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Social Robots and Society: Global Pathways to Acceptance

Contents

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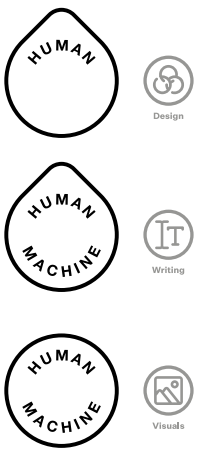

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Executive Summary

As social robots shift from imaginative concepts to active participants in human environments, a deeper look at global attitudes and adoption patterns is crucial for steering their ethical and meaningful uptake.

Social robots are shifting from science-fiction concepts to real tools in daily environments. They are now appearing in hospitals, classrooms, retail spaces, and even homes. Unlike industrial robots designed for repetitive tasks, social robots engage through speech, gesture, and expressive behaviours that emulate human social interaction. Their relevance accelerated during the COVID-19 pandemic, when contact-free assistance and emotional support became urgent priorities in healthcare and eldercare settings.

Although social robots remain in an early and exploratory phase of adoption, the central question has shifted from whether humans will interact with them to how these interactions can be designed to be ethical, meaningful, and socially beneficial. Public acceptance, however, remains uneven and is shaped by cultural differences, perceived usefulness, and concerns around safety, privacy, and reliability.

To better understand these dynamics, the UAE Centre for the Fourth Industrial Revolution (UAE C4IR) in collaboration with Dubai Future Labs undertook an analysis of the societal role and acceptance of social robots. This work builds on original research by Dubai Future Labs at Dubai Future Foundation and previous work from Aymerich-Franch and colleagues, who extensively analysed social robot acceptance across sectors worldwide. Insights from this research form the foundation of the paper, which explores adoption patterns in healthcare, education, and customer service, the sectors currently experimenting most actively with social robotic solutions.

Global perspectives from Japan, Europe, and the United Arab Emirates (UAE) further illustrate the diversity of motivations and challenges shaping uptake worldwide. While early use cases demonstrate clear potential – ranging from patient companionship and classroom engagement to enhanced customer interaction – barriers remain.

The report identifies emerging opportunities and strategic pathways for responsible uptake. It outlines how policymakers, technology developers, and institutional leaders can proactively shape the development and deployment of social robots to maximise societal value while mitigating risks.

With this publication, the UAE C4IR seeks to catalyse a global conversation on the future of social robots, one that emphasises thoughtful governance, inclusion, and long-term societal benefit. As social robots continue their steady integration into human environments, early policy and design decisions made today will determine the quality, safety, and acceptance of human–robot relationships in the years ahead.

Image: Unsplash

Introduction

Public acceptance of social robots is evolving globally, shaped by trust, cultural values, and clear evidence of societal benefit.

Social robots are physically embodied robots designed to interact with humans through social cues and behaviours. Their defining characteristic lies in their capacity to engage with people, and sometimes with other robots, in exchanges that feel authentically social. Unlike industrial robots hidden in factories and designed for precision and repetitive performance, social robots are created to communicate, collaborate, and respond in ways that emulate human interaction. Equipped with sensors, cameras, and artificial intelligence, social robots can interpret speech, gestures, and facial expressions and comply with social norms, allowing them to adapt their responses to different social contexts.

> Social robots are not confined to factory lines or science fiction; they are entering everyday spaces as interactive partners in human life.

Social robots are not confined to factory lines or science fiction; they are entering everyday spaces as interactive partners in human life. These robots have appeared in diverse spaces such as healthcare, education, customer service, and domestic environments, acting as companions, assistants, or educators. Their development lies at the intersection of robotics, cognitive science, and social psychology, aiming to bridge the gap between technology and human emotional connection.

Although we often think of robots as technologies of the future, the fascination with creating automated lifelike machines has been with us since ancient times. Renaissance inventor Leonardo da Vinci sketched designs for humanoid knights, while Islamic scholar Al-Jazari pioneered early social robotics in the 12th century by designing programmable automata that poured drinks, played music, and interacted with guests – marking one of the earliest experiments in human–robot social interaction. In 1920, the Czech play RUR introduced the word “robot” from “*robota*” (meaning forced labour), embedding the idea of artificial workers in modern imagination.

Al-Jazari’s drink-serving automaton

It was not until the early 2000s that humanoid social robots entered the commercial sphere, with AIBO, PARO, Nao, and Pepper being among the most iconic examples. Retailers deployed them to greet customers, hospitals and nursing homes experimented with them to reduce loneliness, and schools used them to support learning. Yet many initiatives remained pilot projects. Complex technical limitations impacting production costs and their functionalities, as well as widespread scepticism about their real-world utility, often constrained widespread adoption.

The COVID-19 pandemic marked a turning point in this regard: social robots moved from curiosity to necessity. In hospitals, they delivered meals and medicine, disinfected spaces, and monitored patients’ vital signs, protecting healthcare workers from exposure.

> The central question is no longer whether humans and robots will interact but how we can design these relationships so that they are ethical, meaningful, and beneficial to society as a whole.

In nursing homes, they comforted isolated residents and enabled remote family visits. In airports and shopping centres, they reminded visitors to wear masks and maintain distance. What once seemed an expensive curiosity suddenly proved indispensable: robots could act when humans could not. As one study identified, over 85 different models of social robots were deployed in initiatives aimed at containing the pandemic worldwide.[1] The social robots' capacity to perform the roles of liaison in tasks that required human–human interaction, to act as a safeguard to ensure contagion risk-free environments, and to act as well-being coaches by providing therapeutic and entertainment functions, which were directly associated with the needs of facilitating physical distance and palliating the effects of isolation, were key to the surge of these robots throughout the pandemic.[2]

The "uncanny valley" is a term used to describe the strange, uneasy feeling many people experience when a robot or digital character looks and behaves almost, but not quite, human. As a robot's appearance and behaviour become more humanlike, people tend to feel increasingly comfortable with it until a critical point is reached at which small imperfections in its face, voice, or movements suddenly make it seem eerie rather than friendly. For social robots that are meant to provide care, companionship, or services, this dip in comfort can be a major barrier to public acceptance, shaping whether people feel able to trust these technologies in homes, workplaces, and public spaces. Understanding the uncanny valley, and designing around it, is therefore essential if societies want social robots that feel helpful, relatable, and aligned with people's expectations.

At present, the use of social robots is still in an exploratory, early-adoption phase rather than a mature, mainstream reality. Early pilots and testbeds, often led by innovators and early adopters, are less about scaling proven solutions and more about learning what works, for whom, and in which contexts, so that future generations of systems can be safer, more intuitive, and more trusted. Each new deployment therefore functions as a real-world experiment that deepens understanding of how machines can coexist with humans in shared social spaces and where design, regulation, and ethics need to catch up. The central question is no longer whether humans and robots will interact but how we can design these relationships so that they are ethical, meaningful, and beneficial to society as a whole; the following pages map emerging-use cases, draw out key challenges and opportunities for human–robot interaction, and outline pathways to guide more responsible adoption over time.

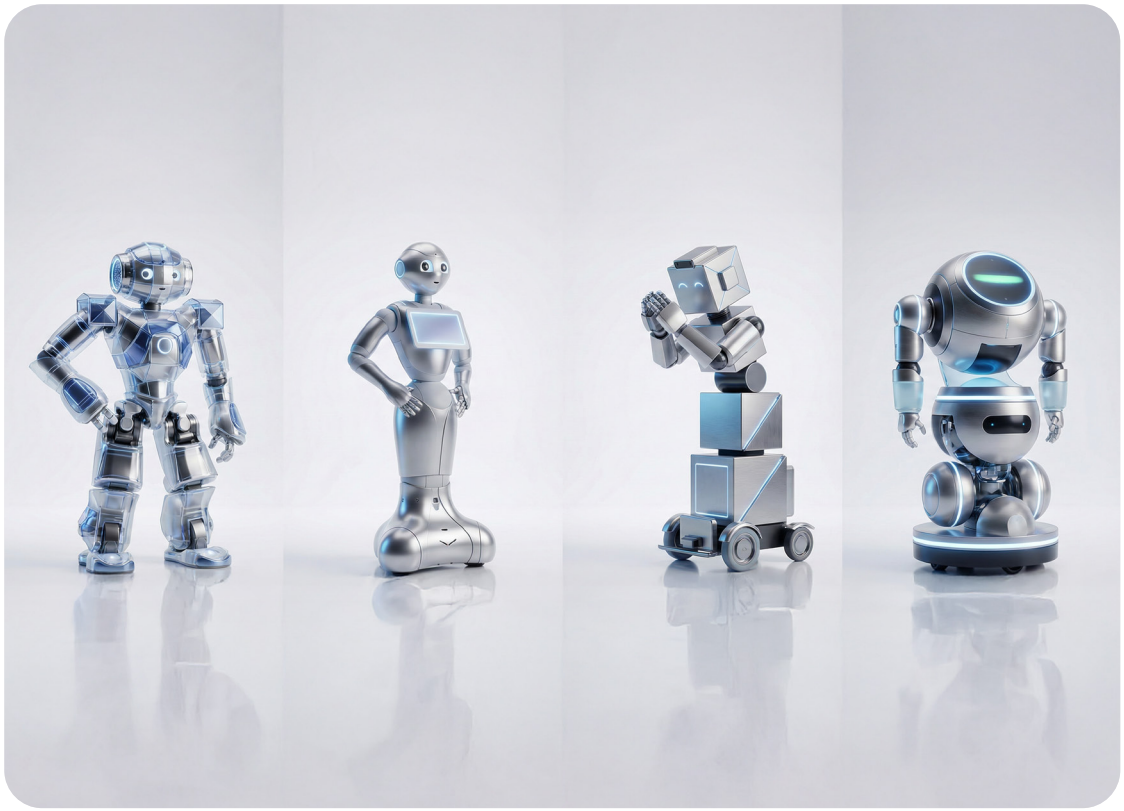
Image: Unsplash

Public Adoption across Sectors

Adoption patterns vary across education, healthcare, and customer service, reflecting differences in regulatory frameworks, cultural expectations, and demonstrated impact.

> The broader adoption of social robots is shaped by the intricate balance between perceived benefits, technical challenges, and societal concerns.

In recent years, hundreds of deployments across continents have demonstrated how social robots can effectively operate alongside humans in real-world environments such as hospitals, nursing homes, classrooms, retail spaces, and private homes. Rather than replacing human care or service, these robots often take on supportive or engaging roles that ease workloads and enhance user experience. Yet, their integration also brings a set of risks and uncertainties. Questions remain around safety, ethics, and the genuine value these technologies provide, and these are issues that continue to fuel public debate. As a result, the broader adoption of social robots is shaped by the intricate balance between perceived benefits, technical challenges, and societal concerns. Understanding this balance is crucial to advancing social robotics responsibly and strengthening trust between humans and machines.



AI-generated images of social robots similar to those used in hospital settings

AI image of robot in a care setting

This evolving symbiotic relationship between humans and robots is most clearly observed in sectors such as healthcare, education, and customer service, sectors where social interaction is central to the quality of experience, where workforce shortages create demand for assistive technologies, and where the emotional and communicative abilities of robots can deliver tangible value. In these contexts, social robots are beginning to redefine not only the boundaries between technology and human care but also the very nature of collaborative work between people and machines.

Healthcare Sector: Companions and Assistants

Healthcare is one of the most dynamic domains of social robot adoption. In a mapping study of nearly 280 deployment experiences identified in 33 countries, more than 50 different robot models were found in hospitals, eldercare centres, occupational health facilities, and private homes.[3]

The researchers identified 20 different functions, which included:

Entertainment and Companionship: Robots such as Pepper and Nao entertained patients in hospitals and provided comfort in eldercare centres.

Telepresence: Robots connected isolated patients with relatives and clinicians, often through screens embedded in their bodies. In hospitals, this was the most widespread function, representing over 40% of deployments

Information and Guidance: Robots provided both general and personalised medical information, guided visitors through complex facilities, and translated across languages.

Rehabilitation and Training: Robots led group exercise sessions, assisted in rehabilitation routines, and acted as patient simulators for medical training.

Logistics and Safety: Robots delivered meals, transported supplies, patrolled spaces, and disinfected rooms.

Testing and Monitoring: Robots were equipped to monitor patients and nursing home residents, measure vital signs, and prompt patients to complete questionnaires as a pre-diagnosis function.

Geographically, healthcare deployments have flourished in North America, Europe, and Asia, and they have also extended to countries such as Mexico, Rwanda, and Ethiopia, showing the global reach of this trend. Beyond functional use, the adoption of social robots in healthcare requires navigating diverse regulatory and cultural ecosystems.

In some regions, like the European Union or the UK, social robots are treated in line with other high risk digital and medical technologies, including requirements for safety assessment, certification, and robust data governance. By contrast, especially in emerging markets, concerns around privacy, informed consent, and technical reliability often temper enthusiasm for large-scale deployment.

Although not yet widely deployed for this purpose, social robots have shown strong potential to enhance psychological well-being. For instance, in a recent study[4], Jibo robots guided university students through positive psychology interventions, leading to measurable improvements in psychological well-being. The value lies not in replacing human teachers or counsellors but in offering scalable, stigma-free support that complements human care.

Education Sector: Robots as Learning Partners

Education is another domain where social robots are being tested and adopted. In group classroom settings, they are particularly valued as a complementary tool that adds personalisation within a shared environment, adapting to students' specific needs while the teacher leads. Milo, Nao, and Pepper, among other robots, help sustain attention, encourage participation, and deliver tailored exercises to students.

Image: Unsplash

Drawing on the analysis of 206 cases of social robots deployed in 28 countries involving 43 different robot models[5], the findings show that social robots' main functions in the education sector include:

Supporting students' well-being through edutainment, entertainment, and psychological support, thereby helping to sustain attention, reduce stress, and create a positive learning climate.

Encouraging healthy habits by promoting physical exercise and well-being adherence, for example through guided routines or reminders that integrate movement into daily activities.

Providing companionship and social presence, which can motivate students, reduce feelings of isolation, and make group learning more engaging.

Assisting with learning by introducing programming and computational skills, supporting language learning through translation and multilingual interaction, and tailoring exercises to individual needs.

Supporting teachers by monitoring pupils, assessing progress, guiding groups in classroom activities, and offering both general and personalised information.

These functions show that social robots in education are not replacements for teachers but supplementary tools that extend learning opportunities, particularly for vulnerable or underserved groups.

Research consistently demonstrates that social robots can enhance both cognitive and affective outcomes, increasing engagement, motivation, and confidence among students through adaptive, personalised interaction. Regions with established digital education strategies and ethical frameworks have integrated social robots into inclusive and adaptive learning policies. In contrast, in regions where digital education is not widespread, the use of robots often remains confined to pilot programmes and research initiatives rather than formal curricula.

Customer Service: Beyond a Branding Strategy

Outside of healthcare and education, companies have also turned to social robots for customer service, though often for different reasons. In a global mapping of nearly 180 cases, most retail and hospitality deployments were found to serve branding strategies rather than purely functional goals.[6] However, these deployments signal a growing commitment to enhancing in-person experiences and reimagining service quality and engagement.

The main functions observed in customer service include:

Greeting and Hosting Customers: Robots act as receptionists, concierges, or store greeters.

Providing Product and Service Information: Many robots answer questions, describe products, and promote offers.

Entertaining Visitors: Robots often engage children through singing, dancing, or other means so that parents can shop uninterrupted.

Guidance and Navigation: In malls, airports, and banks, robots direct customers to counters, gates, or services, often in multiple languages.

Promotional Roles and Data Collection: Robots distribute flyers, highlight deals, or act as mascots that attract foot traffic. Some robots gather customer preferences or loyalty programme information via touchscreen or conversation.

These deployments highlight an important distinction: while robots in healthcare meet urgent human needs, those in customer service often serve symbolic roles, embodying innovation and modernity. Yet both functions matter. In service industries, social robots act as living brand ambassadors, shaping consumer perception while experimenting with new forms of human–machine interaction.

Social robots in customer service are emerging as supplementary tools that enhance interaction quality and brand experience rather than replacing human staff. In highly regulated regions such as Japan and the European Union, robots like SoftBank's Pepper and LG's CLOi have undergone extensive evaluation to ensure transparency, safety, and ethical data handling. Pepper engages retail and hospitality customers through conversation and emotional recognition, while CLOi supports concierge and cleaning tasks in hotels. In Japan and South Korea, robots such as BellaBot and KettyBot are increasingly used in restaurants and cafes to greet customers, deliver food, and provide information. In the UAE, similar deployments align with cultural values of attentiveness and innovation, particularly in hospitality.[7,8]

Across all markets, success depends on context-sensitive design and transparency. When used thoughtfully, robots enhance rather than just automate the brand experience, serving as adaptive, personable interfaces that embody how culture, regulation, and trust shape the evolution of service innovation.

Pudu Robotics' BellaBot

Global Insights and Perspectives

Examples from around the world highlight how social robots are being tested, accepted, and scaled across diverse cultural contexts.

Dubai:
Mapping Acceptance and Insights from Dubai's Large-Scale Survey

To understand how residents perceive and accept social robots in public spaces, Dubai Future Labs conducted one of the region's largest surveys, engaging over a thousand participants from across Dubai's multicultural population. The study explored public attitudes towards robot avatars in service-oriented settings such as shopping malls, airports, hotels, museums, hospitals, and transport hubs.[9]

The findings showed high overall acceptance. Physical, embodied robots were rated more positively than digital or screen-based avatars, emphasising the importance of physical presence in social interaction. Robots with clearly robotic designs were most welcomed, while animal-like avatars received the lowest ratings.

Respondents valued robotic assistance highly for a wide range of tasks, including providing information, offering guidance, and supporting multilingual communication. However, handling complaints remained a domain people preferred to keep human, reflecting limits to automation in emotionally charged contexts.

Acceptance also varied by setting. Commercial venues, libraries, and transport stations were seen as suitable environments for social robots, whereas healthcare and education settings (ie spaces involving vulnerable groups) elicited more cautious attitude.[10]

AI generated image of a helper robot in a shopping mall

Key results include:

- 74.5% of respondents supported robot deployment in shopping malls.
- 59.6% supported their use in hotels.
- 69.6% approved deployment at airports.
- Robots with humanoid yet mechanical appearances were preferred over highly humanlike or animal-inspired designs.
- Emirati participants expressed significantly higher acceptance of android-like designs compared to expatriate groups.

These findings suggest that practical utility and cultural preferences are strong determinants of acceptance.[11]

A Robot in the Majlis – Symbolism and Social Acceptance

At a recent Majlis gathering, His Highness Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Ruler of Dubai, was greeted by the Unitree G1 humanoid robot, presented by Dubai Future Labs. The robot's lifelike posture and humanlike interaction impressed dignitaries and global observers alike. More than a technological showcase, this moment reflects how the UAE integrates innovation into the highest levels of civic and cultural life. It signals two broader meanings: first, that robots are not confined to technical domains but are part of social and political dialogue, and second, that public familiarity and acceptance are accelerated when leaders themselves embrace such demonstrations.

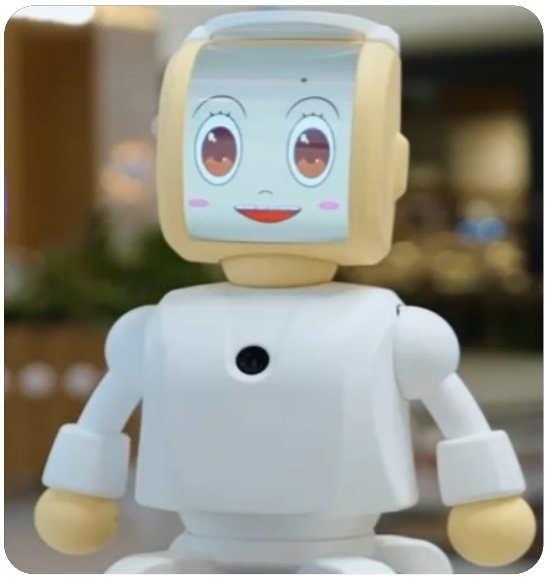
Source: https://gulfnews.com/uae/robot-steals-the-show-at-majlis-with-shaikh-mohammed-video-1.500225428

In partnership with Majid Al Futtaim, Dubai Future Labs deployed social robots in Mirdif City Centre and Mall of the Emirates to assist visitors with wayfinding and product localisation. Visitors could ask a robot about specific products or services. The robot helped identify what stores might potentially have that product, showed directions to reach the store on a screen, and was even able to physically guide visitors to their destinations. Overall, the robot's functions were rated very highly in terms of usefulness, enjoyment, and safety, and participants expressed strong interest in using the technology if it were deployed in shopping malls in the future.

Cultural Acceptance and Practicality

Japan stands out as a society with high familiarity with and integration of social robots, especially in eldercare, hospitality, and public services. Japan leads the world in eldercare robotics, driven by an ageing population, where more than 30% of citizens are over 65, and by earlier projections of a shortage of 400,000 caregivers by 2025. By 2018, the government had invested over US$300 million in research and development for social robots to care for elderly people only. Robots like Pepper and Paro are widely used and have been warmly received in many contexts. Paro is widely used in nursing homes for therapeutic companionship, particularly for dementia patients. Research shows Paro reduces anxiety, depression, and the need for sedatives through tactile and emotional feedback. Japanese respondents consistently show positive attitudes, often rating robots highly for practical roles such as cleaning or providing information in public spaces. However, field studies illustrate a nuanced view: while daily interaction with robots is common, acceptance drops in roles demanding high emotional engagement or the mimicking of human attributes (eg receptionists or avatars). People typically rate actual humans as warmer and more competent, indicating that although robots are widely embraced, distinction remains between them and humans in personal social contexts.[12,13,14]

Japanese culture, with its longer exposure to robots in media and industry, shows relatively positive attitudes towards robots. A December 2019 survey indicated broad acceptance of communication robots across all ages and genders. However, acceptance does not automatically translate to usage, particularly when robots fail to meet practical care needs. Despite government support, adoption remains limited. A 2019 national survey of over 9,000 eldercare institutions found only 10% had introduced any care robots, and a 2021 study showed only 2% of home caregivers had used them. Robots often end up unused in storage due to technological limitations, lack of integration with workflows, and insufficient training.[12]



Teleco robot

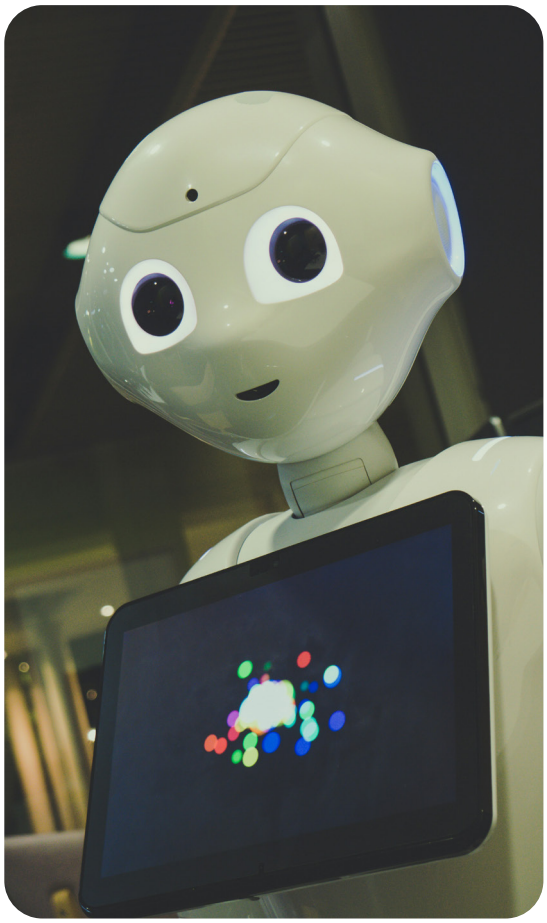


Image: Unsplash

Europe:
Healthcare Social Robots

European Union-funded projects such as SPRING (Socially Assistive Robots in Gerontological Healthcare) have piloted humanoid robots in hospitals and care facilities across France, Germany, Spain, and Italy, supported by €8.4 million in funding. Despite technological readiness, adoption remains limited. A 2023 European study assessing 25 robot applications found that although most demonstrated high technology readiness levels, they received low demand scores from healthcare stakeholders, revealing a significant gap between technical maturity and real-world implementation. Key barriers include regulatory complexity, insufficient staff training, and poor integration with existing care models.[15,16]

A large-scale survey explored the attitudes of European citizens regarding the adoption of socially assistive robots for healthcare in the European Union and found a positive relationship between previous robot experience and attitudes towards them, suggesting that being exposed to these robots might contribute to resolving the fear of the unknown and so increase willingness to adopt them.[17]

Deployment across the World

- **Henn-na Hotel, Japan:** Japan's Henn-na Hotel is the world's first robot-staffed hotel, featuring humanoid receptionists, multilingual concierges, and robotic baggage handlers. These robots handle check-ins and room deliveries while maintaining contactless and efficient operations. While early guest responses praised the novelty and convenience, later studies found that lack of human oversight reduced satisfaction when technical issues occurred, prompting a hybrid staff model.

- **LOTTE Hotel Seoul, South Korea:** At LOTTE Hotel Seoul, AI-driven social robots offer contactless services including check-in, room service, and concierge functions. Robots deliver amenities and interact through voice-activated interfaces integrated with "Giga Genie", an AI-powered voice assistant. The approach has improved customer satisfaction, reduced labour costs, and enhanced hygiene management, especially after the pandemic.

- **Nao Robots, France:** The Nao robot by SoftBank Robotics is widely used in European schools, including primary institutions in France, to teach programming and support children with autism or learning challenges. Teachers report higher engagement and better comprehension when Nao is included in lessons, demonstrating social robots' educational value.

- **Paro Therapeutic Robot, Denmark:** The Paro seal robot is used in European and Scandinavian healthcare settings to provide comfort to elderly and dementia patients. Designed to mimic lifelike animal responses to touch and sound, Paro significantly reduces anxiety and loneliness while improving mood and social engagement.

Emerging Opportunities and Key Challenges for Social Robots

The deployment of social robots is connected to opportunities and challenges that are being investigated and assessed by experts worldwide.

Social robots are moving from experimental deployment towards more embedded roles in care, services, and everyday environments. They are increasingly seen not as replacements for human workers but as tools that can extend human capability, enhance well-being, and improve service quality when thoughtfully designed and governed. This chapter synthesises emerging opportunities and key challenges that were highlighted during a workshop conducted in October 2025 by UAE C4IR and Dubai Future Labs with international experts from the robotics and AI fields.

Emerging Opportunities

Extending care and well-being

Participants highlighted strong potential for social robots to support essential work in eldercare, nursing, and healthcare by addressing both physical and mental well-being. Social robots can assist with repetitive care tasks, reminders, and monitoring, allowing caregivers to focus on complex and relational aspects of care. They can also provide companionship, entertainment, and emotional support, helping reduce loneliness and improving longevity, especially for ageing populations or people living alone.

Enhancing productivity and service quality

A recurring theme was the potential for social robots to enhance productivity and consistency across sectors. Robots can take on tasks that are repetitive, physically demanding, tedious, or undesirable for humans, freeing staff to focus on higher-value activities. In service environments, social robots can help maintain consistent service-level agreements, support better knowledge management, and deliver more reliable information and guidance to customers, thereby improving customer experience and overall service quality.

Supporting communities and public services

Social robots were also seen as tools to meet community needs and support public services. In public spaces, robots can provide information, wayfinding, and basic assistance, while in community hubs they can support learning, inclusion, and engagement. Governments and public institutions can leverage social robots to extend service reach, especially in contexts of staff shortages or geographically dispersed populations, aligning with strategic goals such as addressing ageing demographics or making cities more automated and efficient.

Accelerating innovation and new collaboration models

The pace of advances in AI and physical AI creates opportunities for new forms of human–robot collaboration. Social robots can act as a “second brain” for humans, supporting mental tasks such as information retrieval, decision support, and routine planning. They also create a focal point for collaboration across the robotics value chain – data, AI, simulation, and hardware – enabling research advances towards more capable, safe humanoids and service robots. Large technology firms investing in these platforms can drive down costs, improve reliability, and accelerate diffusion, especially where governments adopt robots in public services and create predictable demand.

Image: Unsplash

Key Risks and Challenges

Human connection and psychosocial impacts

The workshop participants expressed concerns that social robots could reduce human–human interaction and contribute to a loss of human connection. If deployed as substitutes for human contact rather than complements, robots may complicate care processes, create emotional distance, or encourage over-reliance and attachment that could lead to emotional harm when systems fail or are withdrawn. There is a tension between leveraging robots to mitigate loneliness and ensuring they do not become a justification for withdrawing human presence in sensitive domains such as eldercare, mental health, or education.

Unrealistic expectations and operational burdens

Another central concern was that social robots may not deliver on their promised productivity and value propositions. In practice, robots can complicate workflows, add operational overheads, and cause staff discontent when systems are unreliable or poorly integrated. If robots are “mal-used” or introduced without clear use cases, they risk being perceived as novelties rather than useful tools. This mismatch between expectations and reality can erode trust, undermine staff acceptance, and contribute to robots ending up underused or stored away.

Privacy, security, and misuse

Social robots depend heavily on sensing, personalisation, and connectivity, which raises significant privacy and cybersecurity risks. Participants were worried about hacking, data breaches, and the use of robots as control tools, particularly by autocratic governments. Because robots may process large volumes of personal and financial information for perception and decision-making, their security posture needs to be exceptionally robust. There were also concerns about data misuse in training, value misalignment, and the potential for biased algorithms to affect decisions and interactions.

Bias, data limitations, and value alignment

Gaps in robots’ understanding of the world – rooted in biased or incomplete training data – can lead to inappropriate behaviours and reinforce inequalities. Social robots deployed in diverse, multicultural environments may misinterpret emotional cues, respond in culturally insensitive ways, or privilege particular languages and norms. Workshop participants stressed the challenge of ensuring value alignment and trustworthiness as robots gain more autonomy and act as agents in complex environments. Poorly curated training data can translate into unfair treatment, miscommunication, or exclusion of vulnerable groups.

Safety risks in shared human environments

Workshop participants identified safety as a critical challenge as social robots move from controlled settings into shared human environments. Their anthropomorphic design, mobility, and close interaction with people introduce risks that differ from traditional automation, including unintended physical contact, collisions, and system failures. Concerns also extend beyond physical harm to emotional and psychological safety, particularly when robots operate autonomously or engage with vulnerable populations. Persistent connectivity and extensive data collection further raise cybersecurity risks, such as data breaches or remote manipulation. Together, these challenges highlight the need for robust safety standards, continuous risk assessment, and transparent design to ensure trust and responsible deployment.[18]

Systemic Challenges to Adoption

Technology readiness versus real-world implementation

Stakeholders noted that many social robot systems appear technologically advanced in controlled settings yet struggle to operate reliably in complex real-world environments. Hardware robustness, navigation, manipulation, and interaction under real constraints all affect perceived usability. Technology readiness alone is insufficient; reliability, maintainability, and ease of use in actual workplaces are central to adoption. Without strong evidence of real-world performance, users remain hesitant to rely on robots for critical tasks.

Integration with workflows and legacy systems

Integrating robots into existing processes and systems emerged as a major barrier. Social robots often sit at the end of a non-verticalised value chain that spans data, AI, simulation, and hardware, making deployment complex and fragile. Institutions must connect robots to legacy IT systems, digital-to-digital interfaces, and physical infrastructure, all while maintaining safety and continuity of service. Mass object integration with existing systems requires careful design, change management, and technical support; otherwise, robots become isolated devices that do not contribute meaningfully to outcomes.

Governance, regulation, and standards

Participants highlighted regulatory complexity and the lack of clear standards as major obstacles. Different jurisdictions apply overlapping requirements related to medical devices, AI systems, data protection, and workplace safety. The absence of widely accepted standards for acceptable forms of robots, behaviour, and safety features complicates procurement and certification. Without a coherent robotic deployment framework, clear liability rules, and robust standards, organisations may avoid or delay adoption, particularly in high-risk sectors such as healthcare.

Public trust, cultural fit, and user acceptance

Trust and cultural fit are central determinants of whether social robots are accepted in real environments. Users worry about privacy, reliability, job loss, and changes in social dynamics. Acceptance is highly context-dependent: robots may be welcomed for cleaning, logistics, or simple information provision but resisted in roles that mimic human attributes or demand deep emotional engagement. Working with local communities to define acceptable forms – appearance, behaviour, language, and norms – is critical to building trust and ensuring robots respect cultural expectations.

Inclusion, equity, and global access

Workshop discussions also pointed to global equity and inclusion challenges. There is a risk that social robots remain accessible only to wealthy institutions or regions, leaving the bottom 50% in the Global South excluded from potential benefits. High costs, infrastructure requirements, and limited local capacity can widen digital divides. Ensuring affordable solutions, supporting capacity-building, and considering different socioeconomic contexts are necessary to avoid reinforcing inequalities through social robot deployment.

Strategic Opportunities for Governance and Innovation

Living labs and open experimentation

Participants identified "living open labs" for social, trustworthy robots as a key opportunity. Real-world testbeds in hospitals, community centres, schools, and public spaces can enable iterative experimentation with tight feedback loops. Progressive adoption in stages – with close monitoring of impacts, user experience, and safety – allows stakeholders to identify and address problems before scaling. Such labs can involve communities directly in co-design, helping to define acceptable forms, behaviours, and roles for robots.

Ethical and legal frameworks for human–robot interaction

There is a clear opportunity to develop ethical frameworks and regulatory approaches tailored to social robots. This includes defining principles for privacy, transparency, accountability, and value alignment; clarifying responsibilities among developers, operators, and institutions; and setting standards for explainability and human oversight. Legal frameworks can help distinguish between acceptable and problematic uses (eg surveillance, manipulation) and provide mechanisms to address harm, while ethical guidelines can support designers in prioritising human dignity and well-being.

Building trust and skills in the workforce

To support adoption, organisations must invest in staff training and change management. Building AI and robotics literacy among frontline workers, managers, and regulators can reduce anxiety and improve integration. Training programmes can focus not only on technical operation but also on communication, escalation procedures, and human–robot collaboration. By empowering staff and clearly articulating how robots complement rather than replace human roles, institutions can foster more constructive attitudes and realistic expectations.

Orchestrating the robotics value chain

Finally, there is an opportunity to develop pragmatic, executable plans that connect the robotics value chain – from data and AI to simulation and robot hardware – around clear societal outcomes. Coordinated investment, public–private partnerships, and shared infrastructure can reduce fragmentation and support scalable solutions. Governments can use strategic procurement, sandboxes, and targeted subsidies to align industry incentives with social objectives, such as addressing ageing demographics, improving safety, and reducing costs while safeguarding rights.

Safety-by-design and responsible innovation

Participants highlighted safety as an opportunity to strengthen trust and guide responsible innovation in social robotics. Real-world testing through staged deployment, simulation, and digital twins can help identify risks early and improve system reliability before scaling. Embedding safety-, privacy-, and ethics-by-design principles – including explainable AI, human oversight, and robust cybersecurity – can enhance accountability and user confidence. Investing in operator training, clear escalation protocols, and multidisciplinary stakeholder involvement further supports safer integration across sectors. When approached proactively, safety governance can act as an enabler of adoption rather than a barrier, aligning technological development with societal values and long-term public trust.

Taken together, these opportunities and challenges suggest that social robots will be most beneficial when deployed as carefully governed collaborators: augmenting human capabilities, respecting cultural norms, and operating within robust ethical and regulatory frameworks. The next phase of development will be defined not only by technical breakthroughs but by the ability of policymakers, industry, and communities to design inclusive, trustworthy human–robot ecosystems.

Global Pathways and Conclusion

Effective governance and responsible innovation require coordinated action between policymakers and technology developers to advance human-centred social robotics.

Global Pathways

Pathways for Policymakers

- Embed Human-Centred and Globally Harmonised Governance: Develop regulatory frameworks that prioritise user safety, privacy, and autonomy in human–robot interactions, mandating transparency in data collection and algorithmic decision-making alongside clear accountability mechanisms for AI-driven outcomes. Foster international cooperation to harmonise safety standards, data governance frameworks, and ethical benchmarks for social robotics. Collaborative global platforms can facilitate the development of shared norms that enhance cross-border trust, enable scalable deployment, and align innovation with collective human welfare.
- Adopt Participatory and Inclusive Co-Design Processes: Institutionalise user consultation and multi-stakeholder engagement, involving the public and professionals of various sectors, as well as different age groups, throughout the policy lifecycle. These processes should be as interactive and practical as possible, to allow for interaction with social robots while developing and testing new policies. Such inclusive participation strengthens public trust and ensures that robotics policies reflect diverse social needs and cultural contexts.
- Implement Anticipatory and Adaptive Policy Frameworks: Transition from reactive regulation to foresight-driven governance capable of evolving alongside technological advancement. Flexible, adaptive models piloted in cities such as Seoul, Singapore, and Dubai demonstrate how governments can balance innovation, safety, and accessibility within dynamic regulatory ecosystems.

AI generated image of a nurse robot in a hospital

> The future of human–robot coexistence is not predetermined by technological capability. It will be shaped by the choices we make today and the commitment we demonstrate to responsible stewardship.

Pathways for Technology Developers and Industry

- Design for Human Adaptability, Cultural Context, and User Agency: Prioritise social robots capable of learning from multimodal user interactions and adapting to individual preferences, cultural norms, and diverse social contexts. Incorporate participatory design methodologies that involve end-users, caregivers, and cultural experts directly in conceptualisation, prototyping, and testing phases. Robots should be designed with sensitivity to cultural values, ensuring that deployment enhances rather than conflicts with local practices and expectations. The ability of robots to understand human intention and have a corrective cycle that allows the online adaptation of behaviour based on how the human perceives the interaction should also be further investigated.
- Prioritise Transparency, Accountability, and Ethical Responsibility: Design social robots with clear communication about their capabilities and limitations, ensuring users understand what robots can and cannot do. Establish transparent data governance practices and privacy safeguards throughout the product lifecycle. Implement accountability mechanisms for product failures or user harm and commit to independent safety testing and third-party evaluation before market deployment. This builds user trust and ensures developers remain responsible for social and ethical impacts.
- Invest in Integration, Training, and Long-Term Adaptation: Recognise that technological readiness alone does not ensure adoption. Work closely with organisations to integrate social robots into existing workflows, provide comprehensive staff training programmes, and offer ongoing technical and maintenance support. Foster private–public partnerships to develop best practices and standards that facilitate scalable, sustainable deployment across diverse sectors and geographies.

AI-generated image of a robot leading children's play.

Conclusion

Social robots stand at a pivotal moment. The evidence presented in this report demonstrates that their potential to enhance healthcare delivery, transform education, and improve public services is real.

Yet so too are the risks of misalignment with human values, cultural contexts, and societal needs. The global case studies reveal a pattern: adoption succeeds not when robots are most advanced but when they address authentic human needs and are developed with genuine cultural understanding and community participation.

The gap between technological readiness and real-world adoption across Europe, Japan, and beyond underscores a fundamental truth: innovation alone is insufficient. Despite decades of research and significant investment, many deployments remain pilot projects, and robots often end up unused in storage due to poor integration with workflows, insufficient staff training, and misalignment with actual user needs. This pattern reveals that technology maturity does not automatically translate to social value or widespread acceptance. Social robots will serve a public benefit only when policymakers, technology developers, and the public work to embed privacy protection and cultural respect into every phase of development and deployment.

Equally important is recognising that social robotics will evolve significantly as large language models and GenAI become more integrated with robotic systems. Today's social robots operate primarily on programmed rules and reactive systems.

As AI gains a body through social robots, the capabilities, autonomy, and influence of these systems will expand dramatically. Robots with advanced AI will make autonomous decisions affecting human welfare, collect and process vastly more personal data, and potentially reshape social dynamics and labour markets in ways we are only beginning to understand. The frameworks, norms, and accountability mechanisms established today must be robust and flexible enough to guide this evolution responsibly. The choices we make now in establishing governance, design principles, and ethical standards will set precedents for an AI-enabled robotic future.

The pathways outlined in this report provide a roadmap for both the present and the future. Policymakers must establish adaptive, internationally harmonised governance frameworks that anticipate AI-enabled robotics and prioritise transparency, accountability, and human agency. They must move from reactive regulation towards foresight-driven governance that can evolve alongside technological advancement. Technology developers must shift from designing for capability towards designing for human adaptability and cultural appropriateness. They must recognise that trust cannot be engineered but must be earned, through genuine responsibility, transparent communication about limitations, and long-term commitment to user support and safety, and that communities should have a genuine voice in deployment decisions.

The future of human–robot coexistence is not predetermined by technological capability. It will be shaped by the choices we make today and the commitment we demonstrate to responsible stewardship. These choices concern whose voices inform development, which needs we prioritise, how we prepare for AI integration, and whether we are willing to slow deployment to ensure it is just, equitable, and aligned with human values. The opportunity to build this future responsibly is now. The responsibility to act collectively is shared.

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