課題先進国からグローバルな課題解決先進国へ

―シリコンバレーから見た超高齢化、過疎化の日本のポテンシャル―

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Overview

❖ 高齢化、過疎化の課題はご存知の通り深刻なもので、加速している

❖ これによる生産性向上の必要性は言うまでもなく、技術の役割のポテンシャルは明らか

❖ 他の先進国に比べて、日本では人を置き換える AI、そして初心者に熟練の技を与える IA (Intelligence Augmentation)は政治的に追い風

❖ シリコンバレーから見ると、チャンスがあらゆるところに存在する

❖ しかし、これはペインポイントから考えていかないと日本企業にチャンスはない。が、それでもユーザーとして恩恵は受けられる

技術発展について

技術の発展は真空で起こるわけではなく、社会、政治、経済などのコンテクストが重要

　- 例えば冷戦や明治維新

技術の浸透は、技術のみの特性にはかかっていない。

　- 例えば、蒸気エネルギー、工場の電化、90年代までのコンピューターへの投資

技術発展の日本の課題

「ガラパゴス」の本質は「後続者のいない先行者」

-　日本のIT産業の惨劇

国内の技術、ビジネスの方向性を追い求めたら世界とは別の方向に発展。結局はディスラプト

VS

国内競争のロジックが国際展開へのジャンプ台

参考：Kushida, Kenji E. "Leading without Followers: How Politics and Market Dynamics Trapped Innovations in Japan's Domestic "Galapagos" Telecommunications Sector." Journal of Industry, Competition and Trade 11, no. 3 (2011): 279-307.

高齢化と過疎化は技術発展の方向性を大きく定めるが、これはチャンス

1) 高齢化と過疎化が市場チャンス

2) 高齢化、過疎化が起こす劇的な人材、労働力不足

3) 政治、規制が追い風：経済的な課題の解決に向けて

ペインポイントの考え方

ペインポイント（課題）はあくまでユーザーの立場、視座から（お客さん、お客さんのお客さん）

ペインポイントは何ですか？
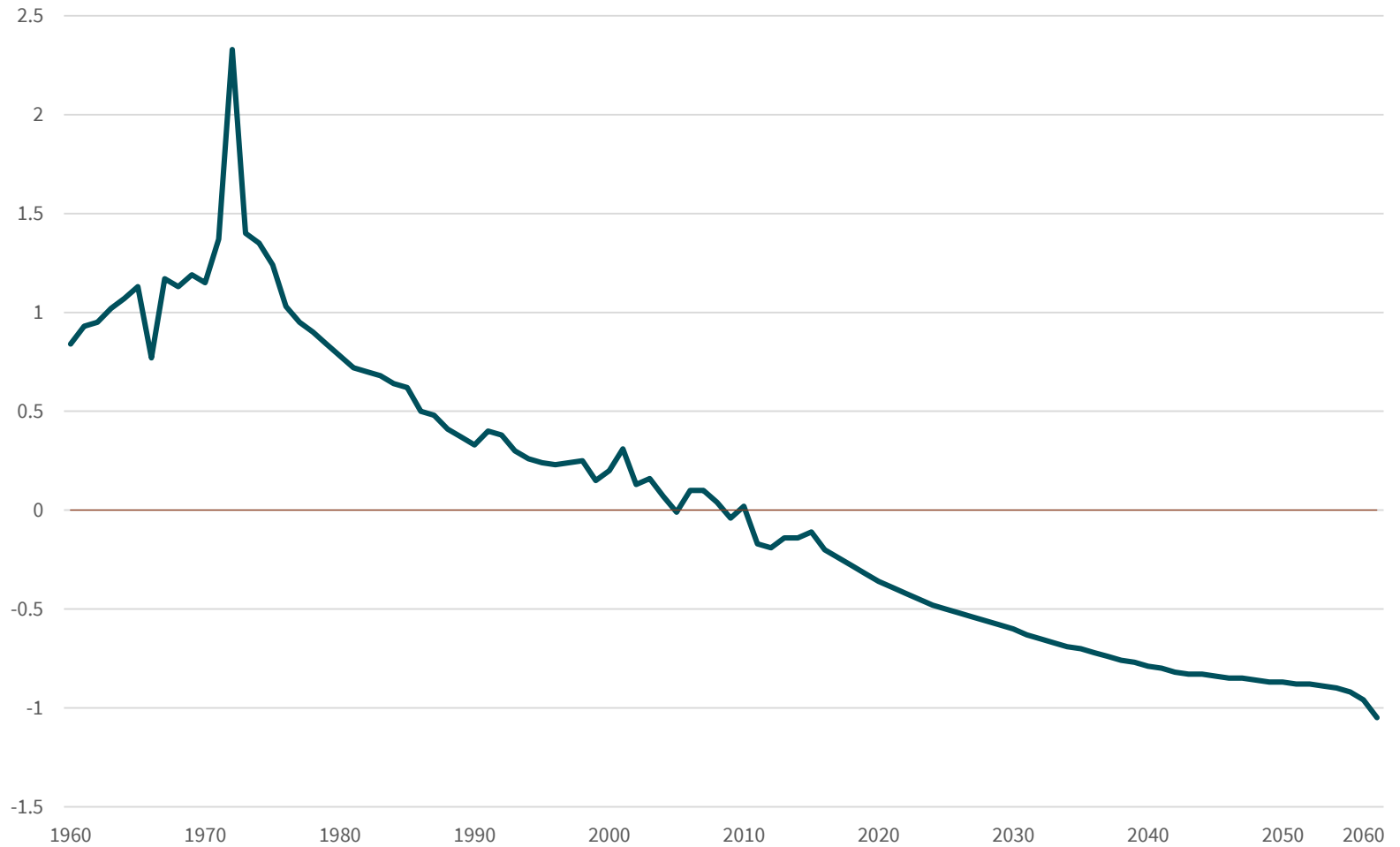- どれくらい深いペインポイントですか？（どうすれば測れますか）

ソリューションは何ですか？

ソリューションはスケールしますか？

スタンフォードd.schoolのデザイン思考は問題や、何をすれば感が動くか（熱量が上がるか、エキサイトするか）などを深掘り

Japan's Demographic Challenges

1. 人口減少と高齢化

2. 世帯の高齢化、高齢者を含む世帯数の増加

3. 医療費の高騰とニーズの増加
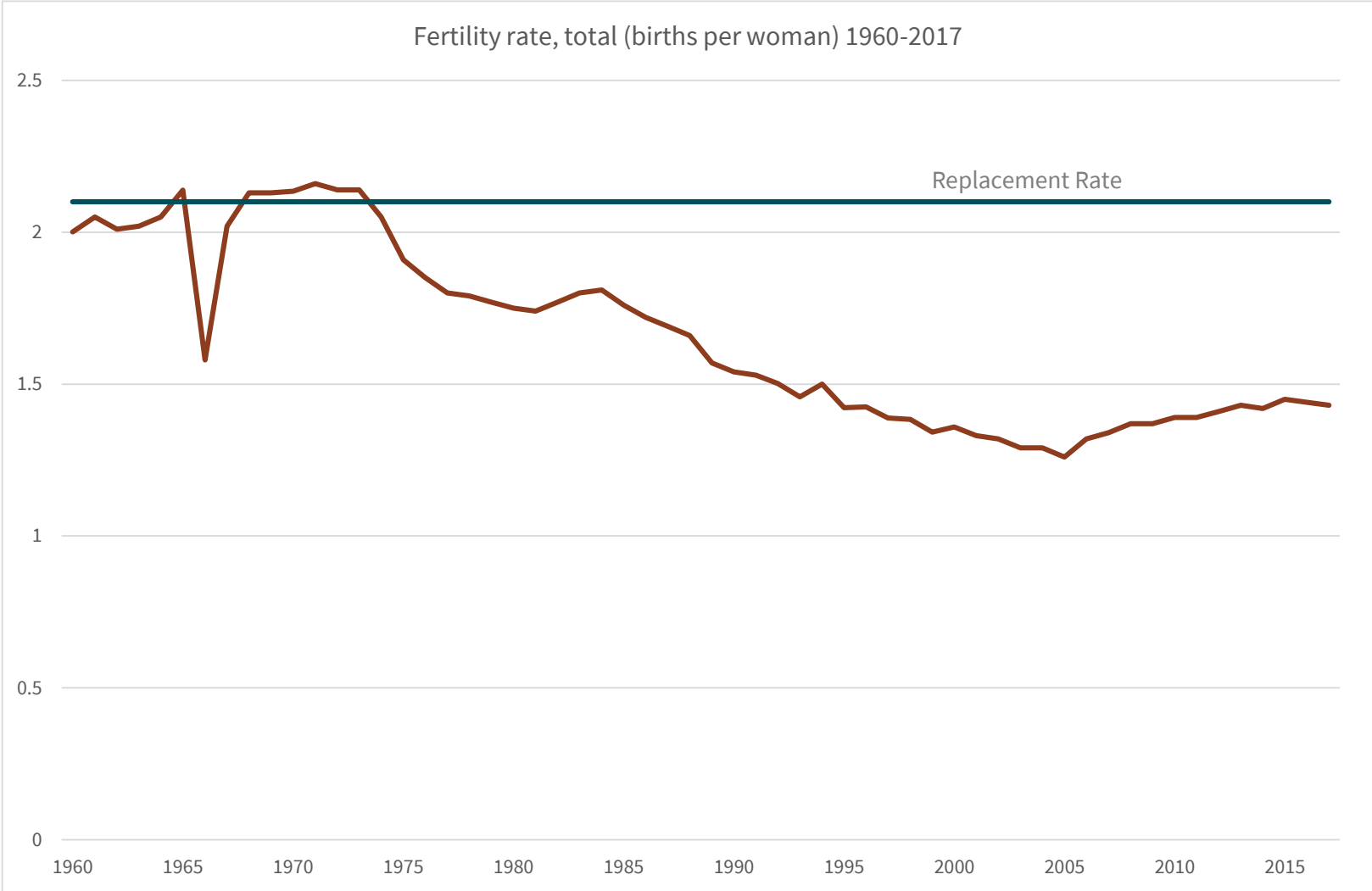
4. 過疎化と地方でのインパクト

5. 人材、労働者不足

Japan's Population Growth Rate

Actual and Projected Population Growth Rate (1960-2060)

Source: National Institute of Population and Social Security Research

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Fertility Rate

Fertility rate, total (births per woman) 1960-2017

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Population Over 65

- 65歳以上が世界で最も多い
  o 2015年から26.6%
  o 2050年までには38%

  ちなみに65歳以上、高齢者は年齢ではなくてファンクション（何ができるか、どんな状態か）で測るべきでは？

出典：統計局

医療費の高騰

- 65歳以上の医療費は65歳以下の4倍、GDPの割合での医療費は1980年に5%だったのが2011年までに8%以上

(Hsu and Yamada 2019).

Need to breakdown from aggregate numbers

理論と学術、そして産業の話

社会科学では企業の役割を省略しがちだが、経済学、政治学、社会学では企業の動きを無視することはできない
- 産業のニーズの視座が抜け落ちていることが多い

- 具体的なペインポイントの話をする必要がある

高齢者が一人以上世帯

- 65歳以上の在住者を含む世帯数が2015年には41%、2200万*

  - 家での高齢者ケアが必要。

  o 家庭での高齢者ケアの情報が必要。物理的な動きの支援が必要な場合が多い。家族には高齢者ケアを行いながら仕事を続けることが必要、或いはその意思がある場合の雇用形態など。

高齢者の一人暮らし

- 2015年には65歳以上の女性21%、男性13%が一人暮らしだった
  - 1995年の女性16%、男性6% から増加
  - 2040年までには女性25%、男性21%が一人暮らし*

- 様々なニーズ：ヘルスケア、家族や親族、友人などとのコミュニケーション、ホームケアや医師、日々の生活のヘルパー、モビリティー（家の中、外出）のロジスティクス、そして娯楽やメンタル、精神的な臨床心理学的なケア

* 出典：内閣府

Rural Aging

- 地方ではより深刻

- 2017年には秋田県、高知県が65歳以上の人口トップで、秋田県は 35.6% 高知県が34.2% その次は島根県 (33.6%)、山口県 (33.4%)
  - 総務省の予想だと 2045年までに, 65歳以上の人口が秋田県では 50.1%、青森では 46.8% になり、東京都と大阪府ではそれぞれ 30% と 36%になると予想。

* 出典：総務省

労働力不足、人材不足がチャンス
日本の面白い取り組みにシリコンバレーが
驚き、喜ぶ

その前にシリコンバレーの話を少し

もう「ソフトウエアだけ」では全くないシリコンバレー

Tesla Model 3 Is #3 Best Selling Vehicle In California Through September
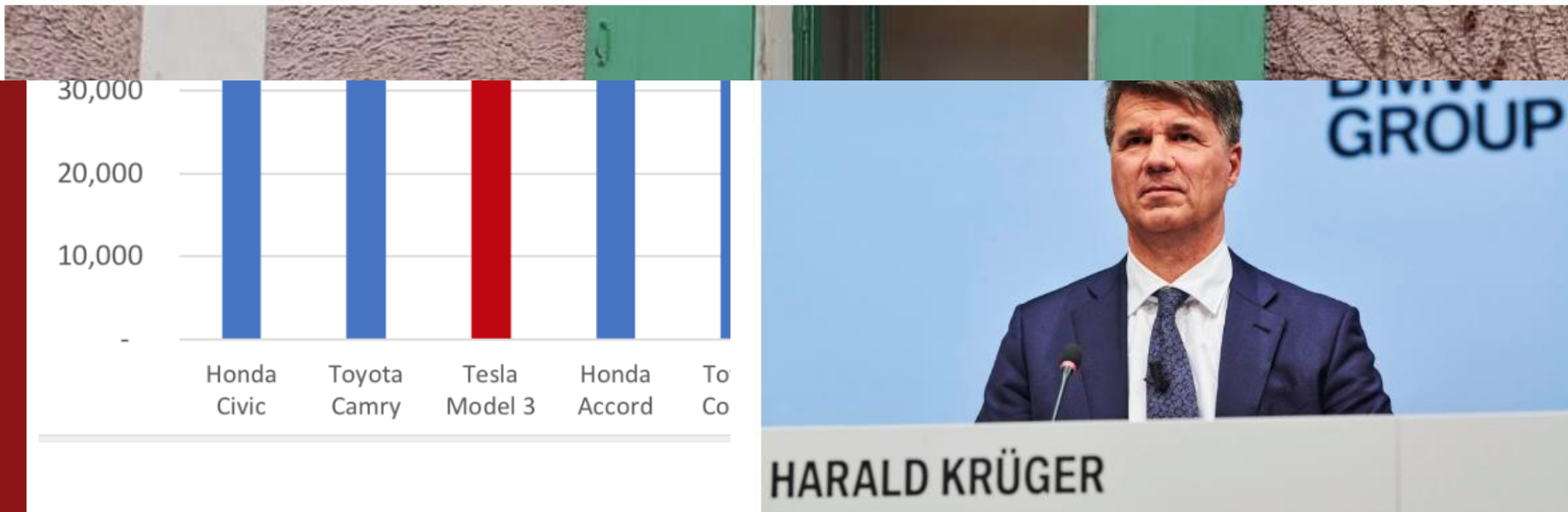
Clean Technica

#1 cleante

Tesla Model 3 Is The Best-Selling Car In Norway In 2019 By Far

Home > Tesla > Model 3 > News > Awards

The Tesla Model 3 Deemed Car Of The Year In Norway
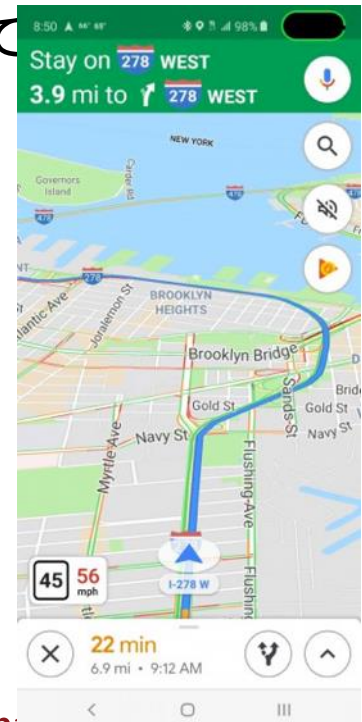

BMW GROUP

HARALD KRÜGER

AIで何ができる？

大企業は価値につなげている（巨人の話）
- AIで膨大な利益を作り出しているからAIに投資をする。トップ人材を連れてこられる。
- FAMGA (Facebook, Amazon, Microsoft, Google, Apple) は圧倒的なリソースを持っている。
- データを持っているから強いのではなく、価値を提供しているからからデータが集まる。
- 価値を提供し、データを持っているから膨大な収益を得て
- 一般公開するツールはデータ集めの

- Amazonの例
- Google datacenter
- Uber/Lyftの例
- Teslaの例

建設

コマツの: Upskilling で、初心者でも熟練の技術が使えるように

2013年から登場したICT建機。10年の熟練の技を初心者が。

これは重要な開発パラダイム。（ドイツの例）

Komatsu

- **The ICT digger 2014**

Uses sensors embedded in several places in the machine to accurately and precisely sense where the joints are located

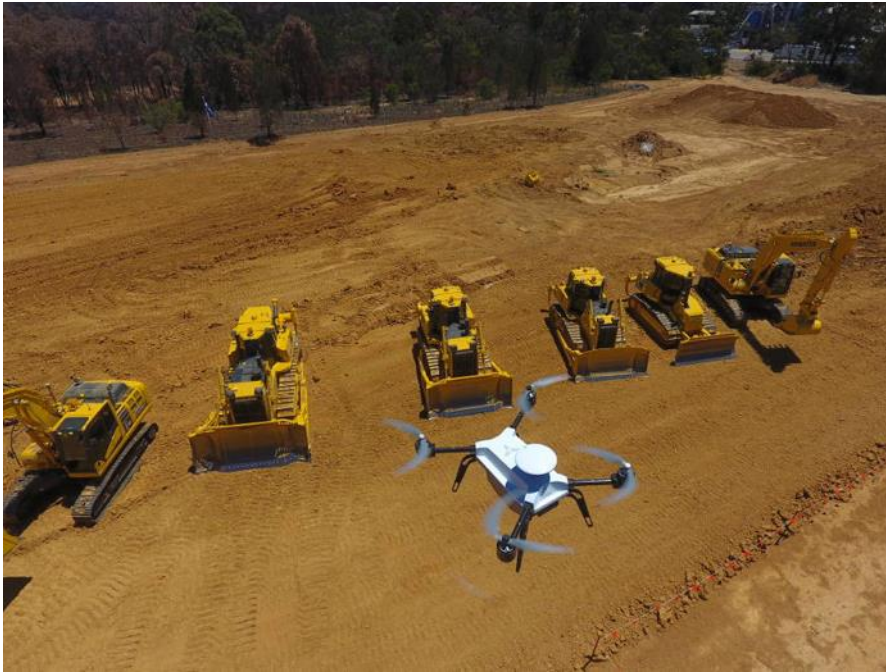- **ICT bulldozers 2013**

Removed the substantial skill requirements to operate bulldozers to get flat surfaces

Komatsu: Partnering with Silicon Valley

- In 2014 Komatsu partnered with Skycatch
  - Platform for drones to create 3D maps for construction sites throughout Japan.

Dramatic reduction in the time and labor intensity of taking measurements of construction sites (eg., 2 weeks to 2 hours)

Agriculture

Age of agricultural workers in Japan is climbing, and proportion of farmers over 65 is increasing.

	2013	2015	2016	2017	2018
Agricultural Workers					
Over age 65	61.6%	63.5%	65%	66.5%	68.5%
Average Age	65.8	66.4	66.8	66.7	66.8
Primary Farmers*					
Workers over 65	61.1%	64.5%	65.0%	66.4%	68.0%
Average Age	66.1	67.0	66.8	66.6	66.6

*those whose primary occupation is farming
Source: Ministry of Agriculture, Forestry and Fisheries

Agricultural Land

The amount of total cultivated agricultural land in Japan has been decreasing.

Year	Millions of Hectares
2018	4.42
2017	4.44
2016	4.47
2015	4.50
2014	4.52
2013	4.54

Source: Ministry of Agriculture, Forestry, and Fisheries

Additionally, in 2016, about **930,000 hectares**, or, approximately **20%** of total farmland area in Japan, is either unregistered or thought to be unregistered. Out of this land, approximately **54,000 hectares** is not being utilized.

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Agriculture: Komatsu

Need to increase the productivity (and incomes) of agricultural workers, as well as better utilize the land

- Using industrial ICT-enabled bulldozers to precisely flatten the ground in the rice paddies
  - o Previously almost impossible
  - o Rice could be planted from seeds without production loss.
  - o Cost savings were app. 40%

シリコンバレーとのコラボレーション

ホイルローダー、まずは農地で自動運転
シリコンバレースタートアップ複数とコラボ

日刊工業新聞

Transportation

日本の商業ドライバーの高齢化

	Bus	Taxi	Truck
Total number of drivers and maintenance personnel	130,000 (2015)	340,000 (2015)	830,000 (2017)
Average age (as of 2017)	50	59	48
Proportion of women	1.7%	2.7%	2.4%
Hours worked per month	210	189	217
Average annual income	4,570,000 yen ($41,700 USD)	3,320,000 yen ($30,300 USD)	4,540,000 yen ($41,500 USD)

Source: Ministry of Land, Infrastructure, Transportation and Tourism

Truck Convoys

トラックのコンヴォイや、ここにもコマツの例

- In 2018, **Hino Motors**, **Isuzu Motors**, **Volvo Group's UD Trucks** and **Mitsubishi Fuso Truck and Bus**, engaged in tests using expressways west of Tokyo. Toyota Tsusho, a trading company subsidiary of Toyota coordinated the tests, with full support of the Ministry of Economy, Trade and Industry (METI).

Self-Driving Buses

Motivated by the mobility needs of elderly and shortage of bus drivers.

- **Odakyu** partnered with Kanagawa prefecture and Keio University to develop autonomously driven buses. SB Drive, a startup, equipped buses from Hino Motors with sensors such as GSP and millimeter wave radar.
  - First tested on Keio University's Shonan Fujisawa campus in June 2018
  - Buses tested on public roads in the Enoshima area, in collaboration with Enoshima Electric Railway in September 2018
  - In February 2019, the buses were tested on 1.4 km of residential streets in Tama City

Autonomous Taxis

- In 2017, DeNA and Nissan began development of a robo-vehicle ride-share service, "Easy Ride."

- A partnership between **Nissan** and Japanese Internet company **DeNA** to develop an unmanned taxi service in 2017 led to Japan's first field tests on public roads in March 2018

Cargo and Buses

- **Yamato** partnered with local bus companies in sparsely populated areas in Iwate and Miyazaki Prefectures to deliver packages along local bus routes.
  - Difficult for bus operators to finance local operations upon which aging communities relied upon
  - Shortage of bus drivers and truck drivers

- Yamato has expanded into refrigerated boxes on buses in Miyazaki to deliver freshly caught salmon to airports, which then sent to Hong Kong
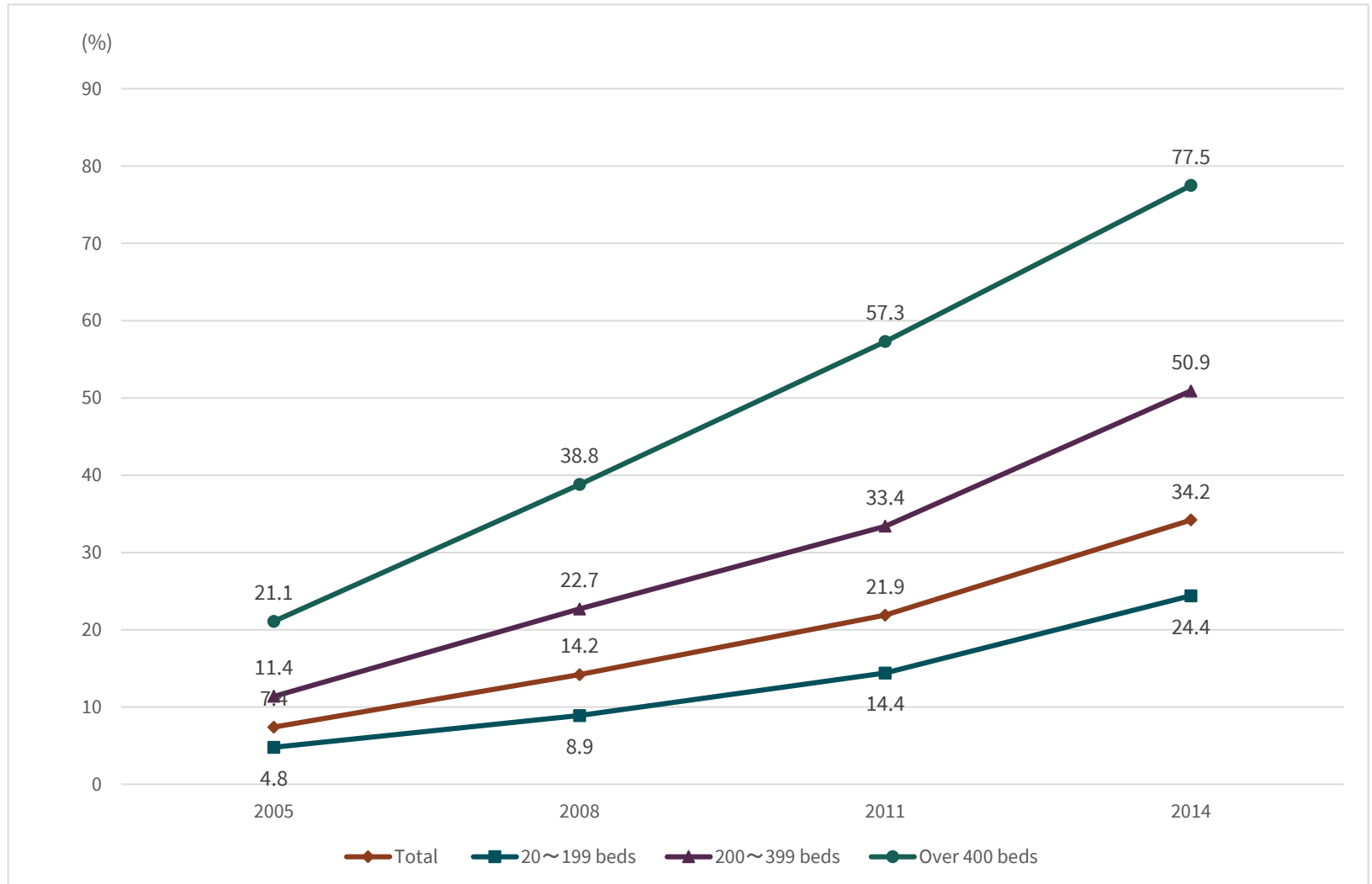
Cargo and Buses

- Sagawa Kyubin, and even Japan Post, joined in cargo sharing with local bus lines

- The Japan Agricultural Cooperative began utilizing space on express buses from regional areas to Tokyo to take agriculture produce

Digitalization in Health Care: Opening the Door to Transforming Medical Care and Physician Labor Markets

Adoption Rate of Digital Medical Records at Japanese Hospitals

(%)

90
80
70
60
50
40
30
20
10
0

2005 — 2008 — 2011 — 2014

Over 400 beds: 21.1, 38.8, 57.3, 77.5
200～399 beds: 11.4, 22.7, 33.4, 50.9
Total: 7.4, 14.2, 21.9, 34.2
20～199 beds: 4.8, 8.9, 14.4, 24.4

Legend: ◆ Total　■ 20～199 beds　▲ 200～399 beds　● Over 400 beds

*excludes specialized psychiatric hospitals
Source: Ministry of Health

Medical Imaging and Remote Diagnosis

- **Lookrec, by Medical Network Systems** (MNES)
  - Clinics and hospitals upload patient medical images to a system built on top of a Google Cloud platform, which are then diagnosed by medical doctors employed by MNES

  - Japan faces an imbalance of having far more medical imaging hardware (MRIs and CT scan machines) than radiology and pathology specialists who can make diagnoses

  - Addresses a mismatch between the workforce of doctors and the patients they need to serve. Employee physicians of MNES do not have to live near the patients they diagnose, and they are not constrained by the working hours of hospitals (popular with female doctors with small children)

Healthcare and Eldercare Logistics Optimization

An acute need to optimize the coordination of logistics among caregivers.

- **Kanamic Network**
  - IT service enabling information sharing between municipalities, medical associations, hospital, home care physicians, and collaboration between medical practitioners and nursing staff, eldercare givers, and care plan managers through a task-management system.

Robotics Assisted Mobility, Communications

- **Obayashi** and **Seismic**

  o Seismic's "Powered Clothing" is designed to augment human strength and give mobility to muscles and joints while looking like normal clothes.

  o The collaboration with Obayashi focuses on developing industry-specific clothing worn by the construction workforce. Developing suits that support workers' core muscles and help augment strength and alleviate worksite fatigue

Human-Machine Interactions in Eldercare

Paro: Therapeutic Robotic Seal for Dementia

- "Mental commitment robot" designed to provide psychological effects such as patient stress reduction and comfort, physiological effects such as improvements in vital signs, and social effects, such as improvement of socialization between patients and with their caregivers

- Some AI built in →
  able to learn a new name,
  respond to patients in a
  way that they prefer

Telenoid: Simplified Communications, Especially for Dementia

- The Telenoid is a human-like remote controlled android created by esteemed Japanese roboticist Dr. Hiroshi Ishiguro

- The idea was to create a robot that could appear male or female, old or young, designed to "transmit the presence" of people in a distant place

Telenoid: Simplified Communications, Especially for Dementia

- An operator sits at a computer with a webcam and special teleoperation software, and cameras and microphones embedded into the Telenoid then project the voice and movements of the operator

- Allows family members can better connect to elderly relatives

- In 2016, 5 nursing facilities in Miyagi prefecture began using Telenoid for treatment

Aibo: Companionship, Entertainment, and Security Monitoring

- Sony began to sell Aibo commercially in 1999, becoming the first consumer robot product available to the mass consumer market.

- Programmed to exhibit emotions and interact with their owners and surroundings. Responds to training as it develops from a newborn puppy to an adult.

Aibo: Companionship, Entertainment, and Security Monitoring

- Although Aibo was initially a success and led to several generations of Aibo robots, Sony eventually discontinued Aibo in 2006 and ended customer support for Aibo in 2014

- In 2017, Sony announced a new generation of Aibo. The new generation of Aibo is more intelligent, with an ability to learn faces, develop familiarity with its owners, and recognize its environment.

- In February 2019, Sony announced that it was adding a new "watchdog" feature for Aibo.
  - This service could provide a layer of security for homeowners when they are not home and could to be an especially useful feature in homes of elderly residents

Digitizing Land and Housing Ownership: Improving Traceability and Inheritance

Proportion of Land with Unknown Ownership

- A 2016 estimate by the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) found that 4.1 million hectares of property, or, 20% of land in Japan have unknown ownership

- Blockchain technology is one of several promising solutions

- In March 2019, Hitachi, Sekisui House and KDDI announced a new partnership to develop a secure information sharing platform that uses blockchain technology

Other Areas: Automating Drink Viscosity Enhancement to Avoid Dysphagia

Transforming food into safer forms for the elderly to chew and swallow

- Dysphagia and aspiration pneumonia are growing concerns for Japan's aging population

- Doctors recommend that increasing the viscosity of thin liquids can help slow the transit of fluid substances, reducing the chance of it going down the airway and causing aspiration

- A rehabilitation and nursing home in Gifu Prefecture recently debuted a vending machine that adds viscosity to coffee and tea drinks

Option to add "Toromi" (viscosity)

SVから見た様々なチャンス

家の中
家の前
生活
あらゆるものを測る
パターン認識

Starship technologies

施工実例写真

https://www.komatsu-co.com/kodawari_BF.html

Conclusion

- Current technological trajectories are driven primarily by the private sector

- Government support has been important in many of the cases
  - Abenomics Reforms
  - Several specific KPIs are supportive of areas such as digital health record and robotics in nursing, as well as general targets such as extending the "healthy" life expectancy.

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Conclusion

- 制度や政策は、政治のフォーカスポイントで動くことが多い。
  - 2019年4月のお年寄りが起こした交通事故で亡くなった母子
  - 実際の問題の確率ではなく、ペインポイント共感で
    - そして業界の静かなロビイングなど

後続者のいる先行者になるか？

日本発の取り組みや技術の応用が世界の先駆者になる可能性

世界的に見て、人材不足の深刻な領域 が人を置き換えるAI、人に熟練の技を身につけさせるIAの実装のフロンティア
    vs.
失業率が高い地域、国、年代コホート

日本企業が最も価値の高い商機を得るとは限らないが、日本は大きな恩恵を受ける可能性がある

技術主導ではなく、「ペインポイント」主導

あくまでユーザーの視点から

- この技術で何ができるか、ではなくどうすればペインポイント問題を解決できるか

- ペインポイントは何ですか？
- どれぐらい深いですか？（測れますか）
- どうやって解決しますか？（ソリューション）
- 解決法はスケールするか？