Jurnal Pengabdian Masyarakat
I-Com: Indonesian Community Journal
Vol. 5 No. 4 Desember 2025, hlmn. 2624-2635
E-ISSN : 2809-2031 (*online*) | P-ISSN : 2809-2651 (*print*)

Strengthening AI and DSS Synergy for Sustainable Research: A Community Engagement for Lecturers and Researchers in Palopo

Muhammad Faisal[1], Nasir Usman[2*], Emil Agus Salim Habi Talib[3], Medy Wisnu Prihatmono[4], Lisa Fitriani Ishak[5], Musdalifa Thamrin[6], Darniati[7], Alvina Felicia Watratan[8], Saharuddin[9], Muh Ilham Akbar[10]

[1, 3, 5, 7, 10] Universitas Muhammadiyah Makassar, Makassar, Indonesia
[2, 4, 6, 8, 9] STMIK Profesional Makassar, Makassar, Indonesia
*Corresponding author: nasirusman@stmikprofesional.ac.id

Received 22-11-2025	*Revised* 21-12-2025	*Published* 30-12-2025

ABSTRAK

Perkembangan pesat teknologi digital menuntut paradigma riset yang lebih inovatif dan berbasis data, namun pemanfaatan *Artificial Intelligence* (AI) dan *Decision Support System* (DSS) di lingkungan akademik masih terhambat oleh kesenjangan literasi digital dan dominasi metode manual yang subjektif. Kegiatan pengabdian masyarakat ini bertujuan untuk memperkenalkan dan memperkuat pemahaman peserta mengenai sinergi AI dan DSS dalam mendukung riset berkelanjutan di era digital. Pelaksanaan kegiatan menggunakan pendekatan partisipatif melalui model Quadruple Helix yang melibatkan 359 peserta dari kalangan dosen, peneliti, dan praktisi. Metode yang digunakan meliputi penyampaian materi interaktif, pendampingan teknis mengenai hybrid intelligence (integrasi Machine Learning dan Multi-Criteria Decision Making), serta diskusi kolaboratif melalui platform Zoom. Hasil kegiatan menunjukkan peningkatan literasi digital peserta sebesar 35,6%, dengan kenaikan skor rata-rata dari 62,5 menjadi 84,8. Selain itu, survei kesiapan teknis menunjukkan skor tinggi sebesar 4,35 pada skala Likert, di mana peserta berhasil mengidentifikasi penerapan praktis AI–DSS dalam bidang pertanian cerdas dan pengembangan UMKM. Kegiatan ini berhasil membangun fondasi awal bagi ekosistem riset yang adaptif dan inklusif.

Kata kunci: Kecerdasan buatan; Sistem pendukung keputusan; MCDM; Riset berkelanjutan; *Quadruple helix*.

ABSTRACT

The rapid development of digital technology demands a more innovative and data-driven research paradigm, yet the utilization of Artificial Intelligence (AI) and Decision Support Systems (DSS) in academic environments remains hindered by digital literacy gaps and the dominance of subjective manual methods. This community engagement program aims to introduce and strengthen participants' understanding of the synergy between AI and DSS in supporting sustainable research in the era of digital transformation. The program employed a participatory approach through the Quadruple Helix model involving 359 participants consisting of lecturers, researchers, and practitioners. Methods included interactive lectures, technical mentoring on hybrid intelligence (integration of Machine Learning and Multi-Criteria Decision Making), and collaborative discussions via the Zoom platform. The results indicate a 35.6% improvement in participants' digital literacy, with the mean score increasing from 62.5 to 84.8. Furthermore, the technical readiness survey yielded a high score of 4.35 on a Likert scale, with participants successfully identifying practical AI–DSS applications in smart agriculture and MSME development. This program has successfully established an initial foundation for an adaptive and inclusive research ecosystem.

Keywords: *Artificial intelligence; Decision support system; MCDM; Sustainable research; Quadruple helix.*

INTRODUCTION

The rapid development of digital technology has brought a paradigm shift in the fields of research and community engagement. This transformation demands more innovative, collaborative, and data-driven approaches so that the outcomes of these activities can generate tangible impacts on sustainable development. One of the main challenges faced by researchers and academics is how to utilize intelligent technologies such as Artificial Intelligence (AI) and Decision Support Systems (DSS) to support faster, more objective, and measurable decision-making processes. The urgency of adopting intelligent technologies therefore requires deeper examination. However, despite this increasingly evident urgency, realities in the field indicate that the utilization of AI and DSS has not yet been fully optimized.

Although the need for intelligent technologies continues to increase, the implementation of AI and DSS within partner environments still faces various obstacles. The primary partners for this engagement include lecturers, researchers, and practitioners participating in the SEMANTIK 2025 seminar in Palopo, who represent various academic and professional institutions in the region. Initial observations reveal that these partners largely operate in a research environment where data processing remains fragmented and decision-making for research priorities is still dominated by intuition rather than structured, data-driven frameworks. Most lecturers and researchers do not yet possess sufficient understanding of basic concepts, the use of analytical tools, or their integration into applied research. This digital literacy gap often results in research decision-making processes that remain manual, subjective, and not evidence-based. Consequently, there is a pressing need among these partners for a practical framework that can bridge the gap between basic digital skills and the advanced analytical requirements of modern research. Specifically, they require tools that can simplify the complexity of Machine Learning and Multi-Criteria Decision Making (MCDM) into applicable workflows for their respective fields, such as agriculture and small business development. To understand the extent to which intelligent technologies can address these gaps, it is necessary to review empirical findings regarding the impact of AI within the context of education and research.

In line with this, (Moeis et al., 2024) explain that artificial intelligence is capable of improving the efficiency and productivity of learning processes and enabling more focused development of students' abilities. These findings are consistent with other studies that demonstrate patterns of increased learning quality through the utilization of AI. Building upon these results, previous training activities have also shown empirical evidence that artificial intelligence technology has a direct impact on improving the quality of learning processes. In the community service report by (Harmin et al., 2024), it is stated that learning efficiency and productivity increased significantly, while the development of students' abilities became more focused.

These positive impacts are not limited to the realm of learning. The potential of AI is also clearly evident when this technology is applied in the context of applied research and large-scale data analysis. These empirical findings provide a strong foundation indicating that the utilization of intelligent technologies can strengthen evidence-based decision-making processes across various scientific contexts. In line with this, (Usman et al., 2023) demonstrate that machine learning algorithms are capable of processing big data, learning patterns automatically, and detecting anomalies more quickly and accurately than manual approaches.

Although various studies have shown promising results, their implementation in the field, particularly in Indonesia, still faces its own set of challenges. The implementation of AI and DSS is hindered by limitations in digital infrastructure, low data literacy, and the lack of technical training related to intelligent technologies. These conditions cause research and decision-making processes in many educational institutions and community sectors to continue relying on manual approaches. This situation highlights a significant gap between theory and practice: while current literature emphasizes the transformative power of AI in achieving sustainable development goals, the practical reality in the field is characterized by technological stagnation due to a lack of technical mentoring and accessible infrastructure. While the theoretical synergy of AI–DSS is well-documented, its translation into a functional competence that researchers can use to drive sustainable outcomes remains largely unrealized in local contexts. Behind these challenges, however, numerous studies emphasize that AI holds strategic potential for supporting sustainable development.

(Toderas, 2025) explains that AI plays an important role in supporting sustainable development through large-scale data analysis, scenario prediction, resource optimization, and its contribution to achieving the Sustainable Development Goals (SDGs). This potential becomes increasingly relevant as AI begins to be directly integrated into decision-support tools. (Scott et al., 2024) emphasize that AI-supported computer-based decision support systems can improve the accuracy and efficiency of decision-making at points of service.

The development of AI as a key technology is also evident in the study by (Ma, 2024), which states that AI has evolved into a transformational technology. This technology is capable of addressing complex challenges through real-time data analysis, predictive modeling, and automation. These capabilities are becoming increasingly important in higher education environments that require rapid, accurate, and fully data-driven decisions to support improved governance and institutional strategic planning.

The integration of AI into DSS has been proven to be a crucial factor in enhancing the effectiveness of decision-making processes across various higher education institutions. This is explained by (Shwedeh, 2024), who shows that AI can strengthen organizational readiness and the quality of evidence-based decisions. (Funda & Francke, 2024) also emphasize that the implementation of AI-enabled DSS

can improve the quality and efficiency of operational decision-making. However, the integration of AI alone is not sufficient because decision-making processes require an analytical approach capable of evaluating various alternatives in a structured manner.

At this point, the synergy between AI and DSS becomes increasingly evident. AI plays a role in adaptively analyzing complex data, while DSS provides a systematic framework for weighing decision alternatives. This aligns with the findings of (Siciliani et al., 2023) and (Soori et al., 2025), which demonstrate that modern decision support systems utilize AI for data integration, semantic interpretation, and predictive decision-making. Furthermore, (Mehra, 2024) emphasizes that hybrid AI models integrating symbolic reasoning and deep learning are capable of improving both the accuracy and transparency of decisions.

To ensure that the decision-making process becomes more transparent, measurable, and consistent, an analytical approach capable of accommodating multiple criteria is required. The Multi-Criteria Decision Making (MCDM) method holds a strategic role in this context. (Sahoo & Goswami, 2023) explain that MCDM provides a framework that enables comprehensive evaluation of alternatives. The relevance of the multi-criteria approach becomes even stronger when (Faisal et al., 2025) demonstrate that the integration of optimization, group decision-making, and sentiment analysis can produce decisions that are more adaptive and inclusive.

The integration of MCDM methods and machine learning produces a hybrid intelligence approach. This approach enables greater flexibility and more holistic analysis because it combines the accuracy of machine learning with the analytical structure of MCDM. (Başeğmez et al., 2025) also show that such integration can provide more comprehensive analytical capabilities to support complex decision-making.

In the context of community engagement, the synergy between AI and DSS through a hybrid intelligence approach becomes highly relevant. Community service activities become stronger when supported by a collaborative framework based on the Quadruple Helix. This framework involves academia, government, industry, and society. (Arif et al., 2023) and (Irungu et al., 2023) emphasize that the Quadruple Helix model is capable of enhancing the relevance of research interventions and contributing to sustainable development.

Thus, strengthening the synergy among AI, DSS, MCDM, and multi-stakeholder collaboration becomes an essential foundation for building a research ecosystem that is adaptive, inclusive, and sustainability-oriented.

Based on these various challenges, opportunities, and empirical findings, it is necessary to conduct community engagement activities that specifically introduce and support the utilization of AI–DSS synergy through a hybrid intelligence approach. This activity is designed to enhance digital literacy, analytical capabilities, and partner readiness in implementing intelligent technologies for sustainable research.

IMPLEMENTATION METHOD

The implementation method of this community engagement activity employs a participatory approach oriented toward cross-sector collaboration through the Quadruple Helix model, which involves elements of academia, government, industry, and society. This approach aims to ensure that the activity is not merely a transfer of knowledge but is also capable of creating an applicative impact for strengthening the sustainable research ecosystem at the local level.

The activity stages begin with a preparation phase that includes identifying the needs of the target partners, namely lecturers, researchers, and practitioners in the fields of technology and applied research. A total of 359 participants were involved in this activity, consisting of lecturers, researchers, and practitioners from various institutions. In this phase, an analysis of the local context is conducted to determine relevant case study focuses, such as smart agriculture and data-driven MSME development. The results of this analysis serve as the basis for developing a training module that emphasizes the application of Artificial Intelligence (AI), Decision Support Systems (DSS), Machine Learning (ML), and Multi-Criteria Decision Making (MCDM) in supporting data-driven decision-making and sustainable research.

The implementation of the activity was carried out through the delivery of interactive materials, technical assistance, and collaborative discussions. In the material delivery stage, participants were introduced to the fundamental concepts and current trends regarding the synergy between AI and DSS, including how these two technologies can be integrated to enhance objectivity, efficiency, and transparency in research decision-making. Technical assistance was conducted by directly involving participants in the practical application of hybrid intelligence models based on MCDM and ML, enabling participants not only to understand theoretical concepts but also to gain practical experience in utilizing intelligent technologies for data analysis and strategic planning. The program was delivered virtually through the Zoom platform. During the technical assistance phase, the implementation team performed live simulations using Orange Data Mining for Machine Learning algorithms and demonstrated structured Multi-Criteria Decision Making (MCDM) models. These simulations were conducted by the team to provide participants with a clear visual representation of the AI–DSS workflow and its practical application in research, ensuring that the core concepts were effectively communicated without requiring participants to operate the software individually. Collaborative discussions were conducted to facilitate the exchange of ideas among participants and to build an adaptive research network aligned with the principles of the Quadruple Helix.

The activity evaluation was carried out both qualitatively and quantitatively through pre-tests and post-tests to measure improvements in participants' digital literacy, as well as through observation and feedback during the implementation process. The pre-test and post-test instruments comprised 15 multiple-choice questions designed to evaluate participants' comprehension of AI–DSS synergy,

specifically regarding Machine Learning and Multi-Criteria Decision Making (MCDM) models. Furthermore, a 5-point Likert-scale questionnaire was administered to assess improvements in participants' digital literacy and their perceived readiness to implement these technologies in applied research. The success of this community engagement program is defined by three primary indicators: (1) a high participation rate, with at least 80% of registered attendees remaining active throughout the session; (2) a statistically significant improvement in participants' comprehension of AI–DSS synergy, evidenced by a higher mean score in the post-test compared to the pre-test ; and (3) a positive perception of digital literacy and technological readiness, characterized by an average Likert-scale score of 4.0 or higher. These indicators ensure that the program's impact is measurable and aligned with its objective of strengthening the sustainable research ecosystem. A joint reflection session between participants and the implementation team was conducted at the end of the activity to formulate follow-up strategies, including opportunities for research collaboration and the development of adaptive decision support systems within academic and community environments. The results of this activity indicate an increase in participants' understanding of the application of AI and DSS, as well as the formation of a collaborative network that serves as a foundation for the development of sustainability-oriented applied research.

RESULTS AND DISCUSSION

This community engagement activity was conducted interactively by involving participants from among lecturers, researchers, and practitioners who have an interest in the utilization of digital technology for applied research. The activity was held on Monday, August 9, 2025, through the Zoom platform in conjunction with the National Seminar on Information Technology and Computer (SEMANTIK) 2025. This integrated implementation allowed for broader and more flexible participation from various institutions. The high enthusiasm of the participants during the opening session is illustrated in Figure 1 and Figure 2.

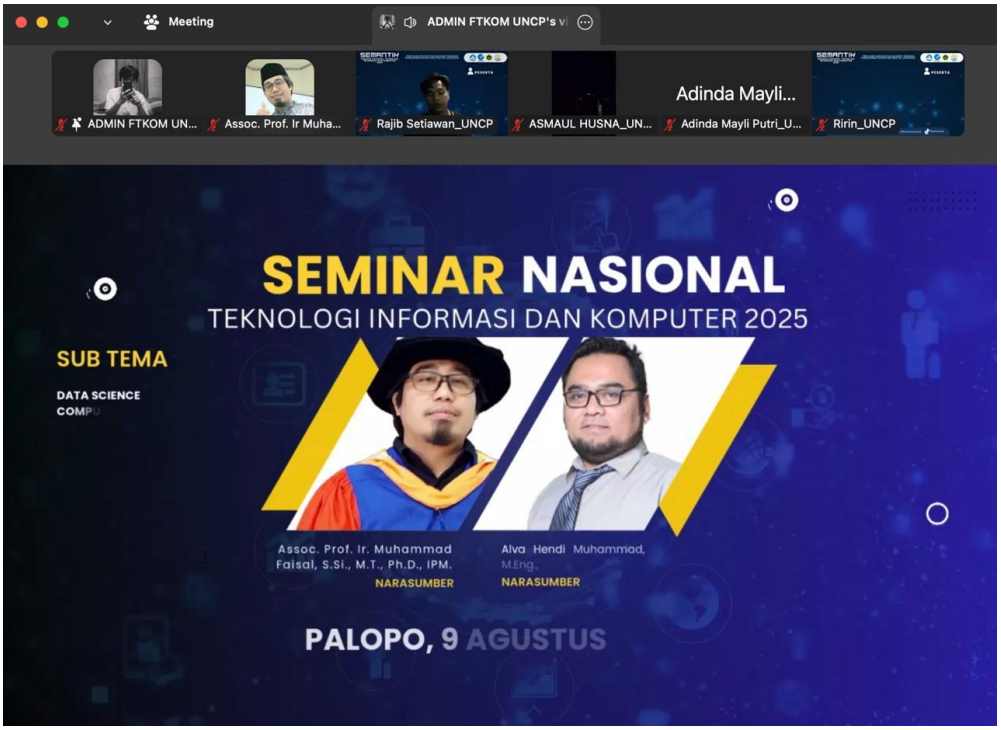

Figure 1 Snapshot of the National Seminar opening session via Zoom platform.

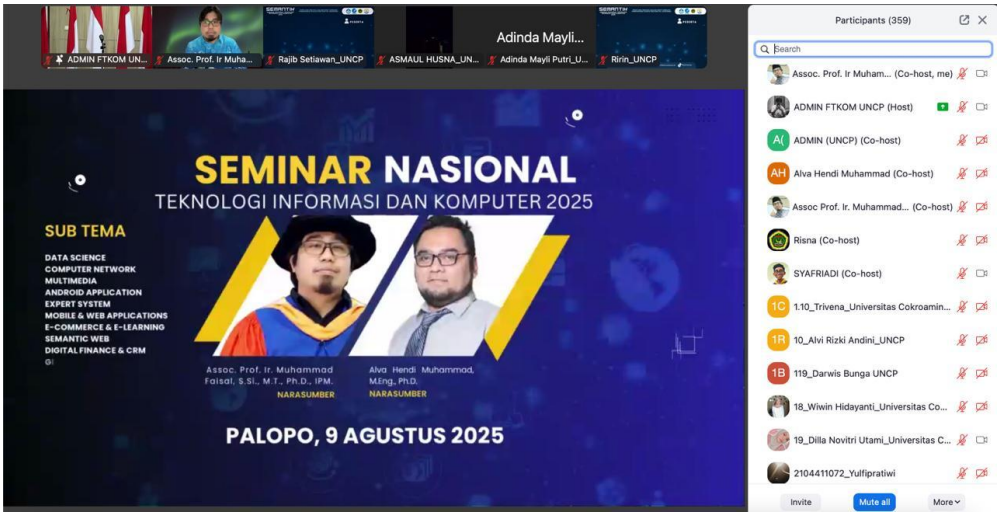

Figure 2 Participants' attendance list showing high enthusiasm with over 300 attendees.

The high level of participation from 359 attendees captured in Figure 1 and Figure 2 provides empirical evidence regarding the effectiveness of the Quadruple Helix model in mobilizing diverse stakeholders, which include lecturers, researchers, and practitioners, to support sustainable development. The online implementation also facilitated the discussion process, delivery of materials, and practical application of AI–DSS technologies in a more effective and inclusive manner.

Based on the implementation results, this activity had a significant impact on increasing participants' understanding of the concepts and implementation of the synergy between Artificial Intelligence (AI) and Decision Support Systems (DSS) within the context of sustainable research. The virtual implementation of the activity

can be seen in Figure 3, which presents documentation of the material delivery by the presenter.

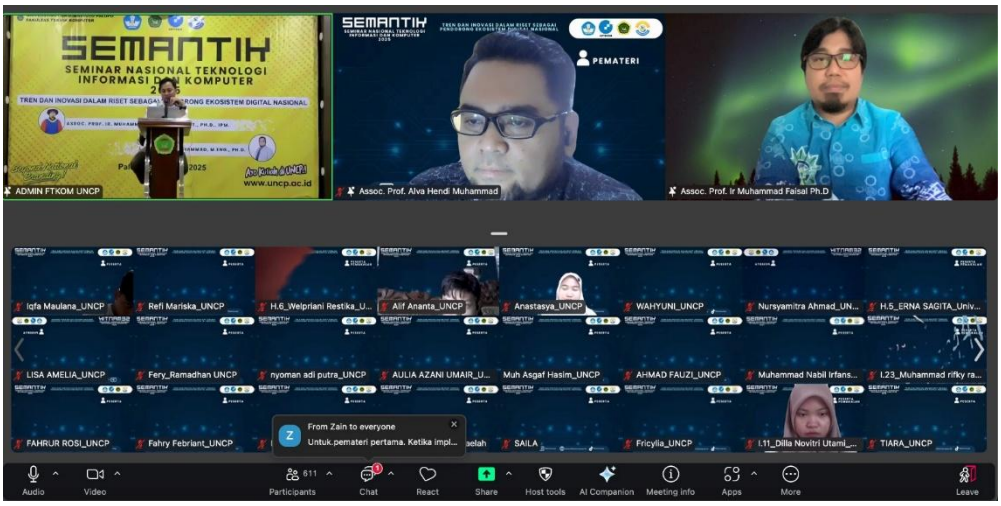

Figure 3 Documentation of the activity implementation and the delivery of materials by the presenter in a virtual setting.

The interactive delivery documented in Figure 3 illustrates the participatory approach used to facilitate the internalization of hybrid intelligence synergy, which is essential for bridging the digital literacy gap among participants. Based on the results of the pre-test and post-test evaluations, there was a noticeable improvement in participants' understanding of the basic concepts of Machine Learning (ML), Multi-Criteria Decision Making (MCDM), and the operational principles of data-driven decision support systems. Quantitative analysis of the evaluation results confirms a significant enhancement in participants' digital literacy. The mean score increased from 62.5 in the pre-test to 84.8 in the post-test, reflecting a 35.6% overall improvement in the comprehension of AI–DSS synergy. Figure 4 is a graphical representation of the comparison between pre-test and post-test mean scores, providing clear visual evidence of the significant improvement in participants' digital literacy and their comprehension of AI–DSS synergy following the intervention. Furthermore, the post-activity survey yielded an average score of 4.35 on a 5-point Likert scale, indicating a high level of perceived readiness and literacy among the 359 participants regarding the implementation of Machine Learning and MCDM models.

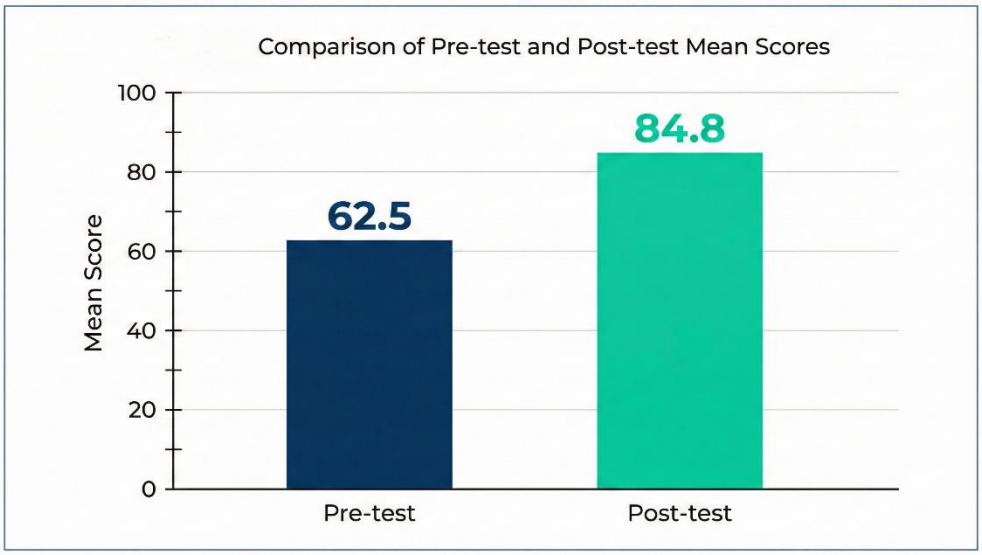

Figure 4 Comparison of Pre-test and Post-test Mean Scores

Participants who previously possessed only general knowledge about AI were, after attending this activity, able to explain practically how AI can be integrated with DSS to enhance objectivity in research decision-making. The observed outcomes of this activity strongly correlate with the established theoretical framework of AI–DSS synergy. The proficiency shown by participants in internalizing and articulating the integration of AI and DSS confirms the theory that hybrid intelligence, which combines the predictive power of Machine Learning (ML) with the structured evaluation of Multi-Criteria Decision Making (MCDM), effectively addresses the digital literacy gap and manual subjectivity highlighted in earlier sections. Furthermore, the participants' shift from general AI knowledge to identifying specific research applications aligns with the theoretical foundation that modern decision support systems provide a systematic framework for objective decision-making through data integration and structured analysis. This transition demonstrates that the community engagement program successfully operationalized the theoretical synergy of AI–DSS into a practical competency that supports evidence-based and sustainable research practices. This improvement in understanding was also reflected in the outcomes of group discussions, in which most participants were able to identify the potential application of hybrid intelligence models within their respective research fields.

During the technical assistance sessions, participants were trained to use tools and simple AI–DSS-based simulations to analyze case studies relevant to local conditions, such as the application of DSS to determine regional research priorities and the use of machine learning algorithms in agricultural data processing. This activity encouraged the emergence of various innovative initiatives from the participants, such as ideas for implementing MCDM-based recommendation systems for the development of local MSMEs, as well as the use of machine learning in predicting crop yields based on weather data and soil conditions.

In addition to enhancing digital literacy, this activity also strengthened the collaborative spirit among participants. Through discussions based on the Quadruple

Helix model, participants were able to map out opportunities for research collaboration among academia, government, and the industrial sector to support sustainable development in the region. Several participants proposed the development of a collaborative platform that could be used to openly share data and research findings, in alignment with the principles of open science and the adaptive research ecosystem promoted by this activity.

From the implementation perspective, the participatory approach proved effective in increasing participant engagement. This approach enabled a two-way learning process in which participants not only received the material but also contributed to formulating contextual AI–DSS-based solutions. This indicates that the concept of hybrid intelligence is not only relevant in technical domains but can also be applied as a collaborative learning model aimed at enhancing research capacity.

Overall, the results of this activity indicate that the integration of AI and DSS through a hybrid intelligence approach is capable of strengthening participants' research capabilities, both in terms of data analysis and evidence-based decision-making. The impact of the activity is reflected not only in the improvement of individual knowledge but also in the formation of a collaborative network that has the potential to become a foundation for sustainable research. Thus, this activity not only provides direct benefits to the participants but also contributes to strengthening a national research and innovation ecosystem that is adaptive, inclusive, and competitive.

CONCLUSION

This community engagement activity, which was based on the synergy between Artificial Intelligence (AI) and Decision Support Systems (DSS), successfully enhanced participants' digital literacy and analytical capabilities within the context of sustainable research. Through material delivery, technical assistance, and collaborative discussions, participants gained a more comprehensive understanding of how the concept of hybrid intelligence, which combines Machine Learning (ML) and Multi-Criteria Decision Making (MCDM), can be applied to support data-driven decision-making processes.

The results of the activity show that the participatory and collaborative approach based on the Quadruple Helix model was able to create an effective learning ecosystem, in which participants not only received new knowledge but also actively engaged in designing innovative solutions for regional research and development needs. The improvement in participants' ability to use intelligent technologies for data analysis serves as one of the key indicators of the success of this program.

In addition to providing positive impacts on the improvement of individual competencies, this activity also produced an initial foundation for the formation of cross-sector collaborative research networks. The continuity of this activity is directed toward the development of a joint research platform that can facilitate collaboration

among academia, government, industry, and society. Thus, this community engagement initiative serves as a strategic step in strengthening technology-based research synergies toward an innovation ecosystem that is adaptive, inclusive, and sustainability-oriented.

REFERENCES

Arif, M., Rokan, M. K., & Kumala, R. (2023). Quadruple Helix Model in the Development of Halal Micro Business in North Sumatra. *Share: Jurnal Ekonomi Dan Keuangan Islam*, *12*(1), 201–224. https://doi.org/10.22373/share.v0i0.15628

Başeğmez, M., Doğan, A., & Aydın, C. C. (2025). Management of sustainable urban green spaces through machine learning–supported MCDM and GIS integration. *Environmental Science and Pollution Research*, *32*(18), 11466–11487. https://doi.org/10.1007/s11356-025-36367-7

Faisal, M., Irmawati, ., Rahman, T. K. A., Jufri, ., Sahabuddin, ., Herlinah, ., & Mulyadi, I. (2025). A Hybrid MOO, MCGDM, and Sentiment Analysis Methodologies for Enhancing Regional Expansion Planning: A Case Study Luwu - Indonesia. *International Journal of Mathematical, Engineering and Management Sciences*, *10*(1), 163–188. https://doi.org/10.33889/IJMEMS.2025.10.1.010

Funda, V., & Francke, E. (2024). Artificial intelligence-powered decision support system for operational decision-making in the ICT department of a selected African university. *African Journal of Science, Technology, Innovation and Development*, *16*(5), 689–701. https://doi.org/10.1080/20421338.2024.2376916

Harmin, A., Moeis, D., & Usman, N. (2024). *SELAPARANG: Jurnal Pengabdian Masyarakat Berkemajuan Pelatihan pemanfaatan chatGPT untuk efektivitas belajar dan penyelesaian tugas akademis siswa-siswi di SMK Muhammadiyah 3 Makassar*. https://doi.org/10.31764/jpmb.v8i1.22216

Irungu, R. W., Liu, Z., Liu, X., & Wanjiru, A. W. (2023). Role of Networks of Rural Innovation in Advancing the Sustainable Development Goals: A Quadruple Helix Case Study. *Sustainability*, *15*(17), 13221. https://doi.org/10.3390/su151713221

Ma, N. (2024). Artificial Intelligence-Driven Decision Support Systems for Sustainable Energy Management in Smart Cities. In *IJACSA) International Journal of Advanced Computer Science and Applications* (Vol. 15, Issue 9). www.ijacsa.thesai.org

Mehra, A. (2024). *HYBRID AI MODELS: INTEGRATING SYMBOLIC REASONING WITH DEEP LEARNING FOR COMPLEX DECISION-MAKING*. https://doi.org/10.13140/RG.2.2.12186.35523

Moeis, D., Usman, N., Faisal, M., Harmin, A., Mulyadi, I., & Thamrin, M. (2024). Microsoft Copilot Training for Monitoring Student Learning: A Case Study Vocational High School Makassar - Indonesia. *I-Com: Indonesian Community Journal*, *4*(3), 1911–1922. https://doi.org/10.33379/icom.v4i3.5134

Sahoo, S. K., & Goswami, S. S. (2023). A Comprehensive Review of Multiple Criteria Decision-Making (MCDM) Methods: Advancements, Applications, and Future Directions. *Decision Making Advances*, *1*(1), 25–48. https://doi.org/10.31181/dma1120237

Scott, I. A., Van Der Vegt, A., Lane, P., McPhail, S., & Magrabi, F. (2024). Achieving large-scale clinician adoption of AI-enabled decision support. *BMJ Health and Care Informatics*, *31*(1). https://doi.org/10.1136/bmjhci-2023-100971

Shwedeh, F. (2024). *The Integration of Artificial Intelligence (AI) Into Decision Support Systems Within Higher Education Institutions Nanotechnology Perceptions The Integration of Artificial Intelligence (AI) Into Decision Support Systems Within Higher Education Institutions*. https://www.researchgate.net/publication/382069725

Siciliani, L., Taccardi, V., Basile, P., Di Ciano, M., & Lops, P. (2023). AI-based decision support system for public procurement. *Information Systems*, *119*, 102284. https://doi.org/10.1016/j.is.2023.102284

Soori, M., Jough, F. K. G., Dastres, R., & Arezoo, B. (2025). AI-based decision support systems in Industry 4.0, a review. *Journal of Economy and Technology*, *4*, 206–225. https://doi.org/10.1016/j.ject.2024.08.005

Toderas, M. (2025). Artificial Intelligence for Sustainability: A Systematic Review and Critical Analysis of AI Applications, Challenges, and Future Directions. *Sustainability*, *17*(17), 8049. https://doi.org/10.3390/su17178049

Usman, N., Utami, E., & Hartanto, A. D. (2023). Comparative Analysis of Elliptic Envelope, Isolation Forest, One-Class SVM, and Local Outlier Factor in Detecting Earthquakes with Status Anomaly using Outlier. *2023 International Conference on Computer Science, Information Technology and Engineering (ICCoSITE)*, 673–678. https://doi.org/10.1109/ICCoSITE57641.2023.10127748