The Economic and Educational Implications of Implementing Intelligent Transportation In Surabaya

Irwandi and Anastasia Caroline Sutandi

Abstract— The implementation of the Intelligent Transportation System (ITS) in Surabaya City has positive impacts on the economic and educational aspects. From an economic perspective, ITS has the potential to be a driver of growth by optimizing the transportation system to improve the efficiency of the movement of goods, services, and labor. This can stimulate business activity, attract investment, create job opportunities, and enhance the well-being of the community. ITS also facilitates the advancement of Surabaya as an intelligent city that offers top-notch public services in the transportation sector. This study aims to examine the effects of installing Intelligent Transportation Systems (ITS) on the economic aspects of Surabaya City. Analyzing the impact of implementing ITS on educational aspects and Identifying challenges and formulating strategies to optimize the benefits of ITS. The method employed is a qualitative approach using case document analysis. The research findings are expected to provide input for policymakers in developing an efficient, safe, and sustainable transportation system, as well as contributing to the advancement of knowledge in the field of intelligent transportation. From an educational perspective, the implementation of ITS open's opportunities for research and development of smart transportation for educational institutions in Surabaya. This encourages collaboration between academics, government, and industry in innovation. The development of ITS also requires competent human resources in the fields of information technology, electronics, telecommunications, and transportation, thereby creating job opportunities for college graduates. However, the implementation of ITS also faces challenges such as the significant investment in infrastructure, the need to align educational curricula with industry needs, and the readiness of human resources to adopt new technologies. A close synergy between the government, academia, industry, and society is necessary to optimize the benefits and address the challenges of implementing Intelligent Transportation Systems (ITS) in Surabaya.

Keywords— Intelligent Transportation System, Surabaya, economy, education, smart city, development, Technology.

1 Introduction

The implementation of Intelligent Transportation Systems (ITS) in Surabaya has significant economic and educational implications, in line with the broader smart city initiatives aimed at enhancing urban mobility, productivity, and environmental sustainability [7]. The implementation of Intelligent transit Systems (ITS) in Surabaya has resulted in several positive economic effects. These include more efficient traffic management, decreased congestion, and improved public transit systems [8]. These factors work together to promote economic growth by lowering travel time, fuel consumption, and environmental pollution. The enhancements in transportation infrastructure have the potential to attract investments, stimulate local enterprises, and augment the general standard of living for citizens, rendering the city more competitive and economically dynamic.

The introduction of Intelligent Transportation Systems (ITS) in Surabaya is a valuable educational prospect for students and professionals in the fields of urban planning, engineering, information technology, and environmental studies. It promotes a culture that values and supports the creation of new ideas and the investigation of new knowledge, hence motivating the advancement of novel technology and problem-solving approaches for urban issues. Educational institutions could incorporate ITS-related subjects into their curricula, which will encourage interdisciplinary learning and equip students with the necessary skills for future professions in the rapidly changing smart city environment. Moreover, the ITS projects implemented in Surabaya can be utilized as case studies for scholarly research, thereby making a valuable contribution to the worldwide repository of knowledge on intelligent transportation and smart cities.

In summary, the adoption of Intelligent Transportation Systems (ITS) in Surabaya highlights the city's dedication to utilizing technology for the purpose of achieving sustainable urban growth. The statement emphasizes the interdependence between economic development and educational achievement, illustrating how smart city projects can stimulate improvement in several areas.

Surabaya, the second largest city in Indonesia, has experienced rapid economic growth and population increase in recent decades [10]. This has resulted in an increase in the demand for mobility among the public and the volume of vehicles on the road. The increase in population and private vehicle ownership in Surabaya has led to an increase in the demand for mobility and traffic congestion [1]. Traffic congestion, air pollution, and traffic accidents are serious issues that require innovative solutions. The Surabaya City Government has implemented an

- *Irwandi, Department Master of Civil Engineering, Parahyangan Catholic University, Indonesia, Email: irwandih105@gmail.com.*
- *Anastasia Caroline Sutandi, Department Master of Civil Engineering, Parahyangan Catholic University, Indonesia.*

Intelligent Transportation System (ITS) as an effort to address transportation issues [2]. Intelligent Transportation Systems (ITS) integrates information and communication technology with infrastructure, vehicles, and road users to enhance driving safety, efficiency, and comfort [5]. The implementation of ITS is expected to have a positive impact on the economic and educational aspects in the city of Surabaya.

From an economic perspective, ITS has the potential to be a driver of growth by optimizing the transportation system, increasing the efficiency of the movement of goods, services, and labor [6]. This can stimulate business activity and attract investment to Surabaya. In addition, ITS also supports the development of Surabaya as a smart city that provides high-quality public services in the field of transportation [9].

In terms of education, the implementation of ITS open's opportunities for research and development of transportation technology for educational institutions in Surabaya. This encourages collaboration between academics, government, and industry in innovation [3]. Information Technology Services (ITS) also requires competent human resources, thereby creating job opportunities for college graduates. The objective of this research is to analyze the impact of implementing Intelligent Transportation Systems (ITS). Regarding the economic aspects in Surabaya City, this includes factors such as economic growth, investment, and employment possibilities [4]. Additionally, it aims to identify challenges in implementing ITS and formulate strategies to optimize its benefits.

2 THEORITICAL FRAMEWORK

The initial phase of implementing Intelligent Transportation System (ITS) in Surabaya involves the use of Adaptive Traffic Control System (ATCS) to regulate traffic light timings based on actual traffic conditions, with the aim of reducing stoppage time and minimizing travel time. ITS the utilization of CCTV and other traffic management systems to monitor traffic conditions and provide real-time information to road users. The regulations and policies of the ITS Program in Surabaya are based on Surabaya Mayor Regulation Number 5 of 2013, which emphasizes the utilization of information and communication technology in the administration of government and the improvement of public service quality.

2.1 The Impact of Implementing ITS on Surabaya Residents

The impact of individual perception on Surabaya Intelligent Transportation System (SITS) services is not very significant. However, from the perspective of the implementing organization, namely the Surabaya City Transportation Agency, the SITS service has an impact on supporting existing operational processes. However, from the perspective of the implementing organization, namely the Surabaya City Transportation Agency, the SITS service has an impact on supporting existing operational processes. Generally, the community feels assisted by the presence of SITS, particularly in terms of road safety and accident prevention, hence minimizing material losses resulting from accidents.

2.2 Characteristics and Management of ITS

Information Technology (IT) encompasses various characteristics, including system structure, subsystems, information gathering, data processing, and follow-up actions involving various information mediums. The management and control system of traffic must be adjusted to distribute the volume and flow of traffic, particularly in large cities.

2.3 Economic Implications

Efficiency gains can be achieved using Intelligent Transportation Systems (ITS). ITS can optimize traffic flow, alleviate congestion, and improve the synchronization of traffic signals and transportation resources. Financial savings Intelligent Transportation Systems (ITS) may lead to financial savings for transportation authorities and road users by reducing traffic congestion and improving traffic control. This can lead to reduced fuel consumption and lower vehicle operating expenses. Enhanced transportation infrastructure can boost economic growth by facilitating the transportation of products and individuals, recruiting enterprises, and fostering tourism. ITS (Intelligent Transportation Systems) can help reduce vehicle emissions by limiting idle times and stop-and-go traffic, resulting in a positive economic impact through improved public health and reduced healthcare expenses.

2.4 Educational Implications

The deployment of Intelligent Transportation Systems (ITS) offers local universities and research institutions the chance to participate in state-of-the-art research, thereby contributing to the progress of knowledge in the domain of smart transportation. Workforce Development: ITS necessitates a proficient workforce with the ability to oversee and sustain intricate transportation systems, hence prompting the creation of tailored educational programs and training endeavors. Public awareness and engagement are crucial for the successful implementation of Intelligent Transportation Systems (ITS). Educational campaigns play a vital role in teaching the public about the advantages of smart transportation and promoting the acceptance of new technology.

2.5 Implementing Intelligent Transportation Systems (ITS) in Surabaya

The main aim of integrating the Adaptive Traffic Control System (ATCS) into Surabaya's Intelligent Transportation System (ITS) is to efficiently regulate traffic signals in real-time, leading to improved traffic flow and reduced congestion. Data-driven decision making is a process that relies on the gathering and examination of transportation data. This data is then utilized to make well-informed choices on traffic management and the development of infrastructure. Effective deployment of Intelligent Transportation Systems (ITS) necessitates collaboration among many stakeholders, such as government agencies, transportation authority, technology vendors, and the academic community. An enabling policy and regulatory framework are crucial for the smooth implementation of Intelligent Transportation Systems (ITS) and for effectively dealing with concerns related to data privacy, cybersecurity, and funding.

3 RESEARCH METHODOLOGY

This research employs a qualitative approach with a case study method. Data collection is conducted through an in-depth study of previous research documents in collaboration with academics. In addition, a document study was conducted on reports, regulations, and relevant scientific publications [11]. The collected data is then analyzed using thematic analysis techniques. To examine the economic and educational consequences of installing Intelligent Transportation Systems (ITS) in Surabaya, it is crucial to employ a complete research technique. This methodology should include both quantitative and qualitative methodologies to capture the diverse impacts of Intelligent Transportation Systems (ITS) on the business and education sector of the city. Presented below is a structured plan for conducting research:

3.1 Experimental Methodology

The study will utilize a mixed-methods research strategy, integrating quantitative data analysis and qualitative insights to gain a comprehensive knowledge of the consequences of Intelligent Transportation Systems (ITS). This methodology enables the process of triangulating data, hence improving the credibility and accuracy of the research results.

3.2 Methods for Collecting Data

The method of data collection used is secondary data. Secondary data refers to research data obtained through intermediaries or indirectly, such as books, records, existing evidence, or archives, whether published or unpublished in general. Data collection is conducted to obtain the necessary information to achieve the research objectives.

Data processing is a crucial process carried out to analyze and interpret information obtained from descriptive, non-numeric, and unstructured data. The initial step in qualitative data processing is transcription, which involves converting references, observational literature studies, or written text data sources into a format that can be further analyzed. Next, the transcribed data will be analyzed using relevant methods. This process involves extensive revision of the text to obtain results that may be used for analysis.

Perform secondary data analysis by using existing data from government publications, project documentation from Intelligent Transportation Systems (ITS), and academic research. Perform case studies on specific Intelligent Transportation System (ITS) projects in Surabaya, such as the Adaptive Traffic Control System (ATCS), to examine their direct and indirect impacts on the economy and education.

3.3 Data Analysis

The method of analysis used in this writing is qualitative descriptive analysis, which is a research approach aimed at understanding and explaining phenomena by describing and analyzing data in a narrative or descriptive manner, without using numbers or statistics, to reveal facts, conditions, phenomena, variables, and occurrences. The issues examined and investigated by qualitative descriptive research refer to quantitative studies, comparative studies, and can also be a study of the correlation between different elements. The approach of qualitative descriptive analysis involves several steps, such as.

Conceptually Analyze interview transcripts and case study materials to identify repeating patterns related to the economic and educational benefits and challenges of Intelligent Transportation Systems (ITS). Perform a content analysis on policy papers, project reports related to Intelligent Transportation Systems (ITS), and academic literature to get valuable information on the strategic objectives and perceived accomplishments of ITS initiatives.

3.4 Constraints and boundaries

Recognize possible constraints, such as data accessibility and the applicability of results outside Surabaya. Unambiguously delineate the extent of the research to concentrate exclusively on the economic and educational consequences of Intelligent Transportation Systems (ITS).

3.5 Anticipated Results

The project aims to provide evidence-based insights on the effects of deploying Intelligent Transportation Systems (ITS) in Surabaya on the city's economy and education sector. The results of this study will enhance the overall comprehension of the impact of intelligent transportation technology on urban development and provide guidance for legislators, educators, and urban planners. This methodology utilizes a thorough approach to examine the many effects of Intelligent Transportation Systems (ITS) in Surabaya. It incorporates several data sources and analytical tools to ensure a strong and detailed comprehension of the economic and educational consequences of ITS.

4 DISCUSSION RESULTS

These effects collectively indicate that ITS can enhance the economic prosperity of Surabaya by enhancing transportation efficiency, decreasing expenditures related to traffic congestion and accidents, promoting industry expansion, and supporting technical advancement. The adoption of Intelligent Transportation Systems (ITS) is in line with overarching economic objectives, including the pursuit of environmental sustainability, social welfare, and the advancement of a technologically sophisticated economy.

4.1 The economic impact of implementing Intelligent Transportation Systems (ITS) in Surabaya can be accurately evaluated through a comprehensive analysis of existing literature and research data.

The economic ramifications of implementing Intelligent Transportation Systems (ITS) in Surabaya can be comprehended through multiple aspects, encompassing the influence on the city's smart city initiatives, economic expansion, environmental sustainability, and the wider consequences for urban development and planning. The following discussion consolidates the main ideas from the given sources.

Surabaya's strategy for becoming a smart city comprises implementing the e-government idea, which encompasses the administration of regional development through a range of electronic systems, including e-project, e-budgeting, e-

controlling, e-procurement, e-delivery, and e-performance. The integration of Intelligent Transportation Systems (ITS) is a component of these wider smart city endeavors, with the objective of optimizing urban planning, ensuring public safety, and mitigating accident occurrences by means of enhanced traffic control and emergency response capabilities.

The economy of Surabaya has had fast growth, primarily due to the dominance of the service sector, as well as the manufacturing, hotel, and food services industries. The city's advantageous location as a regional hub for economic expansion is reinforced by its designation as a prominent seaport. The deployment of Intelligent Transportation Systems (ITS) can enhance economic growth by optimizing transportation efficiency, mitigating congestion, and augmenting the dependability of public transportation. Consequently, this will provide substantial assistance to the commercial and industrial operations inside the city.

Information Technology Systems (ITS) plays a role in promoting environmental sustainability by mitigating traffic congestion, hence reducing car emissions and enhancing air quality. The application of the system dynamics framework to urban mobility and traffic congestion in Surabaya indicates that implementing strategies such as the establishment of Mass Rapid Transit (MRT) and Bus Rapid Transit (BRT) systems, as well as minimizing delays in public transportation, can greatly enhance mobility efficiency and diminish traffic congestion and its related environmental consequences.

The integration of Intelligent Transportation Systems (ITS) in Surabaya is a component of a broader initiative aimed at enhancing the urban environment and enhancing the quality of life in the city. This encompasses the establishment of multimodal transportation systems utilizing light rail transit lines, the construction of park-and-ride facilities, and the encouragement of non-motorized commuting modes like cycling. These endeavors necessitate cohesive planning to guarantee that transportation networks, land use, and urban development policies are harmonized to accomplish sustainable urban expansion.

The deployment of Intelligent Transportation Systems (ITS) in Surabaya has various economic implications, including the advancement of smart city initiatives, the growth of the economy, the promotion of environmental sustainability, and the enhancement of urban planning. Intelligent Transportation Systems (ITS) may make a substantial contribution to the economic prosperity and overall well-being of the city by improving transportation efficiency, reducing traffic congestion, and strengthening the reliability of public transportation. Furthermore, the emphasis on coordinated planning and the establishment of transportation systems that incorporate many modes of transportation highlights the significance of a comprehensive approach to urban development in attaining sustainable economic and environmental results.

Improved Transportation Efficiency: Intelligent Transportation Systems (ITS) enhance traffic management, resulting in reduced congestion and shorter travel times. Enhancing efficiency can result in substantial cost benefits for both the city and its inhabitants by reducing fuel consumption and limiting time wasted in traffic. Enhancing the transportation infrastructure in Surabaya can enhance its appeal to businesses and investors, leading to economic growth and increased attractiveness. Effective transportation is a crucial element for economic activity, which can potentially result in the creation of jobs and enhanced regional competitiveness.

Environmental sustainability can be enhanced by implementing Intelligent Transportation Systems (ITS), which can effectively mitigate vehicle emissions by improving traffic management. Not only does this have immediate health advantages, but it also supports international endeavors to address climate change, perhaps attracting environmentally friendly investments. The adoption of Intelligent Transportation Systems (ITS) is a crucial move in achieving Surabaya's goal of becoming a smart city. Smart city initiatives, such as Intelligent Transportation Systems (ITS), have the capacity to enhance the general standard of living, promote sustainable development, and foster innovation.

4.2 The educational influence of Intelligent Transportation Systems in Surabaya requires a precise evaluation using study data and existing literature analysis.

The educational consequences of deploying Intelligent Transportation Systems (ITS) in Surabaya, as inferred from the given sources, emphasize various significant areas of influence, such as the involvement of cooperative e-government, community empowerment, and the wider educational environment.

The integration of Intelligent Transportation Systems (ITS) in Surabaya, exemplified by the Surabaya Intelligent Traffic Systems (SITS), is a component of the e-government efforts with the objective of enhancing urban safety and mitigating accident frequencies. The study on the role of collaborative e-government in the SITS program highlights the significance of technology in enabling collaboration among many stakeholders, such as government agencies, the public, and educational institutions. Technology plays a vital role in synchronizing data, individuals, and resources, hence improving the decision-making process and operational efficiency in traffic management and accident reduction.

The city of Surabaya exhibits its dedication to improving access to education through programs such as Learning Activity Studio, which empowers the community in the field of education. The objective of these initiatives is to target children who have left school and guarantee that they have access to ongoing educational opportunities in either formal or non-formal educational environments. These initiatives are essential for cultivating an informed population that can more effectively comprehend and participate in ITS and its advantages.

The field of education, specifically in relation to intelligent transportation systems, is changing to incorporate courses and programs that specifically concentrate on ITS. For example, institutions offer courses such as Smart Transportation that provide students with the essential knowledge needed to comprehend and contribute to the advancement of transportation systems from an engineering and planning standpoint. This signifies an increasing acknowledgment of the necessity for specialized education and training to facilitate the progress of Intelligent Transportation Systems (ITS).

The educational implications of Intelligent Transportation Systems (ITS) in Surabaya provide a comprehensive strategy for incorporating technology into transportation and education. Collaborative e-government programs such as SITS have the dual purpose of enhancing traffic management and safety, as well as functioning as instructional tools. They achieve this by disseminating video recordings of traffic offenses to the public, thereby increasing awareness and encouraging the adoption of safer driving practices.

Community empowerment through education is a crucial element, as the city strives to offer educational opportunities to all residents, especially those who have dropped out of school. This comprehensive strategy guarantees that the advantages of Intelligent Transportation Systems (ITS) and other technical breakthroughs are within reach for a wider demographic. Moreover, the incorporation of ITS-related courses in higher education curricula demonstrates the recognition of the significance of providing future workers with the requisite knowledge and abilities to innovate and enhance transportation systems. This is in line with the worldwide movement towards smart cities and the requirement for interdisciplinary proficiency in technology, engineering, and urban planning.

Overall, the introduction of Intelligent Transportation Systems (ITS) in Surabaya has substantial educational consequences, such as improving collaborative governance and community empowerment, as well as transforming the educational environment to incorporate ITS-focused learning. These combined efforts contribute to the creation of a knowledgeable, involved, and proficient population that can effectively advance the research and application of intelligent transportation systems.

The deployment of Intelligent Transportation Systems (ITS) has prospects for fostering research and advancement in the realm of transportation technology. This can promote collaborations among institutions, government organizations, and the commercial sector, cultivating a dynamic environment for innovation. Implementing ITS requires a workforce that is skilled and experienced in new technologies. This stimulates the need for educational programs in engineering, urban planning, information technology, and related disciplines, hence enhancing workforce development and higher education.

Enhanced Learning Opportunities ITS projects can function as realistic case studies for students, offering them genuine learning opportunities in real-world contexts. This practical experience is extremely helpful for students who are seeking jobs in transportation, urban planning, and technology. Public awareness and engagement can be enhanced by educational initiatives that are linked to the adoption of Intelligent Transportation Systems (ITS). These efforts aim to inform the public about the advantages of smart transportation. By educating the public, we can increase their acceptance and utilization of ITS services.

5 Conclusions

The deployment of Intelligent Transportation Systems (ITS) in Surabaya has significant and varied economic and educational consequences. In terms of the economy, Intelligent Transportation Systems (ITS) can improve the efficiency of transportation, promote environmental sustainability, foster economic growth, and aid in the implementation of smart city initiatives. From an educational standpoint, ITS promotes research and innovation, the growth of the workforce, improved learning opportunities, and increased public involvement. These implications collectively suggest that Intelligent Transportation Systems (ITS) not only improve transportation, but also stimulate broader economic and educational advancement in Surabaya. To optimize these advantages, it is crucial for Surabaya to persist in investing in its Intelligent Transportation System (ITS) infrastructure, include stakeholders from other sectors, and incorporate ITS into wider urban development and educational programs.

References

[1] Affandi, A., Rahardjo, D. S., Setijadi, E., Endroyono, E., & Kusrahardjo, G. Roadmap Pengembangan Intelligent Transport System di Surabaya. IPTEK Journal of Proceedings Series, (2), 2017.

[2] Afrizal, Dedy, and Jumadil Saputra. "The Role of Collaborative E-Government in Surabaya Intelligent Traffic System: A Case Study of Surabaya, Indonesia."

[3] Dewi, D. S., Yusuf, M., & Sari, N. I. Local economic development of dolly lane Surabaya: A descriptive study. In IOP Conference Series: Earth and Environmental Science (Vol. 202, No. 1, p. 012076), 2018 November. IOP Publishing.

[4] Elfaki, K. E., Handoyo, R. D., & Ibrahim, K. H. The impact of industrialization, trade openness, financial development, and energy consumption on economic growth in Indonesia. Economies, 9(4), 174, 2021.

[5] Florence, S. Inovasi Pelayanan Publik (Studi tentang Surabaya Intelligent Transport System dalam Meningkatkan Kualitas Pelayanan Publik di Dinas Perhubungan Kota Surabaya) (Doctoral dissertation, Universitas Airlangga). 2018.

[6] Pamudi, P. Penerapan Sistem Dinamik Dalam Sistem Transportasi Cerdas Untuk Mengurangi Kemacetan, Polusi Dan Meningkatkan Keselamatan Berlalu Lintas (Study Kasus Dinas Perhubungan Kota Surabaya) (Doctoral dissertation, Institut Teknologi Sepuluh Nopember), 2018.

[7] Pangestu, R. P. A. G., Sudibyo, D. P., & Nugroho, R. A. Evaluation of Surabaya smart city implementation in realizing smart government, smart economy, smart environment, smart living, smart people, and smart mobility. In 1st International Conference OfEducation, Social and Humanities (INCESH 2021) (pp. 320-327), 2021 November, Atlantis Press.

[8] Pindarwati, A., & Wijayanto, A. W. Measuring performance level of smart transportation system in big cities of Indonesia comparative study: Jakarta, Bandung, Medan, Surabaya, and Makassar. In 2015 International Conference on Information Technology Systems and Innovation (ICITSI) (pp. 1-6), 2015, November, IEEE.

[9] Wrahatnolo, T. 21st centuries skill implication on educational system. In IOP Conference Series: Materials Science and Engineering (Vol. 296, No. 1, p. 012036), 2018, IOP Publishing.

[10] Yusuf, I. M., Astuti, R. S., & Afrizal, D. The Role of Collaborative E-Government in Surabaya Intelligent Traffic System. In The 1st International Conference on Research in Social Sciences and Humanities (ICoRSH 2020) (pp. 775-781), 2021, November. Atlantis Press.

[11] Zhankaziev, S., Gavrilyuk, M., Morozov, D., & Zabudsky, A. Scientific

and methodological approaches to the development of a feasibility study for intelligent transportation systems. Transportation research procedia, 36, 841-847, 2018.