

Measuring AI Governance, AI Adoption and AI Strategy of Japanese Companies

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Abstract: Purpose: This study aims to measure the level of AI governance and AI adoption among Japanese companies.

Theoretical Framework: The research investigates the extent to which Japanese companies have implemented AI governance frameworks and the degree of AI adoption in their operations. The study also explores the relationship between AI governance, AI adoption, and AI strategy, providing insights into the factors that influence successful AI implementation.

Design / Methodology / Approach: a survey questionnaire was administered to a representative sample of Japanese companies across various industries. The questionnaire included items that assessed the presence and effectiveness of AI governance practices within the organizations.

Findings: a positive correlation was observed between AI governance and AI adoption. Companies with well-established AI governance frameworks tended to have higher levels of AI adoption, suggesting that effective governance practices play a crucial role in facilitating successful AI implementation. These findings provide valuable insights into the current state of AI governance and AI adoption among Japanese companies.

Conclusion: The results can assist organizations in benchmarking their AI initiatives against industry standards and identifying areas for improvement. Policymakers and regulators can also utilize these findings to develop guidelines and frameworks that promote responsible and effective AI implementation.

Keywords: AI governance, AI adoption, AI strategy, Japanese companies, Survey research, Structure equation model.

1. INTRODUCTION

According to the report analyses by OECD suggests that the use of artificial intelligence (AI) in firms is widespread in ICT and Professional Services across large and young firms in 11 countries [1]. Meanwhile, Japan is said to be an AI underdeveloped country according to Mr. Son, a founder, and CEO of SoftBank Group [2]. The introduction of AI in Japan is delayed compared to the rest of the world. Son oversees the Softbank Vision Fund, the world's largest private equity fund which only invests in AI related companies; however, it had not made a single investment in Japan.

Small and medium-sized enterprises, which account for 99.7% of Japanese companies, have not yet introduced AI due to problems such as costs and lack of human resources, while large companies have sufficient budgets to adopt AI [3]. The economic effect of introducing AI to SMEs is expected to reach 11 trillion yen by 2025, according to the survey conducted by METI [3]. AI is also effective in addressing issues faced by SMEs, such as resolving labor shortages and passing on technology, although the adoption rate of AI in companies is low at 3%. Many SMEs lack understanding of AI functions and effects. Human resources with knowledge about AI are unevenly distributed among IT vendors, but because the economics of selling to individual SMEs do not match, opportunities for SMEs to access implementation know-how are extremely limited.

The objective of this study is to approach the owners and managers of corporations, including large, small, and medium enterprises (SMEs) throughout Japan to capture their opinions on factors that facilitate AI adoption as well as their thought on AI governance.

2. LITERATURE REVIEW

AI adoption has more than doubled since 2017 [4]; a group of companies which see the highest earnings from AI, continue to obtain advantages.

In business, AI can support automating business processes, gaining insight through data analysis, and engaging with customer and employees [5]. The development of AI technologies has been powered by both commercial and non-commercial interests [6].

AI adoption and AI governance are two important aspects of AI development and implementation. The followings, each concept is explored in more detail:

A. Theories on AI adoption

Radhakrishnan and Chattopadhyay [7] review the articles written on AI adoption. They suggest that The Technology-organization-environment (TOE) framework, Diffusion of Innovation, Technology, Organization and Environment Framework, the unified theory of acceptance and use of technology (UTAUT), Technology Acceptant Model (TAM) were some of the dominant theories/ frameworks used. Oliveira and Martins [8] review theories for adoption models at the firm level and discuss two eminent models: diffusion on innovation (DOI) theory [9], and the technology, organization, and environment (TOE) framework.

Tornatzky and Fleischer [10] developed TOE framework, which adopted the Diffusion of Innovations Theory [9]. The TOE framework points out three characteristics of an organization's context that influence the process by which it adopts and implements a technological innovation: technological context, organizational context, and environmental context (see Fig. 1).

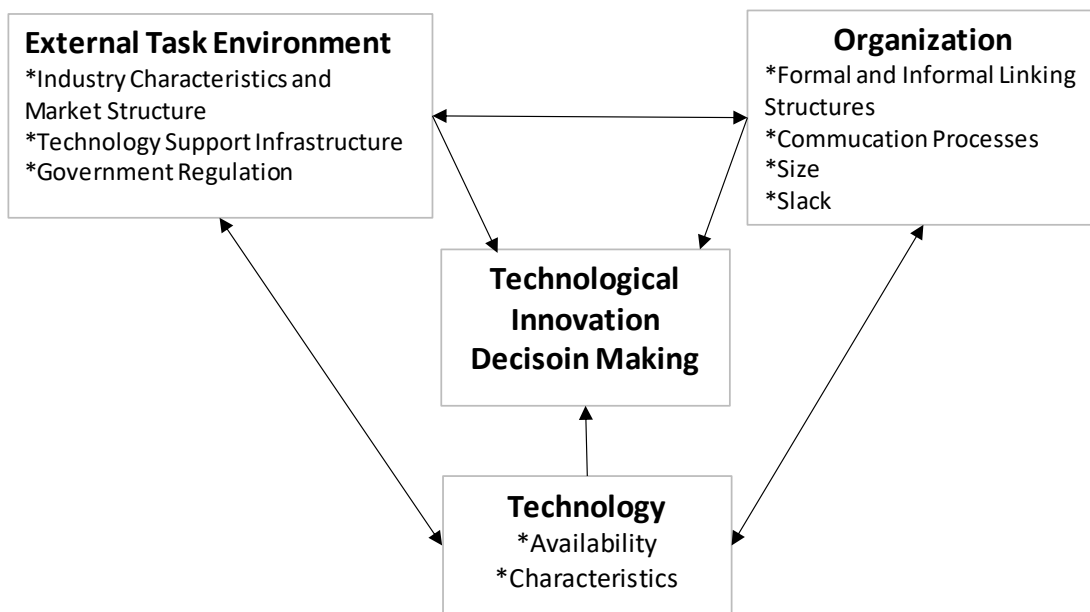


Fig. 1 TOE framework [10]

B. Theories on AI Governance

In Europe and the United States, basic ideas regarding how AI systems should be regulated have been announced, and specific regulations are being considered [11][12][13]. AI Governance in Japan is defined as “a technical, organizational, and design and operation of a public system of social governance system by stakeholders with the aim of maximizing the positive impact of AI while managing the risks arising from the utilization of AI at a level acceptable to them” [3].

B-1. Ethics of AI

Floridi and Cowls [14] propose the five-core ethical framework of principles for AI as shown in Fig. 2. Four of them are consist of those in bioethics, such as beneficence, non-maleficence, autonomy, and justice. They have added “explicability” as a fifth principle.

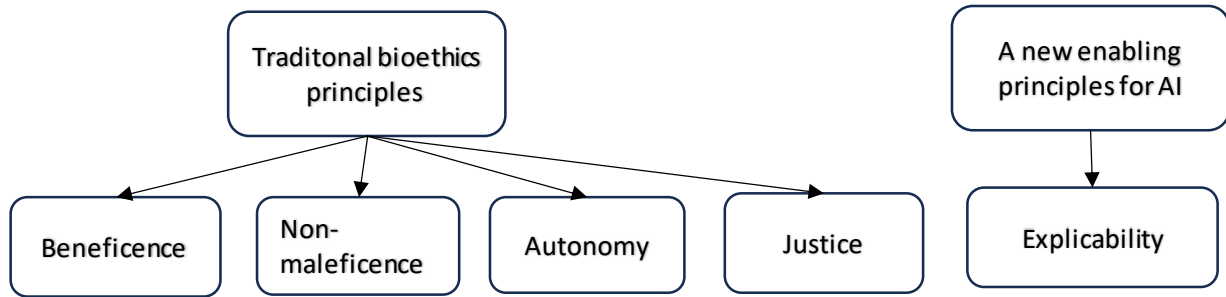


Fig.2 An Ethical Framework of the Five Principles for AI [14]

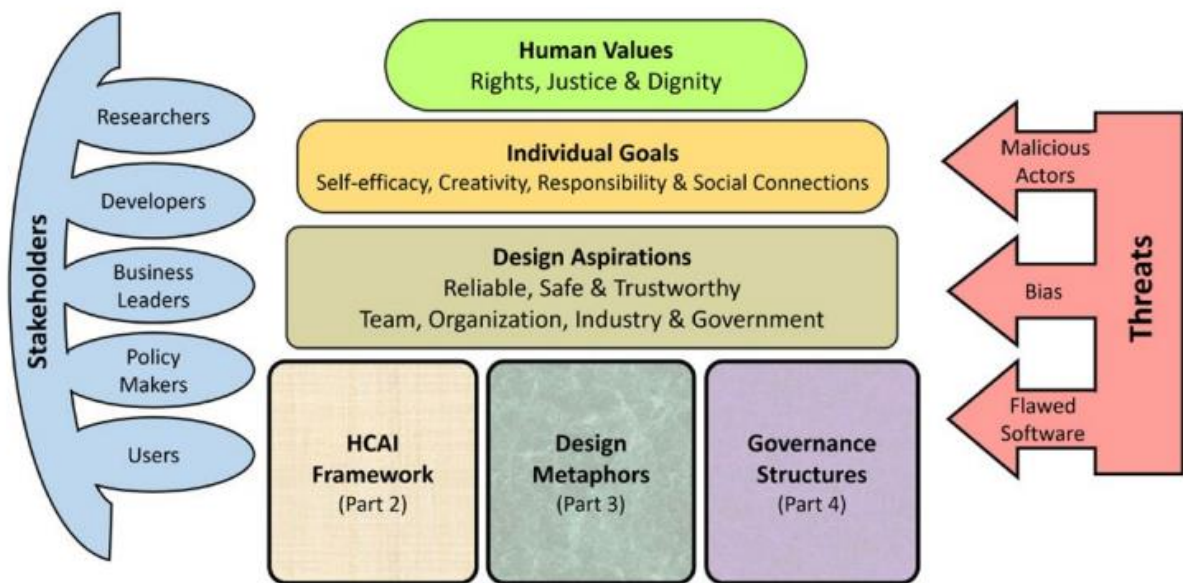


Fig. 3 HCAI overview [15]

B-2. Human-Centric AI

Shneiderman [15] presents the idea which bridge the gap between the ethical principles of Human-Centered Artificial Intelligence (HCAI) and the practical steps that can be taken for its effective governance. HCAI focuses on enhancing human performance, making systems reliable, safe, and trustworthy, as well as supporting human self-efficacy, encouraging creativity, and enabling social participation. A model for HCAI overview is shown in Fig.3.

B-3. Value Alignment

AI accommodates to human values is called AI value alignment [16] [17]. The goal of AI value alignment is to ensure the AI is properly aligned with human values. Russell [16] has proposed the three AI value alignment principles for creating a safe and beneficial AI. (1) A principle of altruism: the AI’s only objective is to maximize the realization of human values. (2) A law of humility: AI as the digital agents is initially not certain of what human values are. But AI agents, in support of advanced machine learning capabilities, may learn those values and preferences by observing human behaviors. (3) To achieve the value alignments between AI and humans.

B-4. Regulatory Governance

In Japan, ideal approaches to AI governance, including regulation, standardization, guidelines, and audits, conducive to the competitiveness of Japanese industry and increased social acceptance, for the purpose of operationalizing the AI Principles, have been discussed and developed [18]. Similar discussion can also be seen in Europe and the United States, where basic policies about regulations on AI systems and more specific regulations have been discussed and published [19].

B-5. International Cooperation

As AI has become a global phenomenon, the importance of international cooperation and collaboration in AI governance are emphasized. For example, the development of shared ethical principles and standards for AI are need in international cooperation [20].

AI is a multidimensional and still evolving field. AI governance focuses on the establishment of policies and frameworks to guide the ethical and responsible development and use of AI, while AI adoption involves the integration of AI into various sectors. These theories provide a foundation for discussions and the development of comprehensive governance framework.

3. RESEARCH MODEL AND HYPOTHESES

Based on the literature review, the author assesses the relationship between AI governance, AI adaptation and utilization, and AI strategy as a research model in Fig.4.

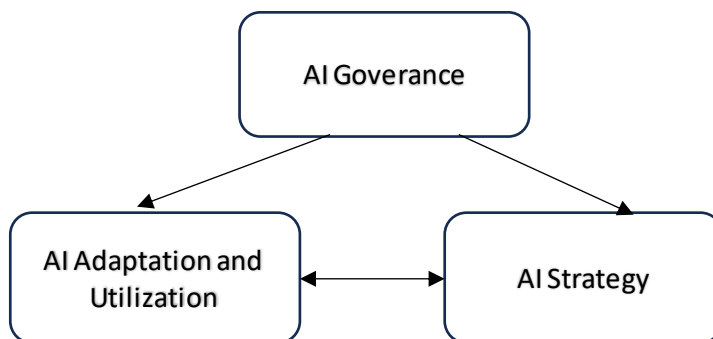


Fig. 4 A Research Model

The following hypotheses are proposed and are examined.

- H1: There is a significant, positive relationship between AI governance and AI adaptation and utilization.
- H2: There is a significant, positive relationship between AI governance and AI strategy.
- H3: There is a significant, positive relationship between AI adaptation and utilization and AI strategy.

4. DATA

Data were collected through an online survey conducted on March 25, 2022. A sample of the survey was selected from database of Freeasy which has the largest scale online survey monitors in Japan with more than 4.5 million people registered. In addition to basic information such as age, gender, and living area, they have prepared some attributes, including occupation and industry. Those who are age between 25- and 70-year-old, working full-time, fixed-term contract workers or dispatch workers were selected. The survey was sent to those monitors up to reach 1,800 responses.

Most of the questionnaires are asked by 4 to 5-point scale. A summary statistic in terms of industries and firm sizes (in number of employees and annual sales) is listed in Table 1. And a list of variables which are used in the analysis is shown on Table 2.

5. RESULTS

Testing the efficacy of the structural equation model was conducted by AMOS 28, and the major results of analysis are shown in Figure 5, the Path Coefficients of Research Model is shown in Table 3, the reliability test for these analyses is shown in Table 4, respectively.

Path Coefficient for the structural model suggested that the regression coefficient for all constructs show significance as shown in Table 3.

Table 1 Sample Characteristics

(1) Industry-Type

Industries	#	%
Agriculture / forestry / fishing / mining	15	0.8
Construction industry	102	5.7
Manufacturing industry	466	25.9
Information and communication industry	160	8.9
Finance / Securities / Insurance	133	7.4
Real estate business	40	2.2
Service industry	221	12.3
Transportation / transportation industry	112	6.2
Electricity / gas / water services	48	2.7
Trading company / wholesale / retail business	156	8.7
Medical / welfare	49	2.7
Education industry	46	2.6
Publishing / printing industry	19	1.1
Media / media / advertising business	5	0.3
Research industry / think tank	50	2.8
Non-profit organization	146	8.1
Not working	18	1.0
Total	1,800	100.0

(2) Annual sales

Annual Sales (yen)	Number	%
Less than 500 million	306	17.0
500 million ~5 billion	319	17.7
5billion~10billion	195	10.8
10billion~30billion	239	13.3
30billion~50billion	149	8.3
More than 50billion	592	32.9
Annual Sales (yen)	1,800	100.0

(3) Size of Employees

Employee	Number	%
Less than 20	133	7.4
20~50	112	6.2
50~100	154	8.6
100~300	276	15.3
300~1,000	317	17.6
More than 1000	808	44.9
Total	1,800	100.0

Table 2. A list of Variables

AI Governance	Supervision and management of AI budget Supervision and management of AI investment evaluation Thorough division of duties and authority regarding AI Establishment of an AI-related steering committee Clarify criteria for prioritizing AI projects and allocating AI resources Standardization of AI introduction process Supervision and management of information security and AI risks
AI Adoption and Utilization	Involvement of AI personnel in the management strategy formulation process Involvement of management in the AI strategy formulation process Management Involvement in Business Reform Projects Using AI Aggressiveness of management towards communication with AI personnel Dissemination of AI strategy from management to employees Business support proposals using AI by management Management encourages and support for the use of AI in the company.
AI Strategy	Importance of using AI to strengthen competitiveness Three-year trends in AI investment Whether there is a post for the director in charge of AI

The path diagram features the structural relationships. In this diagram, the measured variables are enclosed in boxes, latent variables are circled, and arrows connecting two variables represent relations, and open arrows represent errors. When SEM is used to confirm a theoretical model, a greater goodness of fit is required for SEM analysis [21]; the better the fit, the closer the model matrix and the sample matrix. Whence various goodness-of-fit indexes, including Goodness-of-Fit statistic (GFI) [22], the comparative fit index (CFI) [23], and the root mean squared error of approximation (RMSEA) [24]. The Akaike information criterion (AIC) is a mathematical method for evaluating how well a model fits the data it was generated from. In statistics, AIC is used to compare different possible models and determine which one is the best fit for the data [25].

The estimated matrix can be assessed against the observed sample covariance matrix to determine whether the hypothesized model is an acceptable representation of the data. In general, incremental fit indexes (i.e., GFI, CFI) above 0.90 signify good model fit. RMSEA values lower than 0.08 signify acceptable model fit, with values lower than 0.08 indicative of good model fit [24]. Based on GFI, CFI and RMSEA indexes, the result was regarded as acceptable.

The followings are the results of hypotheses:

H1: There is a significant, positive relationship between AI governance and AI adaptation and utilization.

H2: There is a significant, positive relationship between AI governance and AI strategy.

H3: There is a significant, positive relationship between AI adaptation and utilization and AI strategy.

6. CONCLUSION

The purpose of this study is to measure the owners and managers of corporations of large, small, and medium enterprises (SMEs) throughout Japan to capture their opinions on factors that facilitate AI adoption as well as their thought on AI governance. The results of structural equation modelling analysis suggest the followings.

AI Governance and AI Adaptation and Utilization: it implies that effective AI governance contributes to the successful adaptation and utilization of AI technologies.

When organizations have robust governance frameworks in place, they can address potential risks and ethical concerns associated with AI, thereby facilitating its adoption and utilization in a responsible and effective manner.

AI Governance and AI Strategy: it indicates that AI governance plays a crucial role in shaping and influencing AI strategy. By implementing effective governance practices, organizations can establish guidelines, policies, and frameworks that align with their strategic objectives related to AI. This helps ensure that AI initiatives are well-planned, aligned with organizational goals, and adhere to ethical considerations.

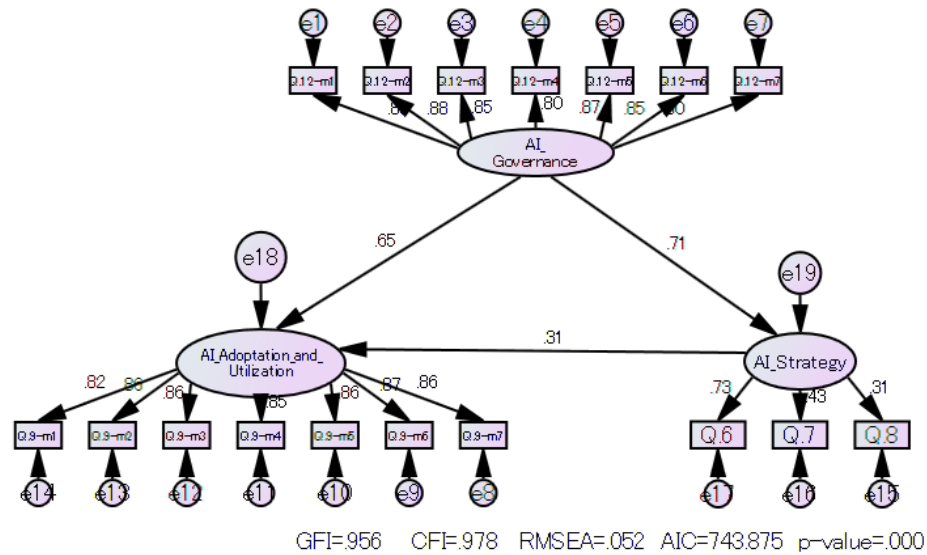


Fig. 5. Results for the Research Model

Table 3 The Path Coefficients of Research Model

construct		Std. weight	Unstd. weight	S. E.	C.R. (t-value)	P value
AI Adoption and Utilization	<--- AI Strategy	0.31	0.631	0.091	6.96	***
Q.12m1	<--- AI Governance	0.847	1			
Q.12m2	<--- AI Governance	0.881	1.04	0.021	49.663	***
Q.12m3	<--- AI Governance	0.85	1.029	0.022	46.58	***
Q.12m4	<--- AI Governance	0.802	0.978	0.023	42.27	***
Q.12m5	<--- AI Governance	0.873	1.052	0.022	48.881	***
Q.12m6	<--- AI Governance	0.854	1.032	0.022	46.992	***
Q.12m7	<--- AI Governance	0.796	1.012	0.024	41.745	***
Q.9m7	<--- AI Adoption and Utilization	0.858	1			
Q.9m6	<--- AI Adoption and Utilization	0.868	1.019	0.021	49.686	***
Q.9m5	<--- AI Adoption and Utilization	0.856	0.998	0.021	48.465	***
Q.9m4	<--- AI Adoption and Utilization	0.85	1.007	0.021	47.783	***
Q.9m3	<--- AI Adoption and Utilization	0.856	0.994	0.021	48.444	***
Q.9m2	<--- AI Adoption and Utilization	0.861	0.995	0.02	48.967	***
Q.9m1	<--- AI Adoption and Utilization	0.817	0.938	0.021	44.546	***
Q.8	<--- AI Strategy	0.308	1			
Q.7	<--- AI Strategy	0.432	1.232	0.128	9.639	***
Q.6	<--- AI Strategy	0.731	1.697	0.157	10.783	***

Table 4 Reliability Test

FIT indices	Recommended level	SEM model
GFI	>0.90	0.956
CFI	>0.90	0.978
RMSEA	<0.08	0.052
AIC	Smaller values suggest a good fitting	743.875
p-value	>0.05	0

AI Adaptation and Utilization and AI Strategy: This relationship suggests that the successful adaptation and utilization of AI technologies are closely linked to the development and implementation of an effective AI strategy. When organizations have a well-defined strategy in place, they can identify the most suitable AI applications, allocate resources effectively, and maximize the benefits derived from AI implementation.

These findings highlight the importance of AI governance in facilitating AI adaptation and utilization, as well as its influence on shaping AI strategy. Furthermore, they emphasize the significance of a well-crafted AI strategy in driving successful AI adoption and utilization within organizations.

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