Volume 2, Issue 4

Innovation Series Quarterly

https://journal.academicapress.org/aps/index.php/isq

Research Article

EquiMotion Trolley

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Keywords:
Accessible AI-driven trolley
Workplace inclusivity
Ergonomic house equipment
ESG compliance
Automated spatial arrangement
Smart inventory management
Zero-emission logistics



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Abstract: *The rapid growth of global logistics has created a critical need for equipment that promotes the greatest amount of workplace inclusivity. The authors created the Accessible AI-Driven Trolley that includes a built-in height adjustable seat console that enables an operator to use a digital interface to control logistics and manage inventory. The objective is to ease the physically demanding work at the warehouse and give opportunities to disabled individuals to get meaningful employment opportunities, acting to help bridge the gap in accessibility and optimize supply chain efficiency. The steps to use this Accessible AI-Driven Trolley: While the operator (employee with physical disabilities) sits and controls the AI workflow, another worker will load items onto a large multi-format platform with dynamic telescopic barriers. The onboard AI will coordinate the spatial arrangement of the items and calculate the volume of standard export cartons as well as non-standard cargo. The system will then determine the exact row and vertical position for each item to maximize stability, replacing processes traditionally driven by manual warehouse operations. This project can benefit disabled workers, for example individuals with lower limb impairments or severe arthritis that can allow them to perform high-value jobs comfortably and safely without putting themselves at risk of injury. Furthermore, the Accessible AI-Driven Trolley is an eco-friendly, zero-emission smart trolley powered by renewable energy. The commercialization strategy includes selling directly to businesses (B2B) and leasing fleets to large distribution centers, manufacturing facilities, and third-party logistics (3PL) providers. This will allow commercial warehouses to implement a practical and efficient method for increasing workforce inclusivity, improving productivity, and meeting their Environmental, Social and Governance (ESG) goals.*

1. INTRODUCTION

The speedy growth of global e-commerce and the use of the third party logistic system has formed the need for operational effectiveness in warehouses. Nevertheless, the traditional approach in operating warehouses is majorly still founded on labor-intensive methods that create a lot of physical strain for workers in the process. Such occurrence makes physical disabilities a real hindrance, which reduces the chance for physically impaired people to have a job in the growing logistics sector. As well, the use of traditional manual methods makes people miss the opportunity to run the processes in an optimal way.

In response to these obstacles, the project presents the Accessible AI-Driven Warehouse Trolley, a new concept aimed at closing the accessibility gap and enhancing supply chain processes. Utilizing existing industrial material handling devices, this solution pleads for necessary value-added functionalities like an inbuilt height adjustable seat console with a digital interface, a flexible multi-format platform with telescope barriers, and an on-board AI spatial management solution. The controller is able to sit securely at a console to control the process at the same time as the AI makes calculations for standard export cartons and non-standard loads to ensure optimal stability of goods when storing them vertically and horizontally.

The automated and eco-friendly control technology used by this smart trolley replaces the physical effort of people with disabilities working in logistics. The smart trolley provides a complete B2B solution for businesses, which enables them to improve the efficiency of their operations while accommodating and supporting the goals of corporate social responsibility.

2. METHODOLOGY

A quantitative research methodology was chosen to assess the acceptance and possible benefits of the Accessible AI-Driven Warehouse Trolley or EquiMotion. This study aimed to gain an understanding of the public perception of the proposed innovation and to establish the potential of the innovation to enhance warehouse operations, workplace safety and employment opportunities for those with physical disabilities. Another key aspect of the research was determining the role that artificial intelligence (AI) and ergonomic characteristics may have in overcoming the shortcomings of traditional warehouse equipment.

Common warehouse operation challenges that involve physical exertion, manual handling of the cargo and have to be done while holding the warehouse are identified in the first phase of the study. For persons with physical limitations, such as lower-limb dysfunction and severe arthritis, these activities may be challenging. Using this as a basis, an innovative warehouse trolley was suggested by EquiMotion fitted with a seat console that can be moved up and down, a digital control panel and an artificial intelligence-based cargo positioning system. The features are designed to alleviate physical strain and enhance the efficiency and accessibility of warehouse operations.

In order to gather primary data, a questionnaire survey was carried out with a total of 35 respondents. The design of the questionnaire aimed to collect feedback on the awareness of the existing warehouse machinery and opinions about the new idea for EquiMotion. Some of the most relevant questions that were addressed include (1) usefulness of the seat for adjusting height, (2) role of AI in the cargo arrangement, (3) inclusion of all workers, (4) safety at work, and (5) possibilities of introducing the innovation to commercial warehouses. The development of EquiMotion was also presented to respondents as an option, and they were asked if they would recommend it.

The responses obtained during the data collection process were analysed with descriptive statistics, namely frequencies and percentages. Data from the results were summarised and displayed in charts to improve the understanding of the feedback from respondents. The approach enabled the researchers to detect typical trends in acceptance, opposition, and concord regarding the new innovation proposed. The findings also helped to identify features that were most helpful in making the warehouse more accessible and reducing operational risks.

Last but not least, information gathered was analyzed for the potential effectiveness and feasibility of EquiMotion as an innovative logistics solution. The assessment primarily concentrated on three areas: workplace inclusion, operational effectiveness, and improvement of workplace safety. The research relied on the perception of the proposed concept by the respondents, hence, it would require additional prototype development and practical testing to ensure that it performs as anticipated. In summary, this approach gave an initial insight on the potential acceptance of EquiMotion and its potential to make the warehouse a safer, efficient and inclusive space.



Figure 1. EquiMotion Trolley (Accessible AI-Driven Warehouse Trolley)

3. FINDINGS

Based on the analysis of the sample which contained 35 responses, the respondents represent 65.7% of male respondents and 34.3% of female respondents. There is a slight lean towards the male gender in terms of their awareness in regards to the female gender. 23 of respondents have seen a standard warehouse machinery or manually operated trolleys and the other 12 respondents have never had the chance to see them. It can be inferred that warehouse machinery or manually operated trolleys has been invented but a small number of people are lacking in terms of the knowledge of its existence. Hence, there needs to be an initiative to raise the awareness of the presence of this particular invention.

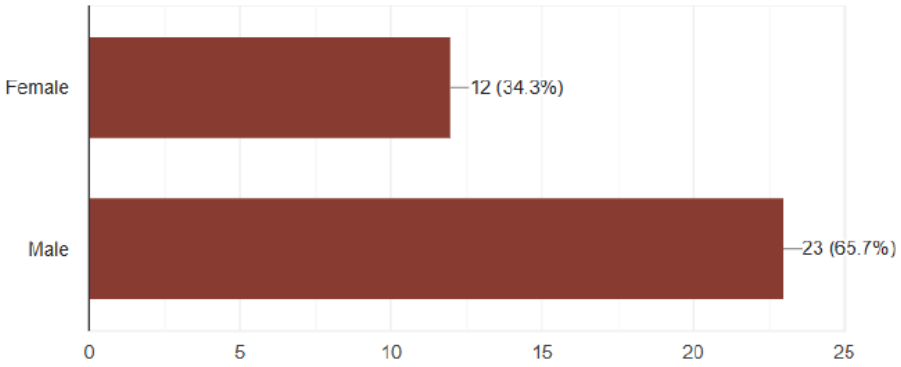


Figure 2. Feedback 1 (a)

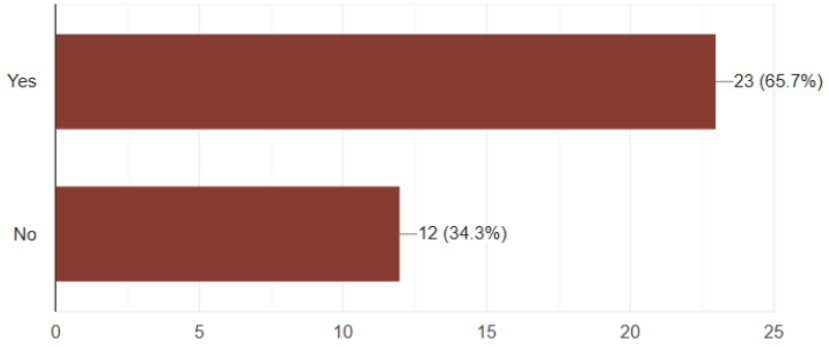


Figure 3. Feedback 1 (b)

A substantial 78.8% of respondents agreed or strongly agreed 45.7% Agree, 34.3% Strongly Agree that equipping a warehouse trolley with a height-adjustable seat console and AI-driven cargo positioning would be a useful innovation. Meanwhile, 15.2% remained neutral and a minimal proportion expressed disagreement. This suggests that potential users view the dynamic ergonomic and automated positioning features as practical enhancements to conventional equipment.

Furthermore, an overwhelming 84.8% supported workplace inclusivity benefits. 42.9% agree and also 42.9% strongly agree, acknowledging that the design enables individuals with physical disabilities such as lower limb impairments or severe arthritis to execute warehouse operation safely. This underscores significant stakeholder buy-in for leveraging adaptive technology to broaden employment opportunities in physical logistics environments.

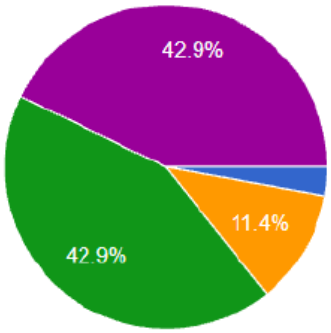


Figure 4. Feedback 2

Additionally, the safety and operational of the onboard intelligence were further supported by the data. If an onboard AI system for calculating spatial cargo layout and volume is essential for preventing operational errors and workplace injury, 87.9% respondents agree or strongly agree which 42.9% Agree,45.7% Strongly Agree. This high level of consensus highlights a clear perception that automated volume calculation and spatial arrangement are vital tools for minimizing manual handling risks and operational inaccuracies.

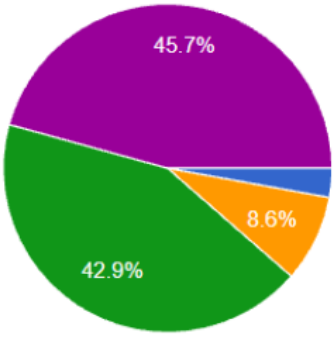


Figure 5. Feedback 3

The findings indicate a high level of acceptance of Accessible AI-driven Warehouse Trolley. 91.0% of the respondents said they would recommend the development and adoption of this Accessible AI-Driven Warehouse Trolley innovation in commercial logistics. Moreover, all respondents indicated a high degree of confidence and trust in the proposed trolley, confirming its viability as an inclusive and efficient solution for commercial supply chain operations.

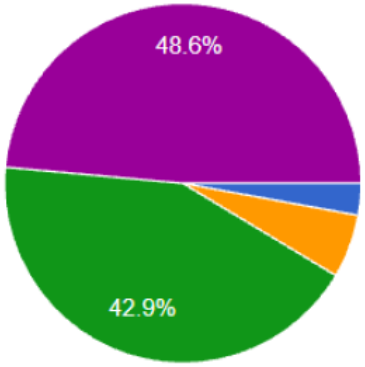


Figure 6. Feedback 4

4. DISCUSSION

4.1 Community and Social Impact

The Accessible AI-Driven Warehouse Trolley offers a transformative solution for workplace inclusivity and social equity in the logistics industry. By integrating the innovation of our product with a height-adjustable seat console and automated AI control, the system enables individuals with physical disabilities such as lower limb impairments or severe arthritis to perform high-value

operational tasks easier and safely. This effectively bridges the accessibility gap in traditionally employee intensive environments, providing meaningful employment opportunities and reducing task related injuries and ergonomic fatigue.

4.2 Industry and Logistics Relevance

Based on the operational perspective, the on-board AI system significantly optimizes supply chain efficiency by calculating spatial arrangements, volume capacities and optimal load stability for both standard and non-standard cargo. By replacing manual layout calculations reduces operational errors and streamlines warehouse throughput. Economically, adopting zero emission, renewable-energy-powered smart trolleys helps distribution centres, manufacturing facilities and third-party logistics (3PL) providers reduce operational overhead while advancing their environmental, Social and Governance (ESG) mandates.

5. CONCLUSION

The Accessible AI-Driven Trolley is an innovative solution that combines artificial intelligence with an inclusive design to improve warehouse operations. The built-in height adjustable seat and onboard AI system helps manage logistics tasks more accessible, organised and efficient. This innovation also aims to create more employment opportunities for individuals with physical disabilities. Renewable energy sources help to contribute to environmentally friendly while producing zero emissions during operations. The next step is to further develop the technology and introduce it to distribution centers, manufacturing facilities and logistics companies. The Accessible AI-Driven Trolley has the potential to improve workplace inclusivity, increase productivity and help businesses achieve their Environmental, Social and Governance (ESG) goals.

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