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CONFERENCE PAPER

How does a project-based organization (PBO) scale its business?

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Synopsis

This paper explores how an organization works to balance growth and economies of scale with delivery risk through a longitudinal case study of a project-based organization (PBO) in the construction industry. It concludes that the case organization appears to maximize the project economies of scale while capping project size to ensure manageable delivery risk. The capped limit of project size increases gradually as the organization develops its project delivery capabilities over the years.

Research design

This study is based on a longitudinal case study of a state-owned project development company in China, covering the years 2001 to 2012. The findings draw from archival research and observation. Data triangulation was achieved through multiple data sources, and sequence analysis was then used to organize the longitudinal data.

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Relevance for practice/education

The findings contributed to developing a better understanding of how a PBO might scale its businesses via an empirical case study. This study is meant to be thought provoking and to explore new angles of theorizing.

Main findings

The results suggest that the project's size is limited by project risks and organizational delivery capabilities. However, a PBO can cope with scale changes by chunking jobs into multiple projects and limiting the organization's average project size to a level that the organization is comfortable to deliver. Further, we observed that short-term fluctuations in resources could be dealt with by outsourcing arrangements, while in the longer term, project delivery competencies could be improved through organizational restructuring, process improvements, crystallization of responsibilities and roles, and the implementation of information systems.

Keywords

Project-based Organization, Economies of Scale, Project Delivery Capability, Project Sizing

Introduction

In product manufacturing businesses, the fixed production cost for a product is shared among the total number of the product produced. The higher the demand for the product, the lower the fixed unit production cost of the product – the so-called economies of scale effect (Chandler, Hiking & Chandler 2009).

In the construction industry, work is typically organized and delivered as projects. Unlike the manufacturing businesses, PBOs have limited potential to benefit from economies of scale across projects because of the unique nature of projects and the fact that project size is associated with project delivery risks (Creedy, Skitmore & Wong 2010; Akinci & Fischer 1998). However, PBOs with projects that are similar to each other or using similar technologies could benefit from economies of scale in procurement and production by increasing project sizes subject to a ceiling of project delivery risk. Further, the PBOs could also benefit from economies of scope by sharing project management costs (e.g. EPMO running costs, process development costs and training and development costs for project manager) across the projects (Chandler et al. 2009; Nightingale et al. 2003; Söderlund & Tell 2009; Levin 2007). On the other hand, the scale or size of a project is constrained by the delivery risk of projects. Increasing the scale or size of a project also increases the risk of project delivery (Creedy et al. 2010; Akinci & Fischer 1998), meaning that project chunking decisions need to balance economies of scale and economies of scope considerations with the risk level. The chunking decisions are typically made by senior managers, such as business development managers and CEOs of PBOs.

Much research on the economies of scale and scope is in manufacturing business, where the operation is continuous. In batch production, increases in production volume are not necessarily associated with increases in total fixed production costs, thus resulting in lower unit production fixed costs as total costs are spread across the total production volume – economies of scale (Hobday 2000). Although in PBOs, projects are basic units of work (Hobday 2000) and the operation is time-paced (Söderlund & Tell 2009), increases in production

scale by adding new projects are typically associated with increases in production materials, management resources and processing resources because of the unique nature of projects. For example, resources need to be duplicated if another project of similar scale is required. This makes it difficult to achieve economies of scale across projects, although it is possible to do so within a project capped by the risk the expanded scale may bring to the delivery of the project. However, it is possible to achieve reductions in average cost per project by virtue of economies of scope – sharing common resource needs, such as management procedures and PMO costs, among projects of a similar type.

Despite the importance of project chunking decisions, few studies have examined how these decisions are made and how project scale is balanced with project risk considerations. Based on a longitudinal case study of a Chinese state-owned enterprise, this study examines the pattern of project chunking decisions and concludes that the case organization appears to maximize the project economies of scale while subjecting project size to a capped limit to ensure manageable delivery risk. The capped limit of project size increases gradually as the organization develops its project delivery capabilities over the years.

In the following section, literature is reviewed, and the research design is described. In the results section, the evolution of the case organization's structure during 2001–2017 is presented chronologically. Subsequently, project chunking data are analysed in terms of annual production scale and annual average project size. Finally, conclusions are drawn, and implications, limitations of this study and future research directions are discussed.

Literature review

PBO'S AND THE CONSTRUCTION INDUSTRY

Work in the construction industry is typically organized as projects. As a result, most organizations in the construction business of delivering projects, such as contractors and developers, are PBOs. Research on PBOs mainly focuses on the knowledge management and innovation process in complex products and systems (Hobday 2000; Gann & Salter 2000; Bresnen Goussevskaia & Swan 2004; Lindkvist 2004; Bayer & Gann 2007). A PBO, unlike the matrix, functional or other forms, assumes the project as the basic organizing unit for integrating all the main business functions within the firm, and develops capabilities around project development and delivery (Hobday 2000). The structure of PBOs has been described as decentralized, autonomous and loosely coupled (Lindkvist 2004).

Because of the unique and one-off nature of construction projects, characteristics, skills and resources required for these PBOs are quite different from standard mass-produced products in the manufacturing industry (Gann & Salter 2000; Bresnen et al. 2004). Whitley (2006) distinguishes types of project-based firms (PBFs) by separation and stability of work roles, and singularity of goals and outputs. Complex construction projects tend to have singular goals and outputs (and do not vary dramatically from project to project) and are delivered by standardized, separate and stable work roles, which make it possible for the PBF to retain organizational learning and share learning and management systems among projects (Whitley 2006).

ECONOMIES OF SCALE AND SCOPE

The concept of economies of scale and scope started in the capital-intensive industries – including manufacturing, transportation and communication – in order to improve the

production capacity and reduce unit costs in the nineteenth century (Davies 1996; Chandler et al. 2009; Babbage 1832). Economies of scope refers to the sharing of costs common to projects within a PBO, such as the cost of running an enterprise project management office (EPMO), project manager development costs, process development and improvement costs.

Economies of scale springs from the unit cost reduction by increasing volume of production (Chandler et al. 2009). Economies of scope are achieved by utilizing the same materials and equipment to provide various products at a lower unit cost (Davies 1996; Chandler et al. 2009). Hobday (2000) argued that the PBO is inherently weak at achieving economies of scale. In the construction industry, each project is unique and thus requires some degree of tailoring the system and process to the project (Bresnen et al. 2004; Davies 1996; Thuesen 2010). As a result, an increase in the number of projects requires dedicated project teams and resources for each project. The scope for economies of scale in construction companies depends on the similarity between the projects undertaken. For example, in the single dwelling construction industry, the builders are able to achieve a considerable level of economies of scale by offering only a set suite of house models to choose from with a limited selection of finishes, thereby achieving economies of scale in procurement and construction efficiency. This trend is prevalent in high-rise apartment complexes as well, where there are set floor plans for customers to choose from. As a project's size (as measured in construction areas, land areas, budget) increases, the unit cost typically decreases. On the other hand, as the project's size increases, so are the risks associated with project delivery because the size is associated with increases in the complexity of delivering the project (Akinci & Fischer 1998; Creedy et al. 2010).

Project chunking refers to the allocation of batches of work into projects. The two primary factors to balance in chunking decisions are project size and associated project delivery risks. Increases in project size could result in economies of scale but also increases project delivery risks. There is little in the extant literature on how to balance the two factors. It is imaginable that the PBOs set a limit or cap on the maximum size of the project (as a surrogate for the max project delivery risk) it is willing to undertake.

Therefore, the research questions are:

- How do PBOs make project chunking decisions?
- How are project size and project delivery risk considerations balanced?

RESEARCH METHODOLOGY

This study is based on a longitudinal case study of a state-owned project development company (JHHG) in China covering the years 2001 to 2012. Case study method was chosen because it focused on the dynamics within single settings and helped us conduct an in-depth investigation into the evolution of organizational activities (Flyvbjerg 2006; Yin 2013). In this article, we chose a well-developed Chinese state-owned PBO as a single case study to illustrate how a PBO scaled its business (Siggelkow 2001).

Data collection methods for this study include archival research and observation (Yin 2013). Archival data included publicly available information and internal documents. One of the authors was a member of a research team that had been collaborating with the organization from 2001 to 2012. The research team was granted access to internal documents including professional consultants' reports, meeting minutes, strategic documents and organizational structure change records. Further, observations in meetings and discussions with key management personnel provide rich and valuable background information. Multiple

sources of data helped to confirm the validity of the data we used in this case (Tellis 1997; Yin 1981).

Sequence analysis was then used to organize the longitudinal data (Abbott 1990). The average project size and the total work volume (measured as annual total production area) for each of the years during 2001–2017 was compiled and analysed. Then, we attempted to explain the pattern of the project size information from the perspective of balancing project delivery risks and project scale.

The main structural changes happened during the 2013–2017 period is only included for completeness. Information during 2013–2017 relies upon publicly available information.

Case description

During the period 2001–2012, the strategy and organizational structure of Jinan Hi-Tech Holding Group (JHHG) changed significantly to adapt to the market changes. The restructuring happened in three major phases. In the first phase, the focus was on urban development. Then, in the second phase, when the residential property market was booming, JHHG expanded its business into residential property development. Subsequently, in the third phase, the plateaus of the residential property market, JHHG pulled back the residential property market and focused on highly complex urban infrastructure development.

PHASE I: URBAN DEVELOPMENT (2001–2007)

High-tech industrial development zones (high-tech zones) are areas set up with special tax and customs concessions to attract investment in the development of advanced and innovative technology industries. High-tech zones have had experienced dramatic growth since 1991 in China. The precursor of JHHG was an organizational unit under the Jinan Municipal Government's committee for high-tech zone. The unit's focus was on developing infrastructures for urban development, such as office buildings, a convention centre and industrial parks, on behalf of the government. To support the development of high-tech zones and urban development around the high-tech zone, the government decided to set up JHHG in 2005 as a state-owned enterprise responsible for the development of the high-tech zone. As shown in Figure 1, the JHHG is under the supervision of the government, and the five shaded units were the core supporting units for urban projects development.

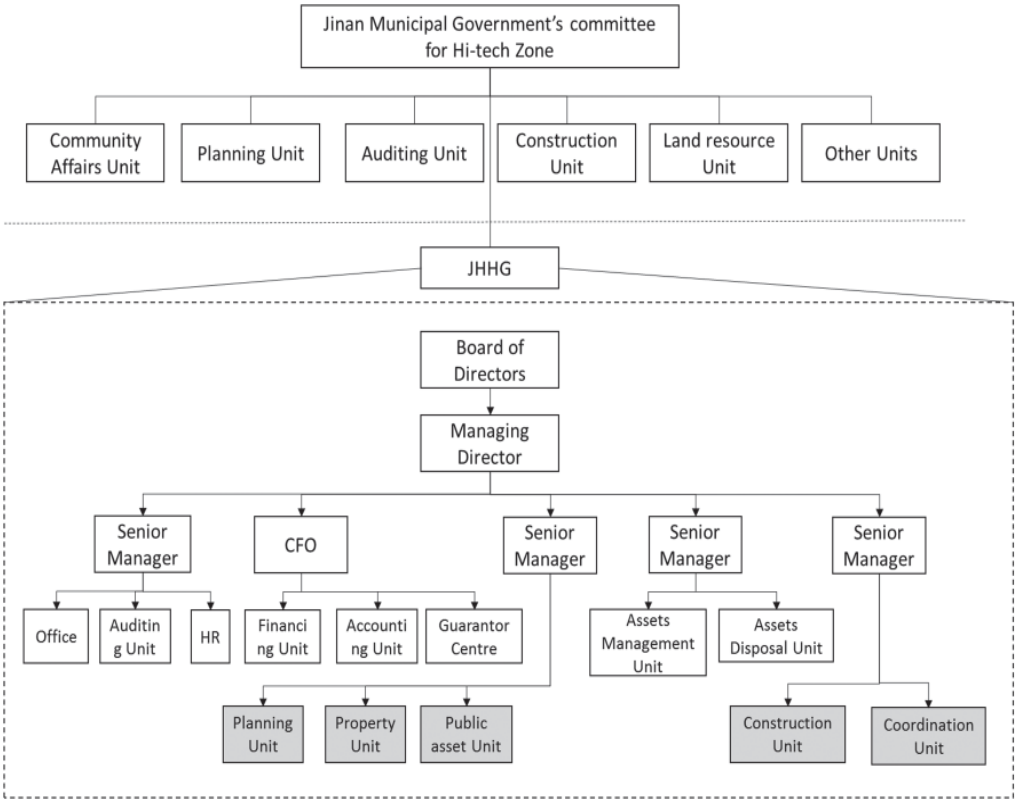

Figure 1 Organizational structure of JHHG (2005–2007)

During Phase 1, the precursor of JHHG (2001–2005) and then JHHG (2005–2007), developed a software park complex from 2001 to 2002, then an international convention centre from 2003 to 2005 and another software industry park from 2005 to 2008; all three programmes have similar scales (estimated total building area around 150,000 m^2).

PHASE II: EXPANSION INTO RESIDENTIAL PROPERTY DEVELOPMENT (2007–2012)

Despite the impact of financial crisis in 2008, the residential property market heated up after a cold spell. For the high-tech zone, the move of the government departments into the zone in 2010 further exacerbated the demand–supply imbalance, giving rise to an evident increase of potential residential demand in this high-tech zone. The market demand was the driving factor for the establishment of the property arm for JHHG in 2007. The arm, a wholly owned subsidiary of JHHG, was responsible for the development of residential projects with autonomy in construction and marketing decisions. The first residential property project was carried out in 2008. After that, another eight residential projects were added to the development process around the same period, from 2009 to 2012, during which 90% of the profit of JHHG was contributed by the property arm, making the residential property development the star performer in JHHG. At that time, half of the residential projects in this high-tech zone were developed by the property arm of JHHG, which made it the biggest real estate developer in the high-tech zone.

The overheated market, however, prompted the government to adopt policies and regulations to slow down demand. The market appeared stagnant. As a consequence, the volume of business in the property arm experienced dramatic fluctuations during 2008–2011.

From the initial project in 2008 to the peak of eight simultaneous projects in 2011, the number of supporting units (such as planning and marketing, sales, construction, communications, design management, etc.) increased from three to eight (shaded units in Figure 2) before all were eventually disbanded in 2012. The property arm's functions were then absorbed into the JHHG.

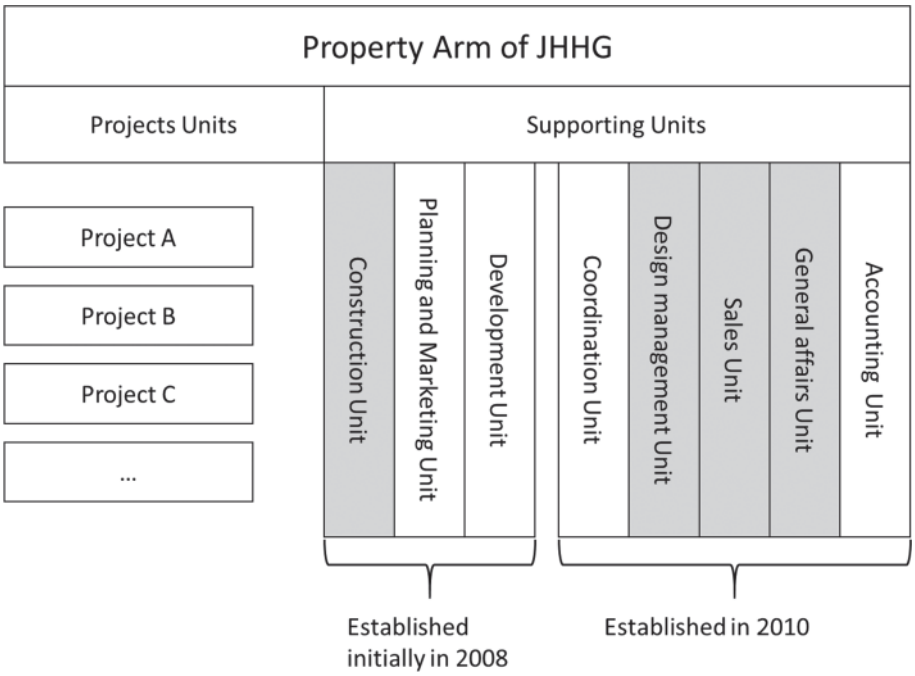

Figure 2 Units of property arm of JHHG

The first office buildings project (337,000 m^2 building area) was developed by JHHG from 2007 to 2010, and the first residential property (160,000 m^2 building area) from 2008 to 2009. Another eight residential properties, covering around 2,380,000 m^2 building area in total, were then developed from 2008 to 2013.

PHASE III: FOCUS ON HIGHLY COMPLEX URBAN DEVELOPMENT (2012–2017)

In the face of an overheated property market with signs of being stagnant and strong government determination to regulate and control the market, JHHG made the decision to pull back from residential property development and refocus on the company's existing strength in urban development (office complex, convention centre, shopping mall, hotel, etc.) with two added caveats. First, banking on years of experience, JHHG's strategic focus had a new priority, that is, projects with a high degree of complexity and high value, and potentially high return to the community. Second, there was an added emphasis on facility management for the high-tech zone.

A large HOPSCA (usually involving hotel, office, park, shopping mall, convention and apartment) project containing a landmark building developed directly by JHHG became the first priority since 2012. With the HOPSCA project progressing into the conceptual design phase and all residential projects nearly in closeout phase, the number of supporting units in the property arm was halved, and resources were relocated to the HOPSCA. This project covered around 4,100,000 m^2 of building area.

After serious consideration and evaluation, the property arm was disbanded and merged into JHHG. Soon after, a steering committee for HOPSCA was set up, composed of senior managers from the key stakeholders in the high-tech zones and heads of functional units of JHHG. To enhance the capability of JHHG to coordinate the stakeholders, an experienced integration management team was appointed. Meanwhile, enterprise resource planning (ERP), building information modelling (BIM), project management information system (PMIS) and project information portal (PIP) had been introduced to support integrated management.

Discussion

As our intention was to extend the understanding of scalability of PBOs, in this section, we first analysed the project chunking data of JHHG based on annual production scale and annual average project size and then how JHHG coped with fluctuations in scale and resources in various contexts. In this paper, project scale and size are measured by building area. Each project was assumed to progress evenly during the year. Accordingly, annual production scale equals the amount of building area constructed during the year; annual average project size equals annual production scale divided by the number of projects undertaken during the year.

ANNUAL PRODUCTION SCALE AND ANNUAL AVERAGE PROJECT SIZE

As presented in the graph below (see Figure 3), annual production scale steadily rose until 2012, when it started to decline, while annual average project size kept relatively stable. From 2001 to 2007, recognized as the urban development stage, both the production scale and average project size stayed around 100,000 m^2/year. Since its formation, JHHG has consistently kept its project sizes to a level that is comfortable to JHHG both in terms of project delivery risks and economies of scale considerations. Bigger project sizes are associated with higher project delivery risks, whereas smaller project sizes could result in inefficient utilization of resources – the opposite of economies of scale (Lyons & Skitmore 2004).

From 2007 to 2010, the annual production scale doubled every year (coinciding with the setting up of the property arm). However, JHHG kept annual average project size almost the same by chunking jobs into multiple projects while limiting an organization's average project size to a level that the organization is comfortable with delivering. In so doing, the PBO was able to maintain its control of project deliveries while capitalizing on economies of scope and scale – sharing costs of project delivery systems on multiple projects and maintaining the maximum project size practical.

We also observed that a project management consulting company was hired to project manage the delivery of residential projects. During this period, residential buildings were the main money-making business of JHHG. JHHG delves heavily into the property market through outsourcing in anticipation of major market corrections.

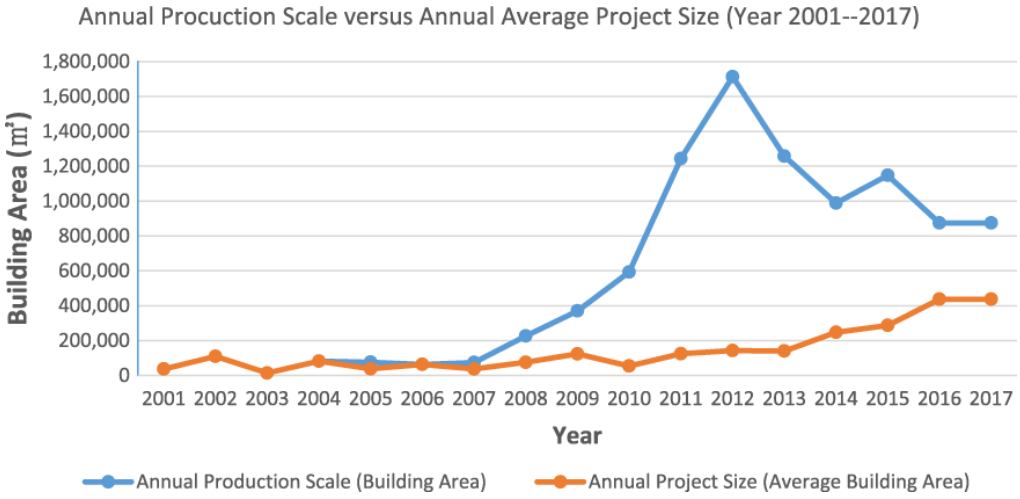

Figure 3 Annual production scale and annual project size of JHHG

Despite the decline in production scale since 2012, mainly due to the closeout of most residential projects, the annual average project size was slowly but steadily increasing, which indicated the gradual improvement of project delivery capability of JHHG.

WAYS TO ACHIEVE BUSINESS SCALABILITY FOR PBO'S

The case shows that JHHG achieves business scalability amid fluctuation in business demands through project chunking. Effective project chunking ensures big construction work is chunked into projects with sufficient size from the economies of scale perspective while the size is below a ceiling marking the organization's comfort zone in dealing with project delivery risks.

JHHG coped with scale fluctuations by chunking jobs into multiple projects with sizes within the range it has successfully delivered. In so doing, JHHG maintained its control of project delivery risks and capitalized on economies of scale by keeping project size within the upper band while sharing costs of project delivery systems on multiple projects (economies of scope).

With its strategic focus on infrastructure development, JHHG delved into the residential property market when the market demand was strong, predictable and steady, through the outsourcing of the project management to specialized consultancies during 2007–2012. JHHG pulled back promptly as the market became stagnant. As shown in Figure 3, with the annual production scale of JHHG increasing from 2007 to 2010, JHHG employed a professional project management (PM) consultancy to look after the design and construction of the residential projects. Meanwhile, JHHG, aware of its need to further improve in-house PM capability, had been taking opportunities to enhance its project delivery capabilities during the period. Workshops were run almost every month to share experiences and lessons learned by both the consultancy and JHHG managers.

It appeared that the development of in-house project delivery capabilities had been a core component of JHHG's organizational capability development on its way to becoming the premier facility management organization in the high-tech zone. Over time, JHHG gradually

enhanced its competencies through organizational structuring, process improvements, crystallization of responsibilities and roles, and the implementation of information systems.

Organizational structure and process were adjusted in accordance with market changes and the corresponding strategic adjustments. Processes, roles and responsibilities were refined gradually based on feedback on the day-to-day running of the projects. The existing capabilities of the JHHG staff were supplemented, in the short run, by outsourcing PM function, during which time JHHG greatly enhanced its project management processes and practical knowledge in project delivery.

The enterprise resource planning (ERP) system initially containing five modules (including procurement management, plan management, contract management, cost management and design management) was developed and implemented as an integrated work platform. The system significantly improved effectiveness and efficiency for information processing, access and distribution, contributing effective project deliveries, including time and costs savings.

As shown in Figure 3, the annual average project size increased gradually over the years from 2013 to 2017, which suggested the capability of JHHG in delivering projects has grown over the years. In other words, the average size of projects JHHG routinely delivers has gone up threefold from 2013 to 2017.

Conclusion

This paper has explored how to balance the economies of scale and delivery risk considerations in project chunking decisions through a longitudinal case study of a project-based organization (PBO) in the construction industry. The findings contribute to developing a better understanding of how PBO scale its businesses. As demonstrated in this case study, it is practical to chunk big jobs into projects while limiting an organization's average project size to a level that the organization is comfortable with delivering. In so doing, the PBO was able to maintain its control of project deliveries while capitalizing on economies of scale and scope – sharing costs of project delivery systems on multiple projects and maximizing project size (within its comfort zone of project delivery risks). Further, we observed that short-term fluctuation in resources could be dealt with by outsourcing arrangements, and in the longer term, project delivery competency could be improved through effective organizational learning practices, process improvements, crystallization of responsibilities and roles, and the implementation of information systems.

As an exploratory study, the findings from this study are based on a single case study and therefore need to be interpreted with caution. This study is meant to be thought provoking and to explore new angles of theorizing. Further studies in various contexts are needed to validate the findings.

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