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新産業育成のための構造的両利き経営と競争・協調能力：日本の水素ステーション業界におけるミッション主導のグランドチャレンジ

Structural Ambidexterity and Coopetition Capability for Industry Incubation: Mission-led Grand Challenges in Japanese Hydrogen Station Industry

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1. Introduction

Firms face the problem of ambidexterity - paradoxical tensions between exploitation for profit maximization and exploration for innovation - when pursuing the future growth (e.g., O'Reilly et al., 2016). Structural ambidexterity is understood as one way to simultaneously purse exploitation and exploration by physically separating subunits within the organization (e.g., Aoki et al., 2017). Most prior studies have been conducted at the firm level to investigate the optimal archetypes of managing structural ambidexterity (e.g., Benner et al, 2003). However, there remains a lack of understanding how to design interorganizational or collective coordination of structural ambidexterity at the industry level. I attempt to introduce this new concept as firms' industry-wide structurally coordinated effort to simultaneously exploit incumbent businesses under competition and collectively explore a nascent business under cooperation. I address the research question: "Why and how does structural ambidexterity at the industry level become effective for industry incubation and scaling up a nascent market demand?" Using a case study methodology (Yin, 2018), I examine an industry business case—a hydrogen station industry in Japan.

2. Theoretical background about structural ambidexterity and its level of analysis

Prior studies have shown that there are four fundamental conditions for the mechanism by which structural ambidexterity at the firm level can be established. First, the units of exploration and exploitation should be structurally separated within a firm so that the explorative unit can secure its autonomy and avoid potentially harmful spillovers from the exploitative unit (e.g., O'Reilly et al., 2016). Second, frontline managers and employees in each separated unit should be dedicatedly specialized in either exploration or exploitation (e.g., Gupta et al., 2006). Third, the separated units of exploration and exploitation should be strategically integrated at the firm level so that both units can complement each other with the firm's strategic resources and its common visions (e.g., O'Reilly et al., 2016). Fourth, a firm's leaders are responsible for a paradoxically structural linking mechanism between exploration and exploitation to maximize the effective use of shared resources under a common strategic vision (e.g., Ossenbrink et al., 2019). However, in many cases in grand challenges it may be difficult for a single firm to mitigate paradoxical tensions between exploration and exploitation due to the limited internal resources in response to scaling up the business by social demand even if the firm meets the four fundamental conditions for the structural ambidexterity at the firm level (e.g., Komiyama, 2020). In this case, transferring from structural ambidexterity at the firm level to structural ambidexterity at the industry level by utilizing collective action principles can be one of the appropriate options to resolve the paradoxical issues in grand challenges.

The innovation literature argues that several studies at the industry level have focused on an industrial collective enterprise for product innovation under public private partnership (e.g., Browning et al., 1995). The enterprise is established by integrating the development unit of each individual firm at the R&D stage in the industry (Sakakibara, 1981) before the dominant design (Utterback, 1994) is emerging. However, there has been little attempt to understand this phenomenon under the concept of ambidexterity. These studies may have focused their research on explorative businesses and overlooked critical trade-offs between explorative and exploitative businesses, and competitive tensions that may arise between firms in the industrial collective enterprise. I aim at addressing these research limitations by investigating why and how firms decide to collectively participate in industry-wide structural ambidexterity activities.

3. Research Methodology

I use a case study approach which focuses on the Japanese hydrogen station industry for explanation building about structural ambidexterity at the industry level. The purpose of this study is to develop a theoretical explanation. Rationales for a single case study as theoretical sampling are a critical, unusual,

revelatory, longitudinal case and opportunities for research access (Eisenhardt et al, 2007). For triangulation of data, I use the following sources: 1) Documentation; 2) Archives; 3) Observations; 4) Interviews. As a middle manager in the industry, the author has had unusual research access to observe many phenomena since the industry's incubation in 2000 (Komiyama, 2020).

4. Research setting

The Japanese hydrogen station industry has unique characteristics for structural ambidexterity at the industry level between incumbent fossil fuel business and new hydrogen fuel business: 1) Hydrogen contributes to solution of climate change problems through no carbon emission as compared to fossil fuels; 2) Hydrogen business unit is explorative in each firm where fossil fuel business unit is exploitative; 3) The industry has a 20-year history of public-private collaborative efforts. The industry has launched the commercialization of hydrogen stations in 2014 for supplying hydrogen to fuel cell vehicles (FCVs) which drive by hydrogen fuels. However, it faced severe difficulties within a few years due to the future hydrogen market uncertainties from the limited sales number of FCVs and the lack of investment resources for scaling up toward the hydrogen station network nationwide. Consequently, the annual number of hydrogen station construction dramatically reduced from 32 in 2015 to 6 in 2017. To overcome these difficulties, after two-year negotiations, the industry and government established Japan H2 Mobility, LLC (JHyM) as a collective enterprise where hydrogen station business was spun off from each incumbent firm (JHyM, 2018).

5. Key findings

Through this study, I show that, in addition to the four conditions necessary for structural ambidexterity model at the firm level, two additional conditions are necessary for the establishment of a collective enterprise such as JHyM: mission-led government initiatives for industry incubation and coopetition capabilities shared among firms. I also propose structural ambidexterity model at the industry level by explaining the decision-making mechanism of the firm based on the complementarity between the exploitation business and the exploration business for maintaining the strategic relationships with stakeholders (Figure 1), and may explain why the public and private sectors are able to cooperate to establish a collective enterprise at the industry level.

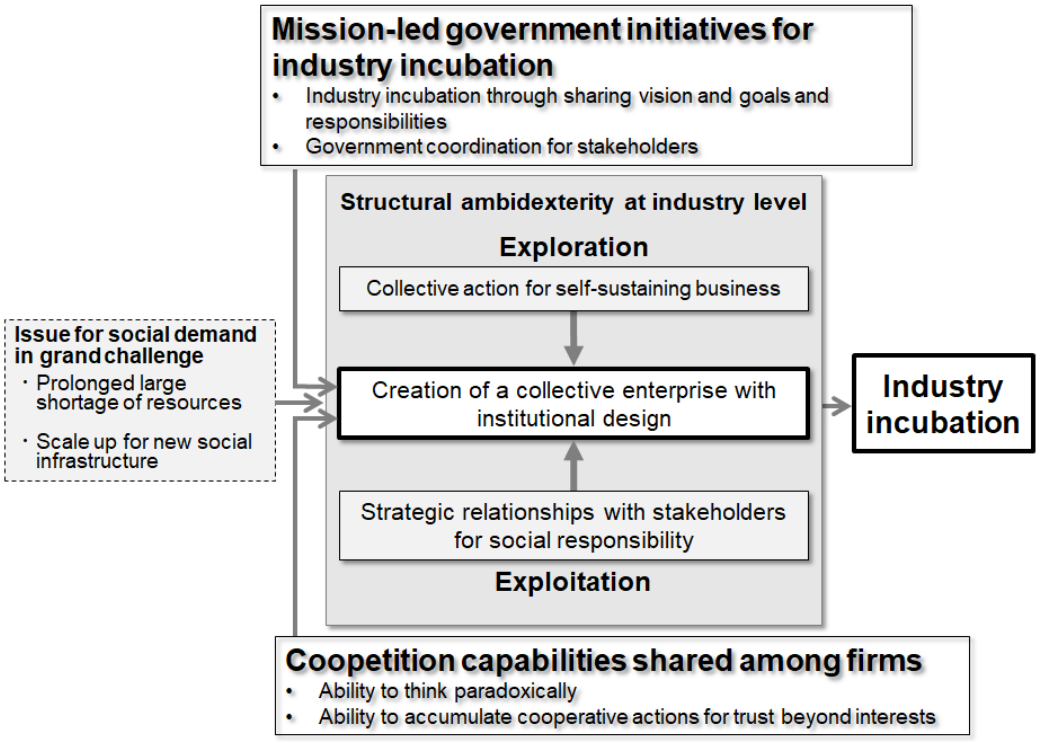

Figure 1 Conceptual explanation model for structural ambidexterity at the industry level

5.1 Why the government and firms decided to establish a collective enterprise

Prior studies have argued that the process of industry incubation in grand challenge requires the public sector to leverage private enterprise partnerships (e.g., Agarwal et al., 2021). Agarwal et al. (2021) suggest

that similarly to industry incubation in private sectors it is critical to respond to high uncertainty in demand in grand challenge, and that one way to counter these uncertainties is collective action through investment by diverse actors.

In this case, the hydrogen station firms have been balancing their incumbent fossil fuel businesses and a nascent hydrogen fuel businesses on the individual firm basis, but the government, which wanted to strengthen measures against climate change, and the automobile industry, which wanted to sell FCVs nationwide even in the nascent market stage, have demanded that hydrogen stations be scaled up numerically and optimally placed nationwide as social infrastructure (JHyM, 2018). Then each hydrogen station firm has been confronted by the key stakeholders with the counter-intuitive challenge of scaling up the loss-making hydrogen business with high business uncertainty (Komiyama, 2020). If this demand could not be met and the hydrogen station industry would face the start-up problem such as who will initiate those efforts, the lack of a continuous increase in the number of hydrogen stations would affect the purchasing behavior of potential FCV users, leading to a decline in sales of FCVs, which in turn would lead to a decline in the construction of hydrogen stations, a negative cycle that would lead to the collapse of the hydrogen station industry (METI, 2021). To give rational explanations these counter-intuitive challenges and minimize future business uncertainty, both the government and the automotive industry, which are on the side of creating hydrogen demand, and the hydrogen station industry, which is on the side of increasing hydrogen supply capacity, decided to share their future commitments at the same time. Consequently, they established JHyM which has the function of supervising these commitments as collective actions by both the government and industries.

5.2 Mission-led government initiatives for industry incubation through structural ambidexterity

Prior studies argue by comparing how governments can be involved in the creation of new industries from the perspective of political institutional structures and their technology policy orientation (e.g., Spencer et al., 2005). Spencer et al. (2005) discussed the cases of public and private partnerships with the government commitments to make its financial institutional and legislative support for the industry incubation.

In this case, I observed that Japanese government initiatives for the incubation of hydrogen station industry to design institutions for sharing goals, rules, responsibilities and commitments between government and the industries significantly promoted to establish JHyM for tackling climate change problems (JHyM, 2018). The commitment the Prime Minister publicly made for the development of hydrogen stations (CABINET, 2017) may have helped to initiate the firms' leaders to think about a rational business decision to balance the incumbent fossil fuel business to emit CO2 with the new hydrogen station business to reduce CO2 under a collective enterprise in public-private efforts. By embedding the JHyM in the government documents such as "Basic Hydrogen Strategy (METI, 2017)" as an agency to implement the government's policy targets, the government has distanced JHyM from the influence of the individual firms' incumbent businesses to secure a certain level of JHyM's autonomy under structural ambidexterity at the industry level.

5.3 Coopetition capability of firms for structural ambidexterity at the industry level

Coopetition is simultaneous competition and cooperation between firms (e.g., Lado et al., 1997). Bengtsson et al. (2016) argue that general firm capability cannot fully account for managing paradoxically coopetitive tensions. Huge failure rates of coopetitive alliances suggest that firms need specific coopetition capability for the paradoxical tensions (Lunnan et al., 2008). Bengtsson et al. (2016) define the concept of coopetition capability, which I adopt for this study, as the ability to think paradoxically and to initiate processes that help firms attain and maintain a moderate level of tension, irrespective of the strength of the paradox.

In this case, the hydrogen station firms faced both externally and internally paradoxical tensions. In externally coopetitive tensions, the government and industries cooperated to create hydrogen demand through establishing JHyM, while individual firms competed for the cost reduction technology in hydrogen stations by using their incumbent business resources (JHyM, 2018). Since cost competitive advantage is firm's inherent capability derived, each firm would not accept to share the cost information and this has led to strong tensions among the firms when cooperatively establishing JHyM. An author observed that to mitigate these tensions, the eleven participating firms in JHyM repeatedly discussed and established legally binding provisions based on Anti-trust law to prevent the leakage of the firm-specific cost information to the competitors through JHyM. In internal paradoxical tensions between whether the hydrogen station business should be discontinued due to its long-term loss-making and whether the business should be continued for strategically maintaining the relationships with stakeholders, based on the business self-sustaining conditions

shown in the industry roadmap which the government and industries collaboratively formulated, each firm collectively decided to establish JHyM to continue the hydrogen business as strategic complements to the incumbent fossil fuel business by reducing CO_2 and maintaining the relationships with their major stakeholders such as the government and the automobile industry.

6. Expected contribution

This study may contribute to both literature and practice: revealing a formation mechanism of structural ambidexterity at the industry level to respond the increasing social demand in grand challenge by focusing on both coopetition capability on which firms can think paradoxically about conflicting tensions and government initiatives for industry incubation; and providing industry executives and government policy makers with theoretical and practical explanations based on case study approach about forming structural ambidexterity at the industry level as opportunities for innovative industrial policies and strategies through transferability of this study to other industries with mission-led grand challenges.

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