional State Governments; 13 Industrial Parks owned by the Federal Government through IPDC; and 7 private Industrial Parks are operating in the country (Table 2). Currently, all the Public Industrial Parks cover a total of 2.66 thousand hectares of land size. They created 83 thousand jobs and generated USD 311.5 million in exports. Similarly, as of 2022, the Private Industrial Parks are operating on 1.98 ha of land; thus, generated USD 43.7 million in exports and nearly 35 thousand job opportunities [8]. Nevertheless, the prevailing context

[1] Sustainable Development Goal 9.
[2] Industrial Parks Development Corporation of Ethiopia.

Table 1
Impact factors of industrial park development.

Positive Impacts	Indicators/Criteria of Assessment	Sources
Economic	Improves the inflow of foreign direct investments	[56,57]
	Promotes sustainable local socioeconomic development	[6,51]
	Contributes to managing the challenges of economic development	[24]
	Improves the supply of goods to both domestic and global markets	[6,51]
	Enhances technology transfer, skill upgrading, and productivity	[52]
	Contributes to the increasing export values and local budget	[6,51]
	Creates better employment opportunities	[53]
	Contributes to the development of better infrastructure systems	[6,51]
	Improves local economic efficiency and foreign exchange earnings	[6,51]
Environmental	Increases the implementation of environmental safeguard mechanisms	[13,53]
	Contributes to controlling pollution by reducing greenhouse gas emissions	[52]
	Improves land use management efficiency of manufacturing enterprises	[13,51]
	Improves water use efficiency by enhancing waste water recycling & reusing	[52]
	Promotes efficient energy use management	[13,51]
Social	Improves working conditions by changing labor structure	[6,51]
	Enhances employees' capacity and manufacturing skills	[53]
	Increases social and cultural diversities	[6,51]
	Creates better social infrastructure and other forms of services	[24]
	Promotes community participation and guarantee local security	[13,51]
Negative Impacts	**Indicators/Criteria of Assessment**	**Sources**
Economic	Increasing cost of attracting enterprises to fill up industrial parks	[52]
	Increasing training and production costs	[6,51]
	High cost of investment to build infrastructure for attracting foreign companies	[3,58]
	Increases the cost of technology exchange that causes price changes	[6,51]
	Creates illegal linkages between informal economic activities	[53]
	Causes involuntary resettlement and loss of agricultural land	[6,51]
Environmental	Causes landscape disturbance and loss of biodiversity	[52]
	Creates soil contamination that can lead to long-term ecosystem damage	[6,51]
	Generates noise, lighting, and massive transport causing local nuisances	[52]
	Increases traffic congestion and vehicle emissions that affect air quality	[6,51]
	Generates secondary pollution caused by inefficient recycling system	[52]
Social	Causes displacement & social conflicts (e.g., land use rights, labor issues)	[3,58]
	Increases strain on social infrastructure and public services	[6,51]
	Generates social instability (social evils, strikes, protests, etc.)	[52]
	Causes loss of cultural identity due to the influx of migrant workers	[6,51]
	Affects public health if there is poor occupational health & safety system	[52]

shows that the country is far from achieving the intended sustainability objectives of its Industrial Parks. Fig. 1 exhibits locational distribution of the presently operating Industrial Parks in Ethiopia.

Overall, the country's Industrial Parks development program has promising results regarding its positive socioeconomic and environmental impacts amid the existing challenges and constraining factors. Table 2 summarizes the current status in Ethiopia.

4. Materials and methods

4.1. Study areas

For the purpose of this research, Adama IP, Bole Lemi-1 IP, Hawassa IP, Bulbula IP, and Eastern Industry Zone were purposively selected based on some criteria that the authors thought could help in identifying the representative sample size by considering the country-specific situation. Thus, the selection criteria include the Industrial Parks' ownership and governance approach, total land size coverage, resident industries, level of operation, number of tenants, number of employees, level of export & foreign exchange earnings, location & accessibility to essential infrastructure, and environmental safeguard management status. Accordingly, Table 3 describes the selected industrial parks, and Fig. 2 exhibits their locational distribution.

Adama Industrial Park. It is located in the Adama City Administration, 74 km from Addis Ababa. In 2018, it started operation with 19 sheds. The park offers world-class infrastructure, including water supply, ICT connectivity, and reliable power supply, thus making it a better location for manufacturing firms to run their operations. It focuses on garments, apparel, and machinery production with 100 % exports. Currently, the Park is in its full operational status with possible future expansion. As of 2022, it generated 11,900 employments and USD 16.55 million exports with average environmental safeguard management status (www.ipdc.org.et).

Bole Lemi-1 Industrial Park. It was established on 353 ha of land as the first Public Industrial Park in the country, and is located in the Addis Ababa City Administration. Currently, it is fully operational and hosts14 resident companies from Taiwan, China, India, South Korea, and America with apparel, textile, and leather manufacturing firms. As of the 2022 official report, they generated nearly 21,737 employees and USD 33.1 million in exports.

Hawassa Industrial Park is the first Public Eco-Industrial Park that was established in 2016, and is located in the Hawassa City

Table 2
Summary of industrial parks in Ethiopia.

Industrial Parks Owned by the Private Sector				
Industrial Parks	Main Industries	Locations	Area (hectares)	Status
Huajian	Textile, Apparel & Leather	Addis Ababa	138	Operational
George Shoe	Leather	Modjo, Oromia	86	Operational
Eastern Industry Zone	Mixed	Dukam, Oromia	400	Operational
Vogue	Textile & Apparel	Tigray	178	Operational
DBL	Textile & Apparel	Tigray	78	Operational
CCCC[a]	Construction Materials	Amhara	100	Operational
CCECC[b]	Mixed	Dire Dawa	1000	Operational
Industrial Parks Owned by the Federal Government				
Industrial Parks	**Main Industries**	**Locations**	**Area (hectares)**	**Status**
Bole Lemi-1	Textile, Apparel & Leather	Addis Ababa	353	Operational
Hawassa I	Textile & Apparel	Hawassa, Sidama	140	Operational
Kombolcha	Textile, Apparel & Leather	Kombolcha, Amhara	75	Operational
Mekelle	Textile & Apparel	Mekelle, Tigray	75	Operational
Adama	Textile, Apparel & Machinery	Adama, Oromia	120	Operational
Jimma	Textile, Apparel & Leather	Jimma, Oromia	75	Operational
Bahir Dar	Textile & Apparel	Bahir Dar, Amhara	75	Operational
Debrebirhan	Textile & Apparel	Debrebirhan, Amhara	100	Operational
Dire Dawa	Textile, Apparel & Machinery	Dire Dawa	150	Operational
Addis Industry Village	Mixed	Addis Ababa	9	Operational
ICT Park	ICT	Addis Ababa	200	Operational
Kilinto	Pharmaceutical	Addis Ababa	279	Operational
Semera	Mixed	Semera, Afar	50	Operational
Agro-Industrial Parks Owned by the National Regional State Governments				
Industrial Parks	**Main Industries**	**Locations**	**Area (hectares)**	**Status**
Bulbula	Agro-processing	Oromia	263	Partly Operational
Yirgalem	Agro-processing	Sidama	176	Operational
Baeker	Agro-processing	Tigray	259	Partly Operational
Bure	Agro-processing	Amhara	260	Operational

[a] China Communications Construction Company.
[b] China Civil Engineering Construction Corporation.
Source: [8].

Administration at 275 km South of Addis Ababa. The Park covers 140 ha of land in its first phase with the apparel, garment, and textile manufacturing industries. It has a Zero-Liquid Discharge facility to treat and recycle the wastewater discharge from the resident manufacturing companies, thus minimize pollution and the related negative environmental impacts. According to the 2022 official report, the 24 manufacturing companies operating in the Park generated 33,783 employment opportunities and USD 62.5 million in exports (www.investethiopia.gov.et)/(www.ipdc.org.et).

Eastern Industry Zone is located in the Dukam City Administration of Oromia, and the first Private Industrial Park of the country. It is fully operational with mixed manufacturing industries on 400 ha of land. Currently, 132 companies are operating in the Eastern Industry Zone, with nearly 22,110 employees. According to the 2022 report of the Ethiopian Investment Commission, it generated USD 15 million in exports (www.investethiopia.org.et).

Bulbula Integrated Agro-processing Industrial Park is located in the Oromia Region and covers 263 ha of land. It was established and put in operation aiming at promoting the expansion of agro-processing industries in the region. Thus, it is expected to enhance the processing of agro-value chains, including fruits, vegetables, dairy, honey, and poultry. Currently, it is in a partial operation status with 12 companies and 12,700 employees and can generate more than 100,000 jobs when fully operational (www.moi.gov.et).

4.2. Methodological framework of the study

The type and choice of a study's methodological framework is determined by the nature of the study [61]. Because of this, it applied pragmatic research philosophy to develop and implement a methodological framework that enabled achieve the objectives as it attempts to fit together insights from the qualitative and quantitative analyses into workable solutions; it offers immediate middle position assumptions with practical and outcome-oriented methods of inquiry; it allows pluralistic approach to understand the research problem; and flexibility of reasoning and selection of techniques that can help to address a range of research questions [62,63]. Thus, to achieve the present study's objectives, a methodological framework involving mixed methods was used by triangulating the related issues that helped to ensure the credibility and validity of the methods and the quality of the findings (Fig. 3).

4.3. Research design and methods

The type of research design used when undertaking a study depends on its objectives [62]. Since investigating the overall impacts of

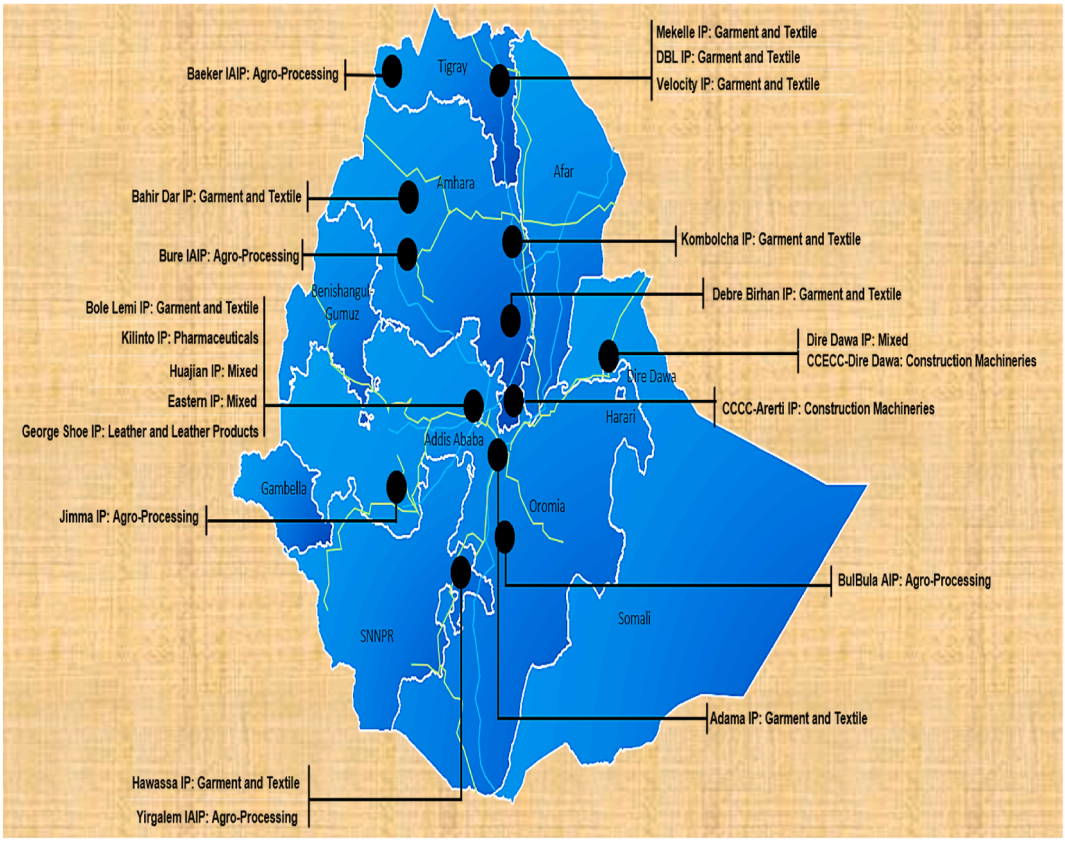

Fig. 1. Locations of the operating industrial parks in Ethiopia.
Source: (www.investethiopia.gov.et)

Table 3
Descriptions of the selected industrial parks.

Criteria	Adama IP	Bole Lemi-1 IP	Hawassa IP	Bulbula IP	Eastern IZ
Ownership	Federal Government	Federal Government	Federal Government	Regional Government	Private
Location	Adama, Oromia	Addis Ababa	Hawassa, Sidama	Bulbula, Oromia	Dukam, Oromia
Total Land Size	120 ha	353 ha	140 ha	263 ha	400 ha
Main Industries	Textile, Apparel & Machinery	Textile, Apparel & Leather	Textile & Apparel	Agro-processing	Mixed
Level of Operation	Fully Operational	Fully Operational	Fully Operational	Partly Operational	Fully Operational
No. of Tenants	7	14	24	12	132
No. of Employees	11,900	21,738	33,783	12,700	22,110
Current Export	16.5 mil USD	33.1mil USD	62.5 mil USD	–	15mil USD
Environmental Management Status	Average	Average	Above Average	Average	Below Average

Source: (www.ipdc.org.et/www.investethiopia.gov.et)

a country-specific industrial park development using the basic sustainability dimensions is a complex process, it requires different data sets of quantitative and qualitative nature. Thus, the research design of the present study used combined data collection, analysis, and presentation methods with purposively selected representative sample sizes of the target populations.

4.3.1. Type and sources of data

Both primary and secondary data sets were used for this study. Accordingly, the primary data set was collected from the sources, including the purposively selected senior experts and officials of the country's Industrial Parks Development Corporation, Investment Commission, Environmental Protection Authority, Ministry of Industry, Urban and Infrastructure Development Ministry, National

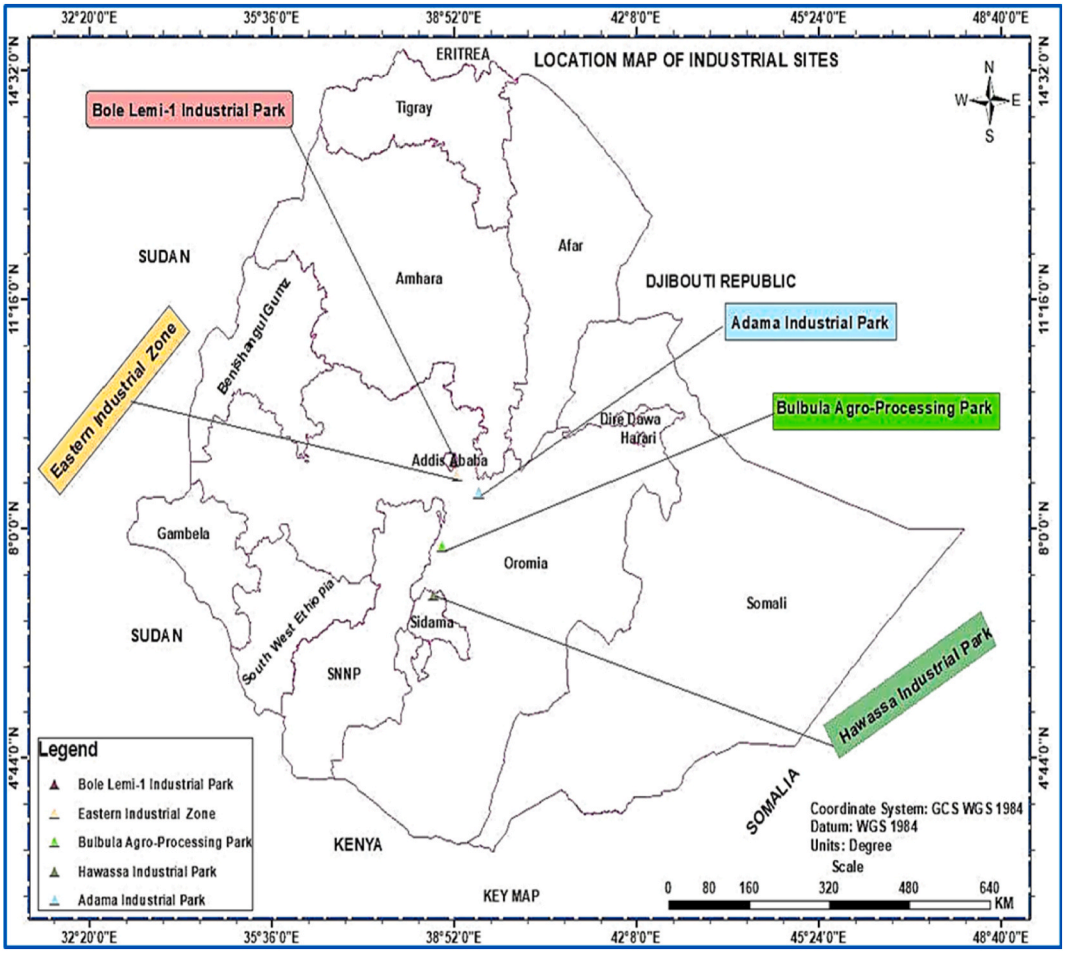

Fig. 2. Locational distribution of the selected industrial parks.

Regional State Government Institutions, and the City Administrations where Industrial Parks operate; experts and managers who are working at the Parks' Management Offices; owners and employees of the resident firms; local community members; and other stakeholders. The secondary data set was collected from the sources, including government proclamations, policies, strategies, planning, and reports; books, journal articles, and previous studies conducted in the country; and the related official webpages and links.

4.3.2. Sampling design

The research objectives and nature of the target population determine the sample size to be considered for data collection and analysis [64]. For this study, the selected target populations' sampling frames include managers and senior professionals working in the industrial parks' management office; owners of the resident firms and the local employees; professionals and officials in the selected government institutions; local community representatives; and other stakeholders. For the qualitative data strand, snowballing and purposive sampling techniques were used to select participants of key informant interviews from the Federal Government Institutions, the National Regional State Government Institutions, City Administrations, and Research Institutes. Accordingly, 38 key informants with the required professional mixes, average years of experience, and proportion were engaged (Table 4).

For the quantitative data collected by survey questionnaires, the study used purposive sampling to select an appropriate sample size of the respondents from the identified target populations based on the study themes. As a result, 133 respondents were purposively selected and participated. Table 5 presents the sampling frame and corresponding sample size of the respondents.

4.3.3. Data collection, analysis, and presentation

Based on the research themes, the authors compiled impact indicators of Industrial Parks development from the relevant literature and official documents, thus identifying and using country-specific assessment criteria within the notion of sustainability (Table 1) for the data collection, analysis, and presentation.

The study applied mixed techniques of data collection that includes questionnaires, structured interviews, and observation. The

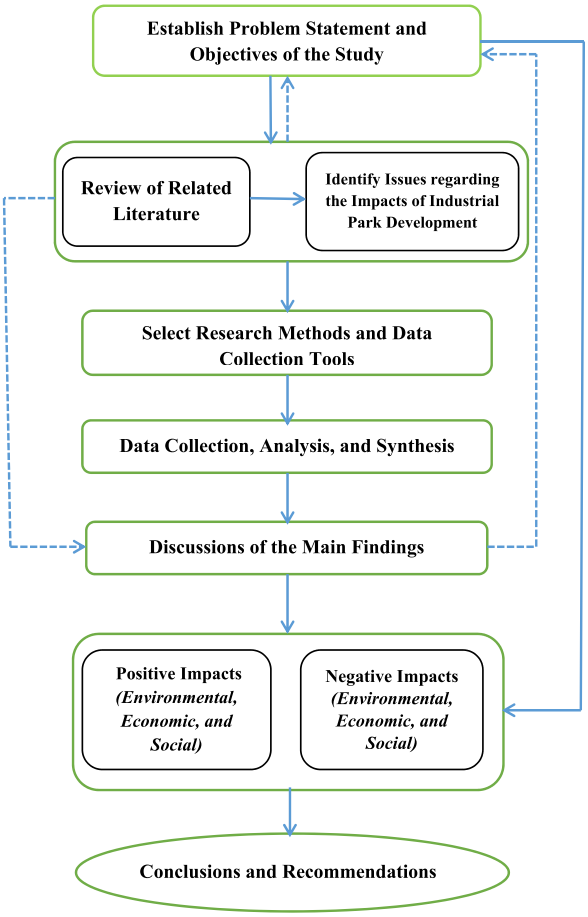

Fig. 3. Methodological framework of the study.

Table 4
Participants' profession and average work experience.

S/N	Profession	Ave. Years of Experience	Number of Participants	Percentage
1	Government Officials	15.8	4	10.53
2	Managers	12	5	13.16
3	Economists	9.6	5	13.16
4	Environmentalists	8.7	4	10.53
5	Sociologists	9	3	7.89
6	Lawyers	12	5	13.16
7	Urban Planners	13	3	7.89
8	Engineers	11.4	6	15.79
9	Researchers	7.8	3	7.89
Total		11.03	38	100 %

research type and corresponding nature of data sets determine the type of data analysis and presentation methods [65]. Thus, the present study implemented mixed methods for data analysis to interpret, discuss, and triangulate the findings. First, the qualitative data set from the key informant interviews, observation, and relevant document review was subjected to an in-depth thematic analysis to scrutinize the overall impacts of industrial parks in Ethiopia. Second, after the qualitative data analysis, the study analyzed quantitative data sets from the survey questionnaire to ensure data validity and reliability.

Many scholars suggest that the reliability of a quantitative data set with Cronbach Alpha (α) value of .7 and higher is acceptable for analysis [66,67]. Accordingly, the quantitative data set of this study is found reliable with Cronbach Alpha (α) values of greater than .7 (>.7) (Tables 7b and 8b). Both the Shapiro-Wilk and Kolmogorov-Smirnov tests indicate that all the significant values are greater than the required normality criteria ($P > 0.05$), confirming normal distribution of the data set that was put into descriptive analysis by using IBM SPSS Version 26 software. To this end, the study used a Five-Point Likert Scale (1 = Strongly Disagree; 2 = Disagree; 3 = Moderately Agree; 4 = Agree; and 5 = Strongly Agree) to rate the average level of respondents' agreement on the impact assessment

Table 5
Institutional proportions of the respondents.

S/N	Institutions	No. of Respondents	Percentage
1	Ministry of Industry	5	3.8
2	Urban and Infrastructure Development Ministry	6	4.5
3	Investment Commission	7	5.3
4	Industrial Parks Development Corporation	8	6
5	Environmental Protection Authority	3	2.2
6	Industrial Park Management Offices	9	6.8
7	Owners of the Resident Firms	12	9
8	Employees Working in the Resident Firms	26	19.5
9	National Regional State Government Institutions	4	3
10	Offices of the Resident City Administrations	5	3.8
11	Local Community Members	38	28.6
12	Other Stakeholders	10	7.5
Total		133	100 %

items included in the survey questionnaires. Using the mean scores and standard deviation values, the study considered that results with the highest average level of agreement represent the respondents' general opinion.

Tables, graphs, charts, and text formats present the results to enhance the description and visualization of the quantitative data analysis. Finally, the interpretation of the quantitative results was triangulated with the qualitative analysis to identify the main findings for discussion.

4.4. Ethical considerations

The study was conducted in accordance with the standard ethical requirements of academic research. A copy of official letter requesting the participants' consent and sincere cooperation to participate in the study was submitted to the selected government institutions, industrial parks management offices, resident manufacturing firms, and the City Administrations where the parks are located. After sufficiently briefing the participants on the study's purpose and every detail of their participation, the authors obtained informed consent. Before conducting key informant interviews, survey questionnaires, and observation, the participants were assured that all the data and information collected from them would be strictly confidential so that no one would access their identities or opinions. It was also made clear that the participation was voluntary.

Table 6
Summary of respondents' demographic characteristics.

Respondents' Characteristics	Frequency	Percentage (%)
Categories of the Respondents		
Industrial Park Managers	5	3.8
Environmentalists	10	7.5
Engineers	13	9.8
Economists	11	8.3
Sociologists	8	6
Owners of the resident firms	12	9
Employees working in the firms	26	19.5
Local community members	38	28.6
Other Stakeholders	10	7.5
Gender		
Male	113	85
Female	20	15
Age		
20 to 29	38	28.6
30 to 44	80	60.2
45 to 59	15	11.2
Level of Education		
Level I- IV	3	2.3
BA/BSC Degree	21	15.7
MA/MSC Degree and Above	109	82
Overall Work Experience		
1–5 years	10	7.5
6–10 years	44	33.1
11–15 years	44	33.1
16 years and above	35	26.3

5. Results and discussions

5.1. Characteristics of the respondents

A summary of the respondents' key characteristics, comprising their gender, age, position and profession, level of education, and overall work experience, is presented in Table 6. Of the total respondents to the survey questionnaires, a higher proportion were male, i.e., 85 % (n = 113), and nearly 15 % (n = 20) were female. Regarding the ages of the respondents, about 28.6 % (n = 38) were in the range of 20–29 years of age. Nearly 60.2 % (n = 80) and 11.2 % (n = 15) were in the ranges of 30–44 and 45–59 years of age, respectively. The analysis also indicated the respondents' level of educational background: about 2.3 % (n = 3) have attained Level I to IV, while 15.7 % (n = 21) and 82 % (n = 109) have attained BA/BSC degrees and MA/MSC degrees and above, respectively. Based on the current work position and profession of the respondents, it has been noted that 5 (3.8 %) Industrial Park Managers; 10 (7.5 %) Environmentalists; 13 (9.8 %) Engineers; 11 (8.3 %) Economists; 8 (6 %) Sociologists; 12 (9 %) owners of the resident firms; 26 (19.5 %) employees working in the resident firms; 38 (28.6 %) local community members, including those who have been displaced from the Parks' site; and 10 (7.5 %) other stakeholders (e.g. consultants, academics, and civic society members) were engaged in the survey.

The results also indicated that 7.5 % (n = 10) of the total respondents were with an average of 1–5 years of work experience, while 33.1 % (n = 44) were with an average of 6–10 years of work experience, and 33.1 % (n = 44) and 26.3 % (n = 35) of respondents had averages of 11–15 and 16 and above overall work experiences, respectively.

5.2. Environmental, economic, and social impacts of Ethiopia's industrial parks

This section discusses the main results of the conducted analysis regarding the impacts of Ethiopia's industrial parks by considering their current status in terms of the pertinent economic, environmental, and social issues. Though successful development of the Parks can accelerate the achievement of the country's sustainability objectives of industrialization, its overall positive and negative impacts vary across countries due to the differences in the specific contexts and competitiveness of their development. In this regard, several previous studies argue that countries should start with their situation to alleviate the negative impacts generated when undertaking the Parks' development and operation [19,68,69]. Empirical evidence from countries with successful experiences (e.g., China, South Korea, Vietnam, and Mexico) also highlights the necessity of implementing a country-specific strategy framework that is designed by conducting a thorough investigation of the external and internal determining factors to maximize industrial parks' overall positive economic, environmental, and social impacts [20,50,70].

The study has endeavored to investigate the current impacts of Ethiopia's Industrial Parks by using the purposively selected representative sample size, thus suggesting strategic measures that could enhance the related positive environmental, economic, and social impacts. Thus, the following subsections discuss the main quantitative results by triangulating with the related qualitative results of the review of related literature and authorized documents, key informant interviews, opinions of experts and academics, and observation of the selected Parks.

5.2.1. Positive impacts of Ethiopia's industrial parks

The insights from literature and empirical evidence show that industrial park development in Ethiopia has brought several positive economic, environmental, and social impacts [14,28,71]. The present study put 19 indicators or assessment criteria of the positive

Table 7a
Descriptive statistics results of the positive impacts.

S.N	Indicators or Criteria of Assessment	Mean	Std. Deviation
PEI-1	Improves the inflow of foreign direct investments	3.21	.835
PEI-2	Promotes sustainable local socioeconomic development	3.62	.849
PEI-3	Contributes to managing the challenges of economic development	3.79	.954
PEI-4	Improves the supply of goods to both domestic and global markets	3.89	1.012
PEI-5	Enhances technology transfer, skill upgrading, and productivity	3.76	.836
PEI-6	Contributes to the increasing export values and local budget	3.42	.845
PEI-7	Creates better employment opportunities	3.45	.783
PEI-8	Contributes to the development of better infrastructure systems	3.42	.781
PEI-9	Improves local economic efficiency and foreign exchange earnings	3.41	.780
PEnI-10	Increases the implementation of environmental safeguard mechanisms	3.33	1.078
PEnI-11	Contributes to controlling pollution by reducing greenhouse gas emissions	3.32	.981
PEnI-12	Improves land use management efficiency of manufacturing enterprises	3.29	1.027
PEnI-13	Improves water use efficiency by enhancing waste water recycling & reusing	3.44	.856
PEnI-14	Promotes efficient energy use management	3.32	1.056
PSI-15	Improves working conditions by changing labor structure	3.04	1.104
PSI-16	Enhances employees' capacity and manufacturing skills	3.64	.899
PSI-17	Increases social and cultural diversities	3.80	1.018
PSI-18	Creates better social infrastructure and other forms of services	3.92	1.049
PSI-19	Improves community participation and local security	3.82	.886
Valid N (Listwise) = 133			

PEI (+Ve Economic Impact); **PEnI** (+Ve Environmental Impact); & **PSI** (+Ve Social Impact).

economic, environmental, and social impacts into descriptive quantitative analysis against which it scrutinized the present status of the country's industrial park development with a purposively selected representative sample. Accordingly, Table 7a presents descriptive results from the quantitative analysis with the mean score of respondents' level of agreement on the current positive economic impacts (PEI-1 to PEI-9) industrial parks in Ethiopia.

Various studies argue that when appropriately planned and strategically implemented based on the country's specific-context, Industrial Park development can generate meaningful positive economic impacts that can significantly accelerate structural economic transformation of the country. Mainly, it helps to create a competitive local business environment and better infrastructure system for the economy's manufacturing industrial sector and enables it to generate significant employment opportunities, enhance the inflow of foreign direct investments, improve the quality and quantity of exports, and significantly increase foreign exchange earnings and national revenue [19,70,72,73].

This paper scrutinized the overall positive impacts of Ethiopia's industrial parks by focusing on the country's prevailing situation and the Parks current performance status.

Accordingly, the descriptive analysis results indicated that the Parks are contributing to improving the supply of goods to both domestic and global markets (3.89), creating better conditions for managing the prevailing challenges of the country's economic development (3.79), enhancing technology transfer, skill upgrading, and productivity of the manufacturing industries (3.76), promoting sustainable local socioeconomic development by generating direct, indirect, and induced economic impacts (3.62), creating better employment opportunities (3.45), the development of better infrastructure systems (3.42), increasing the export values, foreign exchange earnings, and local budget (3.42), and increasing the inflow of foreign direct investments (3.21). Overall, the total average respondents' level of agreement on the survey items (3.57) indicated that the country's industrial parks are significantly generating a positive economic impact (71.4 %) on the local economic growth sustainability.

To promote environmental sustainability in the manufacturing industries, countries of emerging economies have been highly investing to promote sustainable industrial parks development as a policy approach to realize the sustainable objectives of industrialization. Substantiating this, several previous research works conducted in different countries revealed that undertaking industrial parks development by aligning with a country's Sustainable Development framework can generate positive impacts to enhance environmental quality [50,74,75]. Similarly, this paper tried to investigate the positive environmental impacts Ethiopia's industrial parks.

Table 7a shows descriptive statistics of the survey results with the mean score of the participants' level of agreement on the positive environmental impacts (PEnI-10 to PEnI-14). Hence, it can be argued based on the results that since their establishment, the country's industrial parks have contributed to enhancing environmental quality by improving water use efficiency (3.44), promoting the implementation of environmental management safeguard mechanisms (3.33), contributing to reducing greenhouse gas emissions (3.32); promoting efficient energy use management (3.32); and improving the manufacturing enterprises' land use management (3.29). Overall, the total average respondents' level of agreement on the survey items (3.34) indicates that the parks are significantly generating a positive environmental impact (66.8 %) on environmental quality.

Previous research works and the success factors of other countries (e.g., Singapore, China, Denmark, Vietnam, and South Korea) show that successful implementation of industrial park development and operation can generate positive social impacts that contribute to promoting the social quality of the host countries [8,50,76]. By investigating the current positive social impacts of Ethiopia's industrial parks, this study identified the descriptive quantitative results of the conducted survey questionnaire with the mean score of the respondents' level of agreement on the survey items of positive social impacts (PSI-15 to PSI-19) (Table 7a). Arguably, the results indicated that the parks are contributing to improving the country's social quality by creating better social infrastructure and other forms of services (3.92), improving local security by promoting community participation (3.82), increasing social and cultural diversities (3.8), creating favorable conditions for employee training and capacity building (3.64), and changing labor structure that improves working conditions (3.04). Overall, the total average level of agreement on the survey items (3.64) indicates that currently, the parks are significantly contributing a positive social impact (73 %) to improving social quality.

Table 7b briefly summarizes the overall average level of the participants' agreement on the main positive impact themes concerning the present performance of Industrial Parks in Ethiopia. That is, nearly 71.4 % of the respondents, with a total average mean value of 3.57, agreed that the parks are currently generating a significant overall positive economic impact contributing to structural economic transformation of the country. About 66.8 % of the respondents, with a total average mean value of 3.34, agreed that the parks are generating a significant overall positive impact to improving environmental quality, and 73 % of the respondents, with a total average mean of 3.64 agreed that the parks are generating a significant overall positive impact to enhancing social quality.

Table 7b
Descriptive statistics results of the overall positive impacts.

Overall Positive Impacts	*Mean*	*Std. Deviation*	*Cronbach Alpha*	*Kolmogorov-Smirnov Test*			*Shapiro-Wilk Test*		
				Statistics	df	Sig.	Statistics	df	Sig.
Positive Economic Impacts	3.57	.469	.711	.061	133	.200*	.984	133	.129
Positive Environmental Impacts	3.34	.683	.715	.075	133	.065	.988	133	.324
Positive Social Impacts	3.64	.682	.718	.075	133	.067	.984	133	.110
Valid N (Listwise) = 133									

a. Lilliefors significance correction.
* Lower bound of the true significance.

Hence, by triangulating the interpretation of these results with the main findings of the conducted literature review, key informant interviews, and observation, the present study argues that though in the early performance stage with multiple challenges, the parks are significantly generating positive economic, environmental, and social impacts.

5.2.2. Negative impacts of Ethiopia's industrial parks

Many researchers argued that the development and operation of an industrial park are not free from generating negative environmental, economic, and social impacts that need to be effectively managed and minimized based on the host country's context [9,42,77]. Regarding to the case in Ethiopia, apart from their positive impacts, the present study also examined that the country's industrial parks are generating negative economic, environmental, and social impacts. Table 8a presents the descriptive statistics of the respondents' average level of agreement on the negative impact indicators concerning the present status of the country's industrial parks.

Accordingly, the survey results (NEI-1 to NEI-6) from the respondents' level of agreement with mean scores showed the negative economic impacts of Ethiopia's industrial parks, including the costs of attracting enterprises to fill up the industrial parks (3.60), increasing training and production costs to enhance technical skills and productivity (3.45), high cost of investment in building infrastructure to attract foreign companies (3.59), changes in price and increasing cost of technology exchange (3.49), creating illegal linkages between informal economic activities (3.16), and involuntary resettlement and loss of agricultural land (3.00). Similarly, Table 8a displays the scrutinized survey results (NEnI-7 to NEnI-11) based on the respondent's level of agreement that the parks are generating negative environmental impacts, including landscape disturbance and loss of biodiversity (3.24); soil contamination that can lead to long-term damage to ecosystems (3.30); local nuisances such as noise, lighting, and transport (3.25); increased traffic congestion and vehicle emissions that affect air quality (3.04); and secondary pollution caused by inefficient recycling system (3.27). It has also been noted from the survey results (NSI-12 to NSI-16) that the current main negative social impacts generated by the parks include displacement and social conflicts such as land use rights, labor issues, etc. (3.10); the increased strain on social infrastructure and public services (3.27); increased social instability such as social evils, strikes, protests, etc. (3.20); loss of cultural identity due to the influx of a large number of migrant workers (3.41); and poor occupational health and safety management that affects public health (3.30).

Table 8b briefly summarizes the total average level of respondents' agreement on the negative impact themes of the present performance of the country's industrial parks. Thus, nearly 67.6 % of the respondents, with a total average mean value of 3.38, agreed that the parks are generating negative economic impact. About 65.8 % of the respondents, with a total average mean value of 3.29, agreed that they are generating negative environmental impact, and 65.2 % of the respondents, with overall average mean of 3.26, responded that the parks are generating negative social impact. By triangulating discussion of the quantitative results with that of the conducted literature review, key informant interviews, and observation of selected parks, the study investigated that the parks are also generating negative economic, environmental, and social impacts. Hence, it can be argued that apart from the overall positive impacts, Ethiopia's industrial parks are not free from generating negative economic, environmental, and social impacts.

Fig. 4 exhibits the overall positive and negative impacts of Ethiopia's industrial parks that the present study scrutinized with a purposively selected representative sample size. The results represent the average level of agreement on the impact indicators so that the parks' current status shows the overall positive economic (71.4 %), environmental (66.8 %), and social (73 %) impacts. On the other hand, the results show the overall negative economic (67.6 %), environmental (65.8 %), and social (65.2 %) impacts.

By triangulating the interpretation and discussion of the results with the qualitative findings from observation, review of literature and official documents, and key informant interviews, the study thus argues that though the parks are generating significant positive economic, environmental, and social impacts, they also generate undeniable negative impacts. Presently, there is a growing interest in promoting sustainable industrial park development as it offers potential collaborative and efficiency gains; thus, significantly contributes to balancing a host country's social, environmental, and economic objectives of industrialization. The study tried to examine the present performance of Ethiopia's industrial parks; thus, explored the related positive and negative impacts of the parks in light of the key sustainability dimensions. It revealed that much has to be done to significantly lessen their negative environmental, economic, and social impacts. In support of this, to sustainably enhance the parks' overall positive impacts, their development and operation should be properly planned and effectively managed from the onset in line with the principles and performance standards outlined by UNIDO[3] for promoting eco-industrial parks (sustainable industrial parks) development. These mainly include: effective environmental management, industrial symbiosis, resource efficiency, social responsibility, suitable governance approach and institutional set-up, and string stakeholders' cooperation and engagement [56]. In other words, the concept and practice of eco-industrial parks development can provide an integrated framework for effectively managing and minimizing the industrial parks' overall negative impacts.

As noted from the arguments in the literature of the area, the impacts of industrial parks development depend on various internal and external factors that should be thoroughly investigated from the host country's strategic development objectives. Thus, the recent digital revolution with advanced production technologies, the increasing interest in promoting green manufacturing, the growing interests to adopt 'circular economy' for environmental quality management, rapid urbanization, and other related issues need to be considered in an attempt to successfully manage the overall economic, environmental, and social impacts of industrial parks development [55,78].

Substantiating this, a number of previous studies strongly argued that countries need to start with their specific situation for

[3] United Nations Industrial Development Organization.

Table 8a
Descriptive statistics results of the negative impacts.

S.N	Indicators or Criteria of Assessment	Mean	Std. Deviation
NEI-1	Increasing cost of attracting enterprises to fill up industrial parks	3.60	.999
NEI-2	Increasing production and training costs	3.45	1.228
NEI-3	High cost of investment to build infrastructure for attracting foreign companies	3.59	1.102
NEI-4	Increases cost of technology exchange that causes price changes	3.49	1.132
NEI-5	Creates illegal linkages between informal economic activities	3.16	1.211
NEI-6	Causes involuntary resettlement and loss of agricultural land	3.00	1.108
NEnI-7	Causes landscape disturbance and loss of biodiversity	3.24	1.074
NEnI-8	Creates soil contamination that can lead to long-term ecosystem damage	3.30	1.081
NEnI-9	Generates noise, lighting, and massive transport causing local nuisances	3.25	1.117
NEnI-10	Increases traffic congestion and vehicle emissions that affect air quality	3.04	.941
NEnI-11	Generates secondary pollution caused by inefficient recycling system	3.27	.993
NSI-12	Causes displacement & social conflicts (e.g., land use rights, labor issues)	3.10	1.167
NSI-13	Increases strain on social infrastructure and public services	3.27	.986
NSI-14	Generates social instability (social evils, strikes, protests, etc.)	3.20	1.071
NSI-15	Causes loss of cultural identity due to the influx of migrant workers	3.41	.872
NSI-16	Affects public health if there is poor occupational health & safety system	3.30	1.073
Valid N (Listwise) = 133			

NEI (-Ve Economic Impact); **NEnI** (-Ve Environmental Impact); & **NSI** (-Ve Social Impact).

Table 8b
Descriptive statistics results of the overall negative impacts.

Overall Negative Impacts	*Mean*	*Std. Deviation*	*Cronbach Alpha*	*Kolmogorov-Smirnov Test*			*Shapiro-Wilk Test*		
				Statistics	df	Sig.	Statistics	df	Sig.
Negative Economic Impacts	3.38	.731	.719	.076	133	.055	.982	133	.071
Negative Environmental Impacts	3.29	.709	.71	.065	133	.200*	.988	133	.294
Negative Social Impacts	3.26	.73	.745	.077	133	.053	.987	133	.245
***Valid N (Listwise)* = 133**									

a. Lilliefors significance correction.
* Lower bound of the true significance.

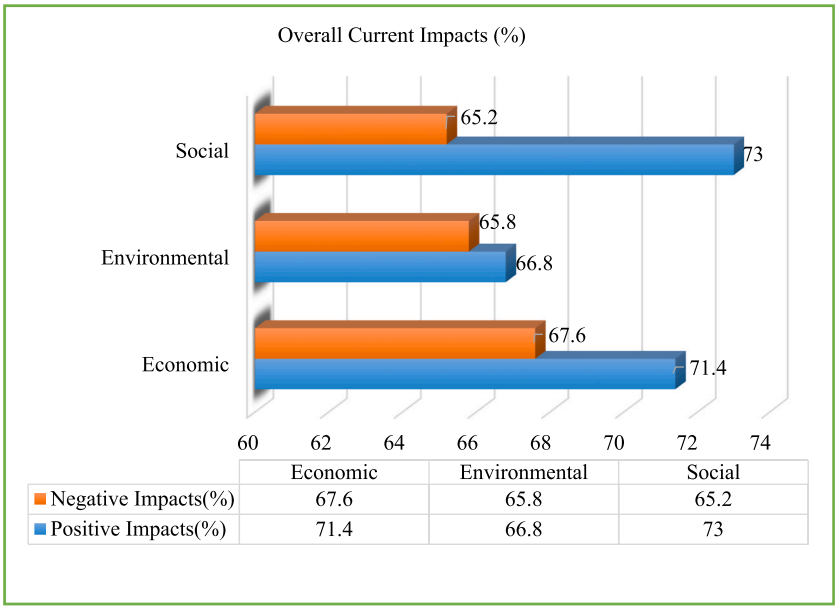

Fig. 4. Overall positive and negative impacts of industrial parks in Ethiopia.

strategically minimizing the overall negative impacts of their industrial parks [19,68]. Empirical evidence and success factors of countries with successful experiences (e.g., China, South Korea, Vietnam, and Mexico) also highlighted the necessity of designing and implementing country-specific strategy framework in line with the UNIDO's principles and standard framework fostering

eco-industrial parks [20,50,79].

In general, promoting Eco-industrial Parks in Ethiopia can accelerate sustainable industrial development in the country; thus, could address the pertinent challenges and problems. Therefore, it is essential to highlight that establishing industrial parks needs detail investigation of the related external and internal factors for implementing a suitable policy framework and an appropriate strategy. This enables stakeholders leverage the performance requirements of sustainable industrial parks development. To this end, it needs creating a common understanding on the basic principles and practices of sustainable industrial parks, establishing standard performance baseline, identifying opportunities for improvement, and monitoring operational performance.

5.3. Managerial and theoretical implications of the study

Undertaking industrial park development within the framework of sustainability is a complex and long-term assignment that needs much thinking and debate. It has been less than a decade since Ethiopia started developing industrial parks in pursuit of addressing the multiple challenges of the country's industrialization. The present study tried to investigate the overall positive and negative environmental, economic, and social impacts of Ethiopia's industrial parks and thus suggested contextual strategic measures for promoting sustainable industrial park development that can enhance the positive impacts. Hence, it provides several managerial and theoretical implications for a broader perspective of eco-industrial park development and operation that can benefit policy-makers, academics, and businesses.

5.3.1. Managerial implications

It has been noted from empirical evidence and experiences that sustainable development of industrial parks can be a better approach to foster inclusive and sustainable industrialization [1,8,80]. To this end, identifying and defining the related opportunities and challenges is essential to select and implement an effective management system for the process.

The present study can provide valuable insights for managers to make informed decisions and enhance stakeholder relationships that can promote sustainable industrial park development. Thus, it has the following important managerial implications:

- Managers need sufficient understanding of its positive and negative impacts for an effective decision-making to plan and implement sustainable industrial park development, operation, supply chain management, and resource allocation. The present study suggests the strategic issues need to be accentuated to lessen the industrial parks' overall negative environmental, economic, and social impacts. The findings can provide insights as reference points to identify strategic focus areas for selecting and applying a suitable policy outline that can enhance the parks' overall positive impacts.
- The study can provide appropriate managerial insights that could help in designing and implementing an appropriate regulatory system in conformity with the international standards sustainable industrial parks development. Thus, it can help to identify and customize the global best practices to minimize the parks' negative economic impacts by maximizing efficient use of resources.
- It suggests the need to design appropriate policy framework and strong legal frameworks for improving environmental quality; thus, implementing green manufacturing technologies and efficient use of renewable energy. Thus, it can help managers ensure compliance with environmental regulations and standards, reducing the risks of fines or legal actions.
- Essentially, the findings justify the need to unceasingly upgrading institutional capacity and production skills, learning, expanding technology transfer, and fostering creativity that could maximize industrial parks' overall positive social impacts.
- It can contribute to successfully aligning industrial parks' sustainability objectives with the Sustainable Development Goals of the country. The findings can provide understandings regarding the environmental, economic, and social benefits and drawbacks that can guide managers in contributing to enhance the potential benefits industrial parks.
- Lastly, the findings with the suggested strategic measures provide important inputs in framing the broader national development agendas that would create strong coordination among the stakeholders.

5.3.2. Theoretical implications

Beyond its immediate findings, the study can lead to broader theoretical insights that can advance academic research, sustainability initiatives, and policy-making in the field of sustainable industrial park development. Thus, it has several theoretical implications, which include the following.

- It adds value to the body of knowledge on sustainable industrialization and environmental management of industrial ecology by providing valuable insights for future research and inspires academic discourse on the importance of promoting eco-industrial parks development. Hence, the study puts a better stepping stone for detail investigation of the overall positive and negative impacts of industrial parks in the country.
- It enhances the understanding multiple factors associated with the benefits of promoting green industrial ecology, thus can contribute to the field of environmental economics by providing data on the cost-benefit analysis of sustainable practices in industrial settings.
- It could further extend the existing theoretical foundations to justify the rationale for undertaking sustainable industrial park development [8,81] by providing country-specific insights that can improve the understanding of policymakers and planners to effectively identify and manage the related challenges and opportunities.
- It sheds light to the contextual understanding and implementation of stakeholder theory [82,83] by creating understandings on the importance of stakeholders' collaboration and contribution to minimize industrial parks' overall negative impacts.

6. Conclusions and recommendations

The study sought to scrutinize the positive and negative impacts of Ethiopia's industrial parks, thus suggested contextual strategic measures for maximizing the positive ones within the country-specific context. The investigated positive economic impacts revealed that the parks are creating better conditions to address the sustainability challenges of the country's economic growth by creating employment opportunities, improving the inflow of foreign direct investments, increasing export values and the local budget, improving the supply of goods to both the domestic and global markets; increasing technology transfer, skill upgrading, and productivity; enhancing local economic efficiency and foreign exchange earnings; and promoting better infrastructure systems.

With respect to positive impacts on environmental safeguards, they are contributing to enhancing environmental quality by implementing modern management safeguard mechanisms, improving industrial land use efficiency, promoting efficient energy use, improving industrial water use efficiency by implementing wastewater recycling and reusing technology, and pollution control by reducing greenhouse gases. It also scrutinized the main positive social impacts of the country's industrial parks, including changing labor structures that improve working conditions, creating favorable conditions for employee training and capacity building, increasing social and cultural diversities, creating better social infrastructure, and promoting community participation.

However, the study also revealed that the parks are not free from generating negative impacts. Thus, the identified negative economic impacts include the costs of attracting domestic and foreign enterprises to fill up the parks, increasing training costs to improve labor technical skills, price changes and cost of technology exchange, and high cost of investment in building infrastructure to link the parks' operation activities to global markets. The investigated current negative environmental impacts include landscape disturbance causing biodiversity loss, secondary pollution caused by an inefficient recycling system, soil contamination that can lead to long-term damage to ecosystems, local nuisances such as noise and lighting, and increasing traffic congestion and vehicle emissions that affect air quality. The examined negative social impacts of the parks are displacement and social conflicts (e.g., land use rights, labor issues), increasing pressure on social infrastructure and public services, loss of cultural identity due to the influx of migrant workers, and poor occupational health and safety management that affects public health.

In general, to significantly enhance and sustain the overall positive impacts of its industrial parks by effectively managing the negative impacts and related existing challenges, the country should implement an appropriate strategic approach with a suitable governance framework. Hence, the suggested strategic measures to minimize the overall negative impacts by fostering sustainable industrial parks include:

- The country needs committed strategic leadership to adopt an effective industrial park management system with a suitable and efficient institutional setup. To this effect, it should ensure the viability of establishing an industrial park by incorporating its objectives into the country's national macroeconomic development.
- Implement strategic business communication that can enhance the positive economic impacts of industrial parks with the available competitive and comparative advantages of the country.
- The government needs to support competitiveness of the local investors in connecting domestic market to the global value chain by implementing necessary initiatives.
- Implement effective livelihood restoration programs to support the local people displaced from their farmland for industrial park construction.
- Implement a national environmental safeguard management strategy in compliance with strict legal frameworks for promoting sustainable industrial park development. Besides, it needs encouraging innovative practices for efficient resource use, sustainable waste management, and biodiversity protection.
- Work to upgrade the quality of labor supply and employee skills by implementing research and training programs, expanding technology transfer, and learning. It also needs a regulatory framework that can enhance occupational health and safety.
- Expand the social infrastructures, including hospitals, schools, youth recreation and sports centers, hotels, supermarkets, etc., inside and outside the industrial parks to minimize the pressure on public services.
- Establish strong institutions to conserve local cultural values and heritages that can minimize cultural assimilation risks when undertaking industrial park development.
- Lastly, the country should implement an effective monitoring and evaluation system that could enhance the sustainability of its industrial parks development.

Nevertheless, the authors acknowledge the following limitations of the study. *First*, its scope is limited to the present performance of industrial parks in Ethiopia. It used a purposively selected small representative sample size due to resource and time constraints. It could have incorporated the manufacturing enterprises with similar characteristics that operate outside the parks. *Second,* insufficient information regarding the issues considered sensitive by resident company owners and local government officials might have limited the required data on the negative impacts. To minimize the challenges of these limitations, the authors made the utmost effort to maintain rigor by using a research approach that employed mixed methods.

Finally, the study suggests important research focus areas for detail and multi-level assessment of Ethiopia's industrial parks development by incorporating the non-resident manufacturing industries. Accordingly, the future research works need to focus on the issues, including the contribution of foreign direct investment to promoting sustainable industrial park development; the use of green manufacturing technology and digitalization for industrial park operation; undertaking a comparative analysis of the country's industrial park development against the contexts in the successful countries with an adequate sample size; and developing and implementing contextual performance indicators and assessment frameworks.

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Statement on data availability

All the data generated or analyzed are included in this paper.

Additional information

No additional information is available for this study.

CRediT authorship contribution statement

Gemechis Guteta Jote: Writing – review & editing, Writing – original draft. **Hailu Worku:** Supervision, Methodology, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

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