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# Reconciliation of Machine-Human Relations through Ikigai Robotics: a Review

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## ABSTRAK

Dinamika baru dalam interaksi antara manusia dan mesin telah dihasilkan sebagai akibat dari kemajuan pesat kecerdasan buatan (AI) dan robotika, yang secara signifikan memengaruhi keberadaan manusia. Untuk meningkatkan interaksi antara manusia dan robot, makalah ini menyelidiki penggabungan konsep Ikigai dari Jepang, atau "alasan untuk hidup," ke dalam pengembangan dan desain robotika. Ikigai adalah konsep yang didasarkan pada empat komponen fundamental: kompensasi finansial, kebutuhan sosial, gairah, dan keahlian. Korelasi Ikigai dengan peningkatan usia panjang dan kebahagiaan secara keseluruhan menunjukkan bahwa konsep ini dapat digunakan secara efektif dalam bidang teknologi. Studi penelitian ini menekankan bahwa mengintegrasikan ide-ide Ikigai ke dalam robot dapat meningkatkan penerimaan dan efektivitas pengguna, terutama di kalangan lansia. Proses desain kolaboratif yang melibatkan para ahli Ikigai mengarah pada interaksi yang lebih ramah pengguna dan bermakna, menyoroti pentingnya umpan balik pengguna. Pertimbangan etis sangat penting ketika mengintegrasikan Ikigai ke dalam pengembangan AI, karena kerangka etika non-Barat mempromosikan keadilan, mengurangi bias, dan memastikan sistem AI sejalan dengan nilai-nilai manusia. Personalisasi interaksi manusia-mesin melalui pembelajaran mesin multimodal, interaktif, dan multitugas mendukung integrasi ini. Penelitian yang berpusat pada pengguna, desain kolaboratif, pengujian iteratif termasuk strategi rekonsiliasi yang memprioritaskan empati, inklusivitas, dan pertimbangan etis. Mendesain bersama dengan lansia menjamin bahwa teknologi responsif terhadap kebutuhan mereka dan berkontribusi pada tujuan hidup mereka. Tinjauan ini menyimpulkan bahwa mengintegrasikan prinsip-prinsip Ikigai ke dalam robotika dapat mendorong interaksi yang bermakna dan bermanfaat antara manusia dan mesin, serta mempromosikan kesejahteraan secara keseluruhan. di masa depan harus terus mengeksplorasi Ikigai dalam berbagai konteks teknologi untuk membimbing Penelitian pengembangan AI dan robotika menuju kemakmuran manusia.
**Kata Kunci:** *Ikigai, Interaksi Manusia-Mesin, Etika AI, Reka Cipta, Robotik*

## *ABSTRACT*

New dynamics in interactions between humans and machines have been generated as a result of the rapid advancement of artificial intelligence (AI) and robotics, which has significantly impacted human existence. In order to improve the interaction between humans and robots, this paper investigates the incorporation of the Japanese concept of Ikigai, or "reason for being," into the development and design of robotics. Ikigai is a concept that is predicated on four fundamental components: financial compensation, societal necessity, passion, and proficiency. Ikigai's correlation with increased lifespan and overall happiness suggests that it might be effectively used in the realm of technology. The research study underscores that integrating Ikigai ideas into robots may improve user acceptability and efficacy, especially among older persons. Collaborative design processes involving Ikigai experts lead to more user-friendly and meaningful interactions, highlighting the importance of user feedback. Ethical considerations are crucial when integrating Ikigai into AI development, as non-Western ethical frameworks promote fairness, reduce bias, and ensure AI systems align with human values. Personalisation of human-machine interactions through multimodal, interactive, and multitask machine learning supports this integration. User-centered research, collaborative design, iterative testing are among strategies for reconciliation that prioritise empathy, inclusivity, and ethical considerations. Co designing with senior adults guarantees that technology is responsive to their requirements and contributes to their sense of purpose. This review concludes that integrating Ikigai principles into robotics can foster meaningful and beneficial interactions between humans and machines, promoting overall well-being. Future research should continue exploring Ikigai in various technological contexts to guide AI and robotics development toward human flourishing.
**Keywords:** *Ikigai, Human-Machine Interaction, AI Ethics, Design, Robotics*

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## 1. INTRODUCTION

The rapid progress of AI and robotic technology in recent years has had a dramatic influence on several parts of human existence. These advancements have not only revolutionised sectors but also brought up new dynamics in the way humans engage with machines. In the midst of these transformations, the Japanese notion of Ikigai presents a compelling structure for cultivating significant and advantageous connections between people and machines.

Ikigai, 生きがい, a concept that means 'reason for being,' has four essential components: passion, proficiency, societal need, and financial remuneration (Schippers, 2017). The concept of Ikigai has been associated with enhanced well-being and increased lifespan, indicating its potential utility in several domains, such as technology and robots.

The purpose of this review is to investigate the incorporation of Ikigai concepts into the design and advancement of robots, with the goal of harmonising and improving interactions between machines and humans. Through a thorough analysis of existing literature and real-life examples, our objective is to pinpoint tactics that synchronise technical progress with the overall welfare of people.

## 2. THE APPLIED CONCEPT OF IKIGAI

Studies have discovered that, for example, feeling of purpose and are both improved by Ikigai. According to Kotera et al. (2021), Ikigai is correlated with decreased psychological distress and well-being – somewhat of an inverse relationship sufficient to reducing stress, anxiety, and depression levels. In fact, it may help the individuals defining their passions in life and knowing what they do best as well as provide them with a deep sense of purpose - these intrinsic factors can contribute to coping mechanisms when faced with adversity and foster resilience.

As robotics and AI evolve, the silver lining of robots living among us comes with equal amount of opportunity as it does peril. Randall et al. (2023) investigated the acceptance of home robots for Japanese older adults and showed that Ikigai-principle leads to high well-being and acceptance among users. That is particularly true of the increasingly elderly population that will be clamouring for technologies that can improve their quality of life.

Kamino et al. (2023) showed with a real-world example of social robots co-designed by Ikigai experts: Co-designing to produce conversation experience is more user-friendly and meaningful. Through involving the users in a co-design process, these two robots are better adapted to the requirements and preferences of each user - thereby improving their quality of life.

The purpose of this review is to investigate the incorporation of Ikigai concepts into the design and advancement of robots, with the goal of harmonising and improving interactions between machines

and humans. Through a thorough analysis of existing literature and real-life examples, our objective is to pinpoint tactics that synchronise technical progress with the overall welfare of people.

**Intersection of Ikigai and Technology**

Integrating Ikigai into robotics involves considering the ethical implications of AI and human enhancement technologies. Ziesche and Yampolskiy (2020) suggest that incorporating non-Western ethical perspectives, such as Ikigai, can enrich the development of AI systems. This includes promoting fairness, reducing bias, and ensuring that AI systems align with human values.

Clabaugh and Matarić (2018) discuss the personalisation of human-machine interactions through multimodal, interactive, and multitask machine learning, aligning with the individualised approach of Ikigai. Personalising these interactions can lead to more effective and satisfying use of technology, as it caters to the unique needs and preferences of each user (Wilkes et al., 2023).

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The four aspects of the framework are: what we love, what we are good at, what the world needs, and what we can be paid for. However, pursuing each one of these components would be said to be the only way of finding a meaningful and a satisfied life (Schippers, 2017). It was adapted to the approach of robots that would work with these human values and priorities. What can be inferred from this is that technology can not only help human beings do certain functions but also it can also encourage the general interests and satisfaction of its users by adhering to guiding principles.

1. **What You Love (Passion):** With an input that users love technology can become a satisfying and enjoyable experience when it is user-centered and creative. As a result, users can make a stronger connection with the technology and therefore, they can be more satisfied. In addition, they can further ensure long-term user engagement.
2. **What You Are Good At (Profession)**: Crafting technology tools that complement the user's skills and knowledge makes them feel talented and successful. To be able to know this end-user the advantages of such cooperation are even more but not the only ones. This is enables users to accomplish more in the technical and more widespread ways, because the reduction of complexity and the creating of more intuitive systems improving overall user experience.
3. **What the World Needs (Vocation):** The use of technology to remedy societal challenges can instead give one a strong feeling of one's contribution to a bigger cause and related purpose. For example, who would have thought in the past that the technology will be there to help the old people and the

people with physical disabilities by doing the most critical societal work? The solution, thus, would be both good for the elderly and disabled and highly beneficial for the community in which they reside.

4. **What You Can Be Paid For (Mission)**: The economic value provided by a technology to the user can be the main reason for its adoption and sustainability. This component is about developing technology that is both the bread and butter for users either by giving them economic benefits or by enhancing their productivity through efficiency improvements.

**Application to Machine-Human Relations**

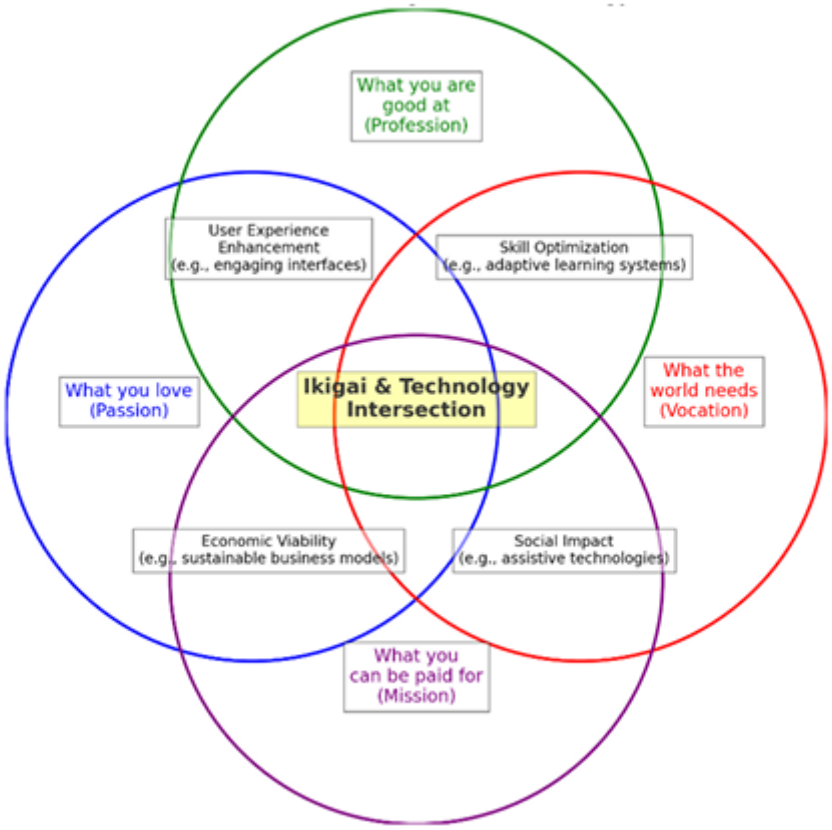


Figure 1. Venn Diagram for Ikigai-Technology Intersection

To apply Ikigai's principle to machine-human relations and create technologies that will increase user satisfaction and well-being is the main aspect of the work. Thus, it is about working on the initiative and creating robots that are able to recognise the users' passions, skills, societal needs, and economic contributions. For example, robots that help out with daily tasks while at the same time giving emotional support can contribute to the quality of elderly users' lives (Randall et al., 2023).

Figure 1 above explains the technology's role in intersecting the four roots of Ikigai to get a balanced fusion that will optimise user engagement and satisfaction. The trees in the overlapping zones

in-between of these components – passion, profession, vocation, and mission – demonstrate the specific areas where technology would be most effective in the humans embracing of their values and needs:

1. **経験向上, Keiken Kōjō (Experience Enhancement)** – Profession + Passion Engaging interfaces and user-friendly designs that make technology enjoyable to use.
2. **スキル最適化, Sukiru Saiteki-ka (Skill Optimisation)** – Profession + Vocation Adaptive learning systems and technologies that help users improve their skills and capabilities.
3. **社会的影響, Shakaiteki Eikyō (Social Impact)** – Passion + Mission Assistive technologies and innovations that address societal needs and improve quality of life.
4. **経済的実現性, Keizaiteki Jitsugensei (Economic Viability)** – Vocation + Mission Sustainable business models and technologies that provide economic benefits to users.

One of the ways to apply these precepts is to make the technology not a mere instrument but rather a companion in ensuring a rich and worthwhile life. This method brings innovation to the robot functionalities and guarantees their well-behaved interaction with the users and the completion of the tasks.

## 3. DISCUSSION

The literature review and formulation of the relations revealed several strong insights with regards to applying Ikigai concepts in robotics and AI. A significant finding is that incorporating Ikigai into the design and operation of robo-tasks enhances users' acceptance, compliance, and effectiveness when engaging in tasks managed by them. Randall et al. (2023) They make a strong point that older adults are much more likely to accept robots that have elements of The concept of Ikigai integrated into their design. It is because those robots resonate with the virtues shared by users and can enhance their common social good. Improved mental and emotional health is particularly important in an aging population.

Without these elements, the interactions between people become more meaningful and satisfying – which the Ikigai specialists read from what Kamino et al. (2023) demonstrate can also emerge out of co-making robots with people. This practice ensures that the robots meet our exact demands and desired, thereby enhancing their overall service. These collaborative efforts in robot design underscore the importance of understanding and incorporating feedback from users, which could lead to the development of more intuitive and user-friendly robots.

Another important observation here is the ethics of employing Ikigai into AI/Robots. Ziesche and Yampolskiy (2020) argued that incorporation of non-Western value systems, such as Ikigai, into AI development could be an approach for mitigating ethical problems we would have to encounter when using advanced technologies to modify or assist human capabilities. This includes ensuring fairness, limiting harm for discrimination, and making AI agents align with human values. This is a testament to the

increasing acknowledgement that discussing more than one ethic is key in the global conversation about AI ethics and as such will help design technical solutions with impact that are inclusive and fair.

**Implications for Machine-Human Relations**

The influence of integrating Ikigai principles into robotics bears great significance for future machine human interactions. By leveraging a combination of what users love, are good at, need, and are compensated for, robots can be created to generate meaningful increases in the quality of life for individuals who seek advanced technologies, finding the rewards far outweigh the significant economic costs. Doing so will not only enhance user experience but also help to forge better and more productive relationships between people and machines.

Introduced by Sartore et al. (2022), the concept of Ikigai Robotics demonstrates the symbiotic relationship between well-being at work and performance. For instance, they found that robots designed based on Ikigai principles for railway maintenance workers enhanced job satisfaction and productivity by fulfilling workers' social desires and providing them with a sense of purpose. This indirectly implies that introducing certain Ikigai elements in professional scenarios may result in healthier workspaces and happier employees.

In addition, therapeutic robots like the Rabbit Robot developed by Akedo et al. (2016) illustrate how the concept of Ikigai can be used to improve human well-being in real life. These robots are created to help reduce stress and improve mental health by providing comfort and companionship. The success of these therapeutic robots suggests the possibility of using similar robots for wider applications in both healthcare and personal well-being, particularly addressing loneliness and depression among the elderly.

A third key point integrated into the design of human interaction with machines is the personalisation of these interactions. Clabaugh and Matarić (2018) suggest that multimodal, interactive, and multitask machine learning can personalise these interactions to meet different people's needs. This is important for developing systems and robots aimed at providing support or extended user engagement. One use case could be therapeutic robots, which calibrate their responses to the behavior of the user, creating a unique therapeutic interaction.

**Ethical and Cultural Aspects**

Incorporating Ikigai into AI development also means making AI decisions with a broader view, considering ethical and cultural perspectives. Ziesche (2023) highlights the need to integrate non-Western AI ethics traditions like Buddhism, Confucianism, and other Eastern philosophy-centered paradigms. These provide rich orientational examples of AI for harmony, community well-being, and sustainable

flourishing. By embedding even the basic aspects of Buddhist principles into AI, we can create systems that act empathetically, seemingly looking out for our best interests and keeping us happy.

The broad societal needs and challenges in robotics, when viewed through this framework, make Ikigai particularly suitable for application. Rochelle and Hoyer (2024) discuss the cross-cultural comparison of behavioural activation and Ikigai as constructs with potential for designing culturally relevant mental health interventions. This approach can help address issues like depression and anxiety, and assist humans in finding a reason for existence by making robots more empathetic.

Numerous case studies provide clear examples of how Ikigai principles can be applied in robotics. For instance, the Rabbit Robot created by Akedo et al. (2016) was designed as a therapeutic companion to relieve users' stress and keep them emotionally well. This robot's cute appearance and engaging performance highlight the importance of emotional concerns in user-centric robot design. Similarly, the survey by Sartore et al. (2022) on railway maintenance workers demonstrates how robots developed using Ikigai principles can enhance job satisfaction and productivity, suggesting these principles could be applicable in various professional fields.

## RECONCILIATION STRATEGIES

### Technical Considerations for Users

Design through a user's lens is fundamental to incorporating Ikigai principles in engineering practices. This means putting users front and center in the design process, which can be achieved in several creative ways:

1. **User-Centered Research and Development**: Conduct thorough research into what users are passionate about, their skills, societal needs, and their economic contributions. The design process must be user-centered, and this can range from surveys and interviews to focus groups to understand what users need and how they interact with technology. For example, Randall et al. (2023) found that robots designed with Ikigai principles are more likely to be accepted by older adults as they align with users' values and contribute to their well-being.
2. **Collaborative Design Processes**: Utilise methodologies such as design thinking for inclusive solutions and participatory design activities. This involves co-design workshops where users, designers, and engineers collaborate to tailor technology to user needs. Kamino et al. (2023) demonstrated that robots co-designed with Ikigai experts lead to more meaningful interactions and higher satisfaction, ensuring the technology is user-friendly and aligns with users' sense of purpose.
3. **Iterative Testing and Feedback Loops**: Implement iterative testing phases where prototypes are tested by users, and feedback is continuously collected and integrated into the design. This ensures that the final product is refined to meet users' expectations and needs. The study by Sartore et al.

(2022) highlighted the importance of addressing social needs and providing a sense of purpose through iterative design, particularly for railway maintenance workers.

4. **Personalisation and Adaptability**: Develop technology that can be tailored and customised to individual users. This can involve incorporating machine learning algorithms that learn and adapt to users' preferences and behaviors over time. Clabaugh and Matarić (2018) emphasised the significance of multimodal, interactive, and multitask machine learning as a first step toward personalising human-machine interactions, resonating with the Ikigai-based individualised approach.

**Human-Centric Design**

Above all, human-centric design is key to ensuring that technology supports and enhances individual well-being in alignment with Ikigai principles. This system has a few main components:

1. **Empathy and Understanding**: Designers need to deeply understand users, their emotions, and needs. This can be achieved through empathy-driven approaches, such as observing users during their daily activities or conducting ethnographic studies. It helps in designing technology that closely connects with users' sense of purpose and well-being.
2. **Inclusivity and Accessibility**: Technology should be designed for a broad spectrum of human abilities, eliminating the need for adaptation by the user. This includes making it equally accessible to older adults, people with disabilities, and individuals from different cultural backgrounds. Kawachi (2020) stresses the importance of co-speculation to collectively imagine futures of Ikigai in aging societies, highlighting inclusive design practices.
3. **Ethical Considerations**: Implementing ethical principles into the design and development of technology is crucial. This means addressing the ethical dimensions of AI and robotics, such as privacy, autonomy, and fairness. Ziesche (2023) advocates for incorporating approaches to AI ethics from non-Western contexts, which offer important perspectives on designing ethical and empathetic AI systems.
4. **Sustainability and Future Impact**: Technology designed with sustainability in mind ensures long term societal benefits. This includes focusing on the environmental impact of technology and designing for longevity and resilience. Wilkes et al. (2023) found that Ikigai could predict well-being and mental health outcomes, suggesting that sustainable design practices may improve a user's quality of life.

**Co-Designing with Users**

Ensuring technology is co-designed with users, particularly older adults, is an essential strategy to ensure that it meets their needs and enhances their sense of Ikigai. This involves:

1. **Engaging Older Adults in the Design Process**: Older adults can offer exceptional insights into their niche requirements and preferences. Partner sessions and co-design workshops can be effective in making sure that new technology systems are designed specifically to support each user.
2. **Meaningful Interactions**: If the technology is designed with input from older adults, it is more likely to create meaningful and satisfying interactions. For instance, social robots co-designed with Ikigai experts can be developed to not only carry out tasks but also offer emotional care and companionship (Kamino et al., 2023).
3. **Creating Trust and Encouragement**: Including seniors in the design process can a sense of trust, leading to increased willingness to accept new technology. Such collaboration helps eliminate fears and ensures that the technology is seen as a net positive rather than as superfluous or threatening.

Table 1. Summary of The Reconciliation Strategies

| Strategy | Description | Reference |
|---|---|---|
| User-Centered Research Reference and Development | Conduct thorough research to understand users' passions, skills, societal needs, and economic contributions through surveys, interviews, and focus groups | Randall et al. (2023) |
| Collaborative Design Processes | Engage users in the design process through participatory design methods like co-design workshops | Kamino et al. (2023) |
| Iterative Testing & Feedback Loops | Implement iterative testing phases where prototypes are tested by users, and feedback is continuously collected and integrated into the design | Sartore et al. (2022) |
| Personalisation & Adaptability | Develop technology that can be personalised and adapted to individual users through machine learning algorithms | Clabaugh & Matarić (2018) |
| Empathy and Understanding | Designers must have a deep understanding of users' experiences, emotions, and needs through empathy-driven design practices. | Clabaugh & Matarić (2018) |
| Inclusivity & Accessibility | Design technology to be inclusive and accessible to a diverse range of users, including older adults, people with disabilities, and individuals from different cultural backgrounds | Kawachi (2020) |
| Ethical Considerations | Incorporate ethical principles into the design and development of technology, considering implications like privacy, autonomy, and fairness | Ziesche (2023) |
| Sustainability & Future Impact | Design technology with sustainability in mind, considering the environmental impact and designing for longevity and resilience | Wilkes et al. (2023) |
| Engaging Older Adults in the Design Process | Engage older adults in co-design workshops and feedback sessions to tailor technology to their specific requirements | Wilkes et al. (2023) |
| Meaningful Interactions | Design technology with input from older adults to create meaningful and satisfying interactions | Kamino et al. (2023) |
| Trust & Encouragement | Involve older adults in the design process to build trust and increase acceptance of new technology | Kamino et al. (2023) |

Through these strategies, we can integrate Ikigai principles into the development and deployment of technology, thereby driving human-centered solutions that bolster well-being, forge meaningful interactions, and induce a positive human-machine relationship.

## 4. CONCLUSION

The integration of Ikigai into the practice of robotic design and development is yet to be fully tested; however, its potential for improving machine-human relations is undeniable. By adopting a human-centric perspective in technological progress, we can create deeper relationships that contribute to the holistic well being of individuals interacting with robots. Future studies should explore the application of Ikigai across various technological realms to ensure the development of AI and robotics supports human flourishing.

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