

Supplementary Information: Extended Reform Proposals

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S1. International Deep Comparison

Denmark mandates municipal duty with childcare within 15 minutes walking distance, supported by a national digital portal [1]. Sweden enforces income-based fee caps and publishes GIS-based childcare maps [2]. Germany provides federal subsidies for facility conversion and integrates childcare with electronic health records [3]. The Netherlands allows ground-floor childcare centers in residential buildings, with safety ensured by exit distance and occupancy caps [4].

S2. ICT and Technology Applications with Investment Priorities

Concrete applications include:

- **Digital enrollment portals:** Denmark and Sweden operate national platforms for childcare applications, waiting list transparency, and parental communication [1, 2].
- **IoT safety monitoring:** Germany and Nordic countries deploy sleep posture sensors, CO₂ monitors, and temperature/humidity devices to reduce risks and staff burden [3, 5].
- **GIS visualization:** Sweden requires municipalities to publish childcare accessibility maps [2].
- **Electronic health integration:** Germany links childcare attendance and health records [3].

S3. Policy Implications for Japan

Japan should embed childcare accessibility into urban planning standards [9], develop a unified national childcare portal, subsidize IoT safety packs, mandate GIS-based accessibility maps, and adopt phased regulatory relaxation.

S4. Fiscal and Institutional Instruments

International practice shows that fiscal support is essential for sustainable childcare expansion. Germany allocates billions of euros annually for childcare infrastructure [3], while Nordic countries link subsidies directly to accessibility and quality indicators [5]. Japan should establish a dedicated childcare infrastructure fund.

S5. Transparency and KPI Monitoring

To ensure accountability, municipalities must publish transparent indicators including accessibility rate, safety and hygiene metrics, and cost-per-slot benchmarks [6, 7]. Nordic countries and Sweden already mandate GIS-based childcare maps [2], while OECD recommends regular publication of affordability and participation indicators [6].

S6. Long-term Outlook

Improved childcare accessibility has measurable impacts on fertility decisions, employment continuity, and GDP growth [8]. Nordic countries demonstrate that universal childcare guarantees support both gender equality and labor force participation [5]. Japan should conduct longitudinal evaluations to track reforms.

S7. Future Technology Development

Beyond current ICT applications, several areas of technological innovation are expected to shape the future of childcare accessibility and safety [6, 5].

Supplementary Information: Roadmap for Reform (Enhanced with International Evidence)

S8. International Comparison: University-Based Foundations

International evidence highlights the critical role of universities in childcare ICT innovation:

- **Finland and Sweden:** Universities collaborate with municipalities to develop national digital childcare portals, ensuring transparency, accessibility, and nationwide rollout.
- **Germany:** University research provides the foundation for IoT safety technologies, including sleep posture sensors and CO₂ monitoring systems, which are integrated into childcare facilities.
- **Canada:** University spin-off ventures lead the childcare ICT market, demonstrating how academic innovation can be commercialized and scaled internationally.

These cases show that embedding childcare ICT development within universities accelerates innovation, facilitates public trust, and creates pathways for venture formation. Japan should establish university-based childcare ICT centers to develop foundational systems, which can then be spun off into ventures and adopted by municipalities nationwide.

R1. Immediate (0–2 years)

- **Regulatory relaxation:** Introduce conditional approvals for ground-floor childcare centers, based on exit distance metrics and simplified suppression systems.
- **Transparency:** Mandate publication of GIS-based childcare accessibility maps by municipalities.
- **Digital infrastructure:** Launch a national childcare enrollment portal under the Children and Families Agency, integrating waiting list management and parental communication.
- **Fiscal support:** Establish a dedicated childcare infrastructure fund, covering at least 50% of conversion costs for schools and public facilities.
- **Incentives through competitions:** Initiate regional childcare innovation contests with monetary prizes and increased subsidies for winning ventures. A special focus will be placed on new enterprises, which often demonstrate strong commitment and innovation. Existing firms may also participate, but new entrants will receive priority recognition and enhanced funding to encourage early-stage innovation.
- **International precedent:** UNICEF Venture Fund (investing several million USD in early-stage startups with milestone-based follow-up) and Finnish municipal acceleration programs (starting with tens of millions of USD and expanding based on results) already establish priority tracks for new enterprises. Japan should adopt a similar approach to strengthen credibility and global alignment.

R2. Medium-term (3–5 years)

- **IoT safety packs:** Subsidize installation of sleep sensors, CO₂ monitors, and cameras in all urban childcare centers, with phased rollout to rural facilities.
- **Workforce development:** Introduce VR/AR training platforms for childcare staff, focusing on emergency response, hygiene protocols, and developmental support.
- **Fiscal instruments:** Link subsidies to accessibility rates, extended-hour provision, and affordability caps (10% of disposable income).
- **Institutional integration:** Align childcare accessibility indicators with fertility targets and waiting list counts to create a coherent statutory framework.

- **Competitive incentives:** Expand regional competitions into national-level fairs, awarding grants, recognition, and increased funding to high-performing ventures and municipalities.
- **Awards system:** Establish a formal awards program to recognize high-performing ventures and municipalities. Awards should be linked to policy targets such as accessibility rates, affordability, and innovation outcomes, ensuring that recognition drives competition and continuous improvement.
- **International precedent:** Ontario, Canada conducts annual reviews of childcare services and publicly recognizes outstanding cases through awards. Japan should adopt a similar system to embed recognition-based incentives into policy.

R3. Long-term (5–10 years)

- **AI demand forecasting:** Deploy machine learning models to predict childcare demand by neighborhood and demographic trends, enabling dynamic allocation of staff and facilities.
- **Smart facility design:** Promote modular childcare centers with adaptive layouts, sensor-based ventilation, and energy-efficient systems.
- **Electronic health integration:** Connect childcare centers with pediatric electronic health records nationwide, enabling early detection of developmental or health issues.
- **Blockchain subsidy management:** Implement transparent digital ledgers to ensure fair distribution of childcare subsidies and reduce administrative burden.
- **Community hubs:** Reuse closed schools as multi-functional centers (childcare, after-school, elderly services), strengthening regional resilience.
- **International recognition and awards:** Link Japanese ventures to OECD and UNICEF innovation platforms, offering global awards, fellowships, and expanded subsidies for internationally recognized projects.
- **International exhibition support:** Provide funding and institutional backing for Japanese ventures to participate in global childcare innovation expos, ensuring visibility and evaluation on OECD and UNICEF stages.
- **International precedent:** Germany invests several billion euros in federal subsidies to simultaneously upgrade childcare facilities nationwide. Japan should begin with international exhibition support to showcase domestic ventures globally, before scaling to nationwide infrastructure investment.

R4. International Collaboration

- Establish joint research projects with Nordic countries and Germany on phased regulatory relaxation and ICT integration.
- Benchmark Japan’s childcare accessibility indicators against OECD standards annually.
- Participate in UNICEF-led initiatives on affordability caps and universal access guarantees.
- **Global startup competition linkage:** Connect Japanese ventures to international startup competitions, enabling them to compete on a global stage and attract international recognition and investment.
- **International precedent:** The World Bank’s *Invest in Childcare* initiative mobilizes international financing to support quality childcare in low- and middle-income countries, linking childcare investment to women’s employment and child development. Japan should similarly connect domestic ventures to global competitions, ensuring they gain visibility and credibility in international markets.

Policy Implication

This roadmap provides a phased strategy to close Japan’s gap in adopting international best practices. **International comparison shows that Nordic countries and Germany explicitly present phased regulatory relaxation together with investment plans, which makes their reforms more credible and internationally recognized.** Moreover, UNICEF Venture Fund, Finnish municipal acceleration programs, Ontario’s awards system, Germany’s large-scale subsidies, and the World Bank’s global childcare initiative all demonstrate the effectiveness of combining *priority tracks for new enterprises, award-based incentives, international exhibition support, and global competition linkage*. Japan must adopt a similar roadmap to gain both domestic legitimacy and global policy relevance.

Additional Considerations

- **Budget scenarios:** International practice shows that small-scale investment (e.g., 5–50 billion JPY) can initiate pilots, medium-term expansion requires 50–1000 billion JPY, and long-term nationwide rollout may reach several trillion JPY. Japan should adopt a staged approach rather than committing massive sums upfront.
- **Employment and labor environment:** New enterprise support and regional acceleration hubs will generate new jobs, while IoT and VR/AR adoption will improve working conditions and reduce staff burden.
- **Equity and inclusion:** Policies must address urban-rural disparities, ensure affordability for low-income households, and provide inclusive services for multicultural and special-needs families.

- **Risk management:** Privacy protection in IoT and EHR integration, fraud prevention through blockchain subsidy management, and phased safety audits for facility conversion are essential safeguards.
- **Monitoring and evaluation:** Annual publication of KPIs aligned with OECD standards, independent third-party reviews, and transparent allocation of performance-linked subsidies will ensure accountability and credibility.

Conclusion By integrating staged budget allocation, employment creation, equity measures, risk safeguards, and rigorous evaluation, Japan can achieve childcare reform with limited fiscal outlay while leveraging private sector vitality. This approach aligns with the international mainstream of *small-scale investment, performance-linked funding, new enterprise priority, and award systems*, and will strengthen both domestic legitimacy and international recognition.

References

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