

How to "smartly " allocate resources for digital entrepreneurship?

— A longitudinal case study from the perspective of resource orchestration

ABSTRACT

Amidst the backdrop of the digital economy, orchestrating resources effectively to foster the success of digital ventures has captivated widespread interest across academic and practical domains. This study adopts a case-study methodology, spotlighting the paradigmatic digital enterprise, Shanghai Tonglu yun Transportation Technology Co., Ltd. Grounded in Tonglu yun's entrepreneurial endeavors, we demarcate the digital venture journey into three salient stages: Market Insight; Technological R&D and Entrepreneurial Strategy; Product Creation & Start-up Incubation; culminating in the transition to expansive applications. Employing the Resource Orchestration Theory, we undertake a comprehensive examination of Tonglu yun's methodologies for resource creation, integration, and deployment across these stages. The research underscores data as the cornerstone in the digital venture trajectory, with enhancing data competencies central to resource amalgamation. Concurrently, profound industry-academic collaborations emerge as vital in resource amplification. Through this meticulous case analysis, the study presents a refreshed theoretical scaffold and actionable insights for resource orchestration in digital ventures, envisaged to guide future scholars and industry practitioners.

Keywords:

digital entrepreneurship; case stud ; resource orchestration; data resources

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1. Introduction

As the digital economy undergoes rapid expansion, digital entrepreneurship emerges as a pivotal catalyst for innovation and economic proliferation (Paul, Alhassan, Binsaif, & Singh, 2023). This nascent form of entrepreneurship, originating in the early 21st century with the advent of e-commerce and the Internet surge, is increasingly recognized as a substantial contributor to economic dynamics. Academically, digital entrepreneurship is delineated as the spectrum of entrepreneurial endeavors wherein digital technologists discern, cultivate, and exploit digital entrepreneurial opportunities, thereby penetrating digital markets and forging novel digital products and services (Xiumei & Shan, 2022). This domain has evolved from its nascent stages of mobile applications and e-commerce platforms to incorporate sophisticated technologies such as cloud computing, artificial intelligence, and big data analytics, thereby broadening its commercial scope (Elia, Margherita, & Passiante, 2020).

Contrasting with conventional entrepreneurial models, the digital entrepreneurial milieu is characterized by heightened complexity and uncertainty. This is attributed to the swift evolution of market demands and technological advancements. Concurrently, the resources at the disposal of digital entrepreneurs

are increasingly fragmented and heterogeneous. This necessitates entrepreneurs to possess acute acumen and adaptability in various facets including technology, market strategies, organizational structures, and resource allocation(Rangaswamy, Moch, Felten, Van Bruggen, Wieringa, & Wirtz, 2020). Consequently, the strategic and efficacious deployment of these finite resources towards synergistic value co-creation is posited as a determinative factor in the success trajectory of digital entrepreneurship endeavors(Ngoasong, 2018).

Despite a considerable volume of scholarly work focusing on the components(Nambisan, 2017; Xiumei, Yue, & Haitao, 2020), outputs(He, 2019; Song, 2019), and impacts of digital entrepreneurship(Hansen, 2019), there remains a paucity in research specifically addressing resource allocation within this domain. Early academic forays into this subject suggest that the strategic orchestration and collaboration of digital resources by entrepreneurs culminates in distinctive business models(Hafezieh, Akhavan, & Eshraghian, 2011), thereby influencing competitive advantage(Sirmon, Hitt, Ireland, & Gilbert, 2011). Scholars such as Amit and Han (2017) have posited that the paradigm of resource allocation undergoes a transformation in the digital entrepreneurial context, thereby necessitating a novel framework for digital resource allocation that aids in the realization of value co-creation. However, these explorations have not delved deeply into the granularity of resource orchestration, indicating a gap in academic inquiry that this paper seeks to address.

In addressing the exigent need for deeper understanding and to ameliorate the research lacuna, this paper endeavors to explore how digital entrepreneurs can efficiently amalgamate and allocate resources to catalyze enterprise value creation. To this end, the paper introduces the theoretical lens of resource orchestration. Rooted in the traditional resource-based view(Kraaijenbrink, Spender, & Groen, 2010), which posits resources as the fulcrum of sustained competitive advantage, resource orchestration theory, as expounded by Sirmon et al. (2011), provides a dynamic framework for managing resources in rapidly shifting market and technological landscapes. This theory accentuates how enterprises can adeptly organize, amalgamate, safeguard, and reconfigure resources to navigate and capitalize on external environmental vicissitudes(Yoshikuni & Dwivedi, 2023). In the digital entrepreneurship context, characterized by swift technological progress and market flux, resources are often unique, dynamic, and dispersed, necessitating strategic integration into competitive business models(Nambisan & Baron, 2021). Thus, the paper posits resource orchestration theory as a salient analytical framework, providing nuanced insights into resource allocation and management strategies within the ambit of digital entrepreneurship(Haibo, Yiqin, Haitao, & Chen, 2022).

Employing a case study methodology, this paper scrutinizes Shanghai Tonglu Yun Transportation Technology Co., Ltd (hereinafter referred to as "TLY") through a comprehensive longitudinal analysis. This endeavor aims to unravel the mechanisms and strategies pertinent to resource arrangement in digital

entrepreneurship, thereby offering valuable insights for practitioners and academicians in the field.

2. Literature review and theoretical basis

2.1 Connotation, characteristics and challenges of digital entrepreneurship

Amidst the intensification of the global digital transformation, the paradigm and praxis of entrepreneurship have experienced marked shifts(Chunhua, Wei, & Jihai, 2020; Xinbo, Mingchao, & Yongxia, 2022). Steininger (2019) delineates digital entrepreneurship as a novel entrepreneurial process wherein the genesis, delivery, and acquisition of value predominantly hinge on the application of digital technology. This form of entrepreneurship exhibits a greater reliance on digital tools and platforms over tangible assets or geographical constraints, distinguishing it from its traditional counterpart(Elia et al., 2020).

The characteristics of digital entrepreneurship are distinct and noteworthy. Initially, it presents a divergent cost structure from traditional ventures. Digital startups, leveraging scalable technologies, generally incur high initial fixed costs. However, as the user base expands, the marginal costs tend to diminish, illustrating the economies of scale achievable in this domain. Furthermore, digital entrepreneurs frequently navigate a volatile technological and market landscape, introducing inherent uncertainties. Data and algorithms are pivotal in this context, serving as crucial supports for decision-making processes and potentially conferring competitive advantages(Xiumei et al., 2020; Zhengang, Yamin, & Taiye, 2021). Lastly, the success of digital entrepreneurial ventures often relies on network

effects, where the utility and value of a product or service amplify with the increasing number of users(Paul et al., 2023; Xiumei & Shan, 2023).

However, the journey of digital entrepreneurship is not devoid of challenges. Entrepreneurs in this field grapple with the rapid pace of technological advancement and market evolution, making it strenuous to anticipate future trends and consumer needs(Guopeng, Ting, & Shiyi, 2022). The incessant need to invest in keeping abreast of technological advancements to maintain competitiveness adds another layer of complexity(Xiumei et al., 2020). Additionally, as the digital realm burgeons, concerns surrounding data privacy and security escalate. Digital entrepreneurs are thus tasked with the dual responsibility of ensuring their business models are robust and future-proof while also safeguarding user data against breaches and vulnerabilities. Addressing these multifaceted challenges is imperative for the sustainable growth and success of digital entrepreneurial ventures(Haibo et al., 2022).

2.2 Digital entrepreneurship resources

In the sphere of digital entrepreneurship, scholarly discourse has increasingly acknowledged the significance of resource-related considerations. Kraaijenbrink et al. (2010) emphasize the pivotal role of resource scarcity and uniqueness in cultivating an organization's competitive edge. This assertion is particularly salient within the realm of digital entrepreneurship, where, as Zulkefly, Ghani, Hamid, Ahmad, and Gupta (2021) elucidate, the procurement, amalgamation, and

governance of digital assets such as data, algorithms, and technical prowess are integral to entrepreneurial triumph.

Contrasting with traditional entrepreneurial ventures, the resource landscape in digital entrepreneurship necessitates not only rapid acquisition but also the capacity for dynamic allocation to effectively navigate the perpetually evolving environment(Jiang, Shi, Yue, & Jing, 2018). Nonetheless, the intrinsic attributes of digital resources present a plethora of managerial challenges(Hussain, Hassan, Hussain, & Hossain, 2020; Oguntimilehin & Ademola, 2014). Primarily, the intangible and mobile nature of these resources complicates their identification, acquisition, and safeguarding. For instance, data resources, often dispersed across a myriad of platforms, applications, and services, pose formidable challenges in terms of seamless integration, quality assurance, and security(Singh & Reddy, 2015; Xuesheng & Ziyuan, 2020).

Furthermore, the intrinsic worth of digital resources frequently hinges on their synergistic interaction and integration with ancillary resources(Miles, 2019). Data, in isolation, might hold minimal value, yet when adeptly paired with algorithms, it can catalyze substantial commercial opportunities. Despite the existing scholarly discourse addressing resource acquisition and capability enhancement in digital entrepreneurship, there remains an evident lacuna in research specifically focusing on the dynamic allocation of resources to fulfill business objectives within the digital entrepreneurship milieu, particularly through the lens of empirical enterprise examples. This gap underscores the need for further academic inquiry to elucidate

the strategies and mechanisms underlying effective resource management and allocation in this rapidly evolving domain.

2.3 resource orchestration theory

Within the ambit of enterprise and entrepreneurial scholarship, the stewardship and distribution of resources is a perennially central theme. The foundational resource-based view posits that enterprises should be conceptualized as conglomerates of various resources. This theory delineates core attributes that resources must possess to engender a sustained competitive edge for organizations, namely scarcity, value, inimitability, and non-substitutability (Gerhart & Feng, 2021). It posits that resources embodying these characteristics are pivotal in fostering an enduring competitive advantage for firms.

However, in light of the brisk pace of market and technological shifts, strategies rooted in the traditional resource-based view are increasingly perceived as somewhat limited. In response to this evolving landscape, Sirmon et al. (2011) introduced the resource orchestration theory, which proffers a more dynamic framework for enterprise resource management. This theory concentrates on the methodologies by which organizations effectively organize, amalgamate, safeguard, and redeploy resources to navigate and capitalize on external environmental fluxes (Sirmon et al., 2011; Xuemei & Yuhang, 2022).

Resource orchestration theory bifurcates into three principal processes: resource structuring, resource bundling, and resource leveraging. Resource structuring encompasses the methodologies through which enterprises amass or

procure necessary resources, achieved via methods like acquisition, accumulation, and divestment. Resource bundling refers to the process by which organizations synthesize individual resources into combinations or capabilities that are valuable, scarce, and challenging to replicate, encompassing strategies of stabilization, enrichment, and innovation. Resource leveraging, meanwhile, concentrates on optimizing the use of these bundled resources to extract maximal value, primarily through mobilization, coordination, and deployment.

In the dynamic milieu of digital entrepreneurship, enterprises are confronted not just with the rapid evolution of technology but also with fluctuating consumer demands, competitive landscapes, and regulatory frameworks. Thus, the astute management and strategic allocation of resources become paramount. Moreover, this dynamic allocation necessitates enterprises to exhibit heightened strategic acuity and executional prowess, enabling them to swiftly discern and adapt to market and technological shifts and recalibrate their resource strategies accordingly. Hence, the resource orchestration theory offers a robust theoretical scaffold for examining resource management within the domain of digital entrepreneurship.

3. Research design

3.1 Research methods

This manuscript employs a longitudinal case study methodology as its primary research approach. A longitudinal case study entails the examination of a case's evolution and transformation over an extended duration, offering scholars an in-depth comprehension of the development of a particular phenomenon or event

(Saratchandra, Shrestha, & Murray, 2022; Street & Ward, 2012). The merit of this approach lies in its temporal depth, which permits researchers to chronicle and scrutinize the evolution and dynamic processes of specific phenomena (Changbao, Zhihong, Runhui, Lingling, & Yanfang, 2023).

The rationale for selecting a longitudinal case study for this research is multifaceted: Firstly, it enables dynamic analysis. The resource allocation in digital entrepreneurship is not merely a static snapshot but an ongoing, evolving process. Longitudinal case studies introduce a temporal dimension, allowing for the tracking and understanding of how entities adapt their resource allocation strategies in response to external environmental shifts over time(Xiumei & Shan, 2022). Secondly, this method unravels internal complexities. By delving deep into the organization, longitudinal studies yield rich, detailed insights into how internal factors, such as corporate strategy, structure, and culture, affect the orchestration of resources. This internal lens elucidates the manner in which digital entrepreneurs can adeptly manage their resource allocation. Lastly, longitudinal case studies offer structural coherence and depth. Relative to other research methodologies, they provide a profound and nuanced understanding of the studied phenomenon in a structured manner. They emphasize how events and decisions at different temporal junctures accumulate and interplay, thereby presenting a comprehensive and temporally continuous narrative of resource allocation dynamics.

3.2 Case selection

To thoroughly investigate the nuances of resource orchestration in digital entrepreneurship, this study selects TLY as the focal entity for analysis. The rationale for choosing this particular company as a case study is multifold: Firstly, TLY serves as a prototypical exemplar within the digital entrepreneurship landscape. Leveraging cutting-edge digital technologies and extensive big data analytics, the company strives to deliver intelligent and automated solutions for the management, maintenance, and operation of transportation infrastructures, including highways, bridges, and tunnels. As such, TLY epitomizes the quintessential characteristics of digital entrepreneurship, offering valuable practical insights and elucidating the intricate practices of digital resource arrangement. Secondly, the depth and detail provided by TLY enhance the robustness of this research. The company has afforded access to a wealth of internal data, documents, and interviews with key decision-makers. This has facilitated a comprehensive examination of its resource allocation strategies and practices, ensuring that the study is grounded in rich empirical evidence. Consequently, selecting TLY as the primary case for this investigation allows for a profound analysis of the resource orchestration process within the context of digital entrepreneurship, underpinned by concrete, real-world examples from the company's operations. Description of the data is presented in Table 1.

Table 1. Description of the data

Method of data acquisition	data description		
semi-structured interview	Interview rounds	Number of interviews	Position of the interviewees

	first round In December, 2021	4 240 Minutes	Executive Vice President, Sales Director, Technical Director, R & D Engineer
	second round In October, 2022	3 200 Minutes	Executive Vice President, Sales Director, Technical Director
	The third round In August, 2023	3 280 Minutes	Executive Vice President, Vice President of Technology, and researcher of cooperative universities
	The fourth round In September, 2023	2 120 Minutes	Executive VP and VP of Technology
field observation	2 visits (2021 and 2022)		
Internal information of the company	Company strategic planning documents, company products and patent information, and market and technology related documents		
Literature and Network information	Industry reports, research literature, news reports and online media materials		

3.3 Data analysis process

Within the data analysis phase, the research team employed systematic coding, labeling, and categorization techniques to dissect the textual data, aiming to discern and delineate prevalent concepts, interrelationships, and emergent trends. The data encompassed interview transcripts, observational records, internal corporate documents, and digital literature, each designated with the respective codes FT, GC, NB, and WL for ease of reference.

The analysis was particularly concentrated on themes pertinent to resource allocation strategies and practices within the ambit of digital entrepreneurship, seeking to isolate and interpret recurrent core themes and patterns within the data

corpus. To enhance the analytic rigor and reliability, the study utilized a triangulation verification method. This approach entailed cross-referencing information from disparate data sources, including interviews, internal company records, and network media publications, to corroborate the consistency and veracity of the findings.

In the advanced stages of analysis, the derived insights were juxtaposed with extant literature and theoretical frameworks, fostering a theoretical contextualization and interpretation of the research outcomes. To further bolster the study's accuracy and credibility, a feedback loop was instituted wherein researchers and enterprise managers were invited to review and comment on the preliminary analysis. This collaborative scrutiny culminated in the development of a tripartite coding structure, as delineated in Table 2. This structure served as a scaffold for the systematic categorization and interpretation of the data, thereby ensuring a robust and valid analytical outcome.

Table 2 Tertiary encoding structures

Polymerization dimension	Second order theme	First order concept
Resource Structuring	Acquisitive Resource Structuring	Get data resources
		Investigate market demand
		Participate in entrepreneurship competitions
		Enter the science and technology park
		Purchase of university patented technology
	Accumulated Resource Structuring	Apply for scientific research and innovation projects
		Develop digital technology
		Cultivate talent team
		Develop digital products
	Divest Resource Structuring	Design the solution
		Update and iterate on the products

Resource Bundling	Stablization Resource Bundling	Participate in technology research and development to lay the technical foundation of the project
		Obtain stable technology and talent support
		Maintain the technology leadership position
	Enrich Resource Bundling	Enrich the contact with external investors
		Conduct product development and market validation
		Provide multiple solutions
	Pioneering Resource Bundling	Identify the opportunities and challenges
		Integrated solution
		Data product development for future situations
Resource Leveraging	Mobilization Resource Leveraging	Determine the market positioning based on digital technology
		Ensure the professionalism and advancement of the product
		Business transformation and enterprise brand building
	Coordination Resource Leveraging	Docking between the market and universities
		Ensure high coordination of technology and market
		Multi-scenario solution
	Deployed Resource Leveraging	Start-up project landing
		Product validation and iteration
		Realize large-scale application and commercialization

4. Case description

TLY is primarily engaged in road data collection and operations, providing digital services for the integrated vehicle-road system. In collaboration with TJ University, the company has established the Transportation Infrastructure Digital Research Center, pioneering the development of core technology for lightweight road data collection. This initiative has led to the creation of a suite of equipment, algorithms, and platform products, spearheading the digital transformation of transportation infrastructure operation and maintenance through high-frequency, multi-dimensional lightweight detection. Utilizing advanced digital technology and big data analytics, TLY offers intelligent and automated solutions for the management, maintenance, and operation of transportation infrastructures like

highways, bridges, and tunnels, aiming for comprehensive, intelligent road maintenance that enhances safety and driving comfort.

The research traces the digital entrepreneurship journey of TLY through three primary stages:

1. **Market Insight, Technology Development, and Entrepreneurship Planning (2016-2019):** Prior to its formal establishment, TLY's founders, as core members of TJ University's road testing research team, engaged in profound market and technological explorations. They identified a critical market need for an efficient, cost-effective road quality rapid detection system, as traditional methods were labor-intensive or prohibitively expensive. The team's innovative lightweight road data acquisition technology garnered significant recognition and awards in national competitions, propelling the conceptualization of its commercialization and the strategic planning for TLY's future development.

2. **Product Development and Enterprise Incubation (2019-2021):** With a clear understanding of market needs and technological capabilities, TLY's founding team initiated the commercial transformation of their technology. They acquired the core patent technology from TJ University and established the company, with the leading professor becoming TLY's chief scientist. Stationed at TJ University's Science and Technology Park, TLY began transforming its research into practical applications. The company developed a high-frequency, multi-dimensional, low-consumption lightweight intelligent patrol system, integrating cutting-edge

technologies such as machine vision and AI for comprehensive road assessment capabilities.

3. ****Achievement Transformation and Scale Application (2021-to date):****

The successful implementation and commercialization of TLY's integrated road testing solutions marked a significant milestone. The company continued to refine its offerings based on market feedback, integrating additional technologies to construct a comprehensive digital perception system for road infrastructure. TLY expanded the application of its solutions to various scenarios, collaborating with a diverse range of partners to deepen the practical use of its technologies. The company's products and solutions have been implemented in multiple regions, becoming benchmarks for intelligent infrastructure management and contributing both economic and social benefits while actively exploring further industrial applications.

5. Case analysis

Employing the theoretical construct of resource orchestration, this study undertakes a case analysis focusing on the methodologies of structuring, bundling, and leveraging resources throughout the digital entrepreneurship process. Through meticulous analysis of the gathered data, this paper delineates the resource orchestration framework pertinent to digital entrepreneurship, as illustrated in Figure 1.

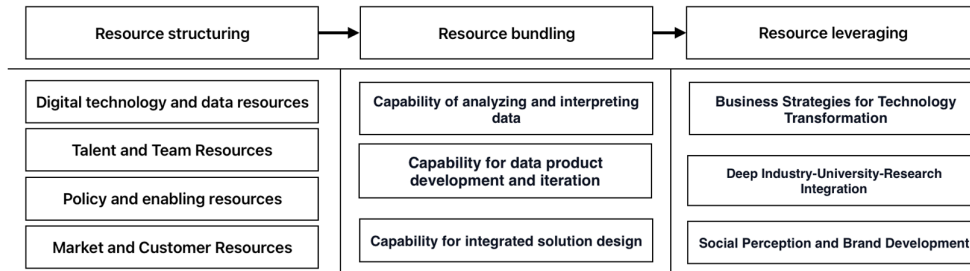


Figure 1 The resource orchestration framework of TLY

The resource structuring phase encompasses an array of elements: digital technologies and data resources, which form the technological backbone; human capital and team resources, which drive innovation and execution; policy and support mechanisms, which provide the necessary operational and regulatory frameworks; and market and user insights, which ensure that the solutions are tailored and responsive to real-world needs and opportunities. In the resource bundling phase, the aforementioned elements are synthesized into a cohesive, strategic asset. This involves the integration of digital technologies with data analytics capabilities, transforming raw data into valuable insights, products, and services. It's a critical step where discrete resources are combined to create unique capabilities and solutions that are difficult for competitors to replicate. Finally, in the leveraging phase, the bundled resources are strategically deployed to achieve business objectives. This includes the implementation of robust business strategies, fostering deep industry-academic partnerships to drive innovation, enhancing social recognition, and building a strong brand. Together, these efforts culminate in a competitive advantage for the enterprise, positioning it to capitalize on digital entrepreneurship opportunities effectively.

5.1 Resource structuring strategy of TLY

This study conducts an analytical exploration of resource structuring within the realm of digital entrepreneurship, culminating in the formulation of a resource structuring trajectory as depicted in Figure 2. This trajectory delineates the various stages of digital entrepreneurship along the abscissa, while the ordinate represents the modes of resource structuring. Illustrative examples substantiating this model are presented in Table 3. Within the theoretical framework of resource orchestration, resource structuring is predominantly stratified into three strategic categories: acquisition (Acquire), accumulation (Accumulate), and divestment (Divest).

An examination of TLY's entrepreneurial journey reveals the manifestation of these three strategic approaches within its resource allocation practices. Data acquisition, a pivotal element, is consistently evident across the various stages of TLY's digital entrepreneurship. During the technology development phase, comprehensive data analysis is employed to ascertain the reliability of new technologies, discern potential technical hurdles, and identify optimal solutions. As the technology matures and product development advances, data reassumes a central role, this time to validate the functionality and stability of the emerging products. In the service delivery phase, data transcends to become TLY's primary offering. Through the analysis of collected road data, TLY furnishes clients with critical decision-making insights regarding road maintenance needs, scheduling, and focal areas.

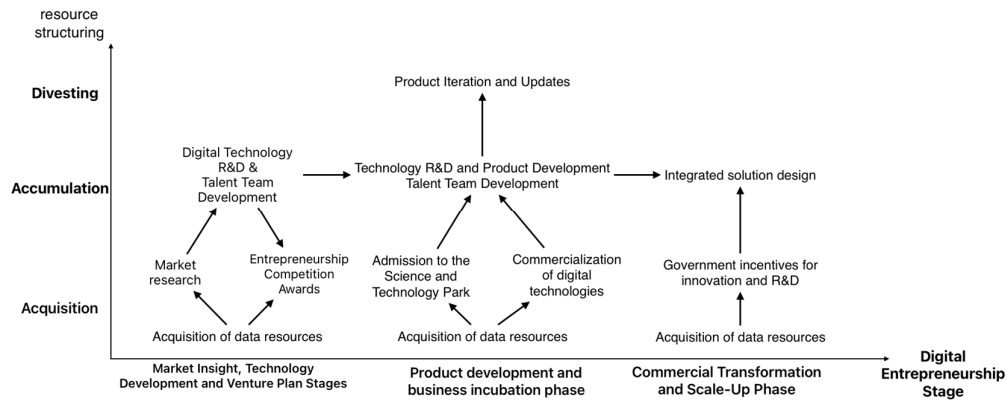


Figure 2 Resource structuring strategy in the process of TLY digital entrepreneurship

From the perspective of resource structuring theory, TLY's methodical acquisition and utilization of data epitomize acquired resource structuring. The company harnesses its road data collection infrastructure to acquire pertinent data during both technology R&D and market service provision phases. The case of TLY distinctly illustrates the unique value proposition of data in digital enterprises compared to traditional entities. In the digital entrepreneurship ecosystem, data is not merely a resource but also the principal product offering of the company. Thus, the firm is tasked with the dual imperative of leveraging data to facilitate technology R&D while concurrently offering data as its main product form to the market. This dual role underscores the centrality of data as both a resource and a product in the digital entrepreneurial landscape.

Table 3 Typical evidence is cited in the resource structuring stage

Dimension	Theme	Concept identification	Some of the typical data
Resource Structuring	Acquisitive Resource	Get data resources	With TLY attaches great importance to data resources and related technologies to improve the reliability of

	Structuring		data collection.
		Research the market demand	In line with the customer-centered service concept, we are committed to the digitalization of road infrastructure and intelligent maintenance services, and promote the comprehensive inspection and coverage of different diseases of various grades of highways and roads.
		Participate in competitions and meetings	Actively participating in well-known entrepreneurship competitions not only demonstrates our innovation ability, but also helps us reach potential investors and partners.
		Enter the science and technology park	After entering the park, the science and technology park opened up a shared laboratory to help enterprises carry out business and data analysis.
		Purchase of university patented technology	We work deeply with the top universities in China to purchase and introduce their latest research results and patented technologies to maintain the frontier of the technology.
		Apply for scientific research and innovation projects	Whenever there is a suitable national or local scientific research project, we will actively declare it, expecting to further promote the research and development work through project funding and technical support.
		Accumulated Resource Structuring	Develop digital technology
	Cultivate talent team		We firmly believe that talent is the most valuable resource, and we will jointly cultivate talents with TLY and TJ University.
	Develop digital products		In the process of product development, we always put the project in the first place, to ensure that each product can meet the actual needs of users.
	Design the solution		In the process of practice, the product has been continuously optimized. Through the high-frequency and multi-dimensional data collection and the all-aspect linkage of the business system, the digital-business double closed-loop solution has been realized.
	Divest Resource	Update and iterate on the	TLY has a professional solution team, which focus on providing customers with precise and effective

	Structuring	products	business strategies to solve the problems they encounter in practice.
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Throughout its entrepreneurial journey, TLY has adeptly acquired external resource support through a variety of avenues, including participation in entrepreneurship competitions, industry conferences, establishment in technology parks, and applications for governmental scientific research and innovation grants. Engaging in entrepreneurship competitions and industry conferences has been instrumental for TLY, not only elevating its market and public visibility but also facilitating crucial interactions with investors and industry experts. Settling in a technology park has provided TLY with comprehensive resource support, offering state-of-the-art facilities, a conducive research and development environment, and an array of entrepreneurial services, all of which are pivotal for TLY's technological and product development. Access to government-funded scientific research and innovation grants has furnished essential financial backing, particularly during early stages of financial constraint, simultaneously enhancing TLY's market and industry credibility.

In the evolution of the enterprise, the strategy of cumulative resource structuring has been crucial across various domains, including technology research and development, product evolution, solution design, and talent cultivation. TLY has consistently allocated human and financial resources to not only meet immediate technological demands but also to invest in long-term technological development. Through ongoing market engagement and user feedback, TLY has ensured its products remain responsive to market shifts and demands. The

accumulation of human resources, through recruitment and strategic academia-industry collaborations, has formed a robust pillar supporting the company's growth. Presently, the company boasts a substantial team with a significant proportion dedicated to R&D, many of whom are recipients of provincial and ministerial science and technology awards. Additionally, TLY benefits from the intellectual support of leading experts and professors from TJ University.

Moreover, TLY employs a divestment strategy in its resource structuring, continually iterating and innovating its products to maintain a technological edge in the industry. As a provider of road data collection, operation, and digital services, TLY recognizes the intrinsic value of data in its entrepreneurial trajectory. Digital technology and data transcend mere supportive tools, evolving into core components of the enterprise's competitive advantage, transforming into strategic resources and assets. In contrast to traditional enterprises that depend on internally accumulated data through digital transformation, digital startups like TLY have the inherent capability to collect and synthesize external data from inception. This capability to effectively integrate and analyze external data can significantly enhance enterprise value and transform it into a pivotal asset, offering a unique competitive edge.

Consequently, this paper posits the following proposition:

****Proposition 1:**** Within the digital entrepreneurship landscape, digital technology and data have emerged as pivotal resources and strategic assets for

enterprises. Contrary to the gradual accumulation of data resources through the digital transformation process, in the digital entrepreneurship context, externally collected data, when legally compliant and algorithmically processed and analyzed, can be transformed into valuable enterprise resources and assets.

5.2 Formation of resource bundling strategy and capability with TLY

Integrating insights from digital entrepreneurship and resource bundling theory, this paper formulates a model for TLY's resource bundling strategy, as illustrated in Figure 3, with supporting evidence presented in Table 4. Within the framework of resource orchestration, resource bundling strategies are categorized into three types: maintenance, enrichment, and innovation.

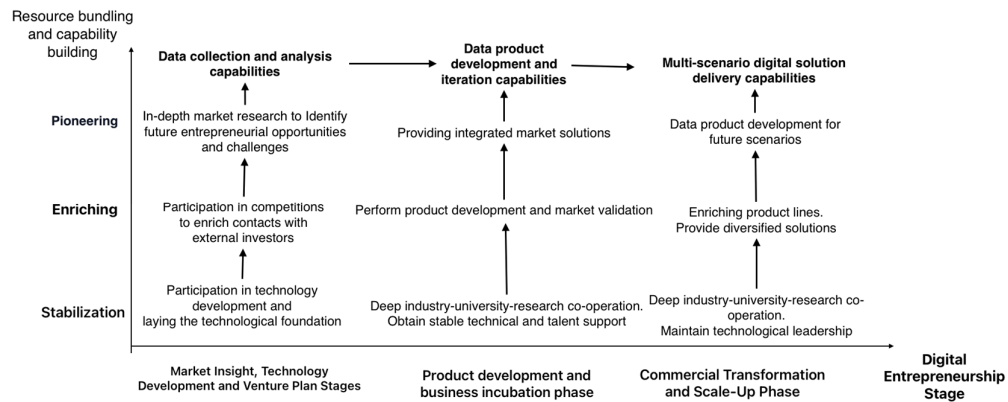


Figure 3 Resource bundling strategy with TLY

TLY adeptly employs these strategies to synergize various resources, thereby enhancing its data capabilities. The maintenance resource bundling strategy emphasizes optimizing and fortifying existing resources. During TLY's entrepreneurial journey, the company's founder, as a key member of a university technical team, played a pivotal role in technology R&D. The acquisition of core

patented technologies and deep collaborations with academia and research institutions have provided a robust technical foundation for TLY's product and service development. This sustained partnership with academia ensures a continual influx of cutting-edge technical knowledge and R&D outputs, maintaining TLY's technological leadership. This collaboration not only furnishes TLY with technical support but also amplifies its existing technical capacities, bolstering its market competitiveness.

Notably, TLY transcends the confines of specific technological domains. It harnesses complementary technologies like the Internet of Things and cloud computing, allowing for a multi-dimensional expansion of its products and services. Particularly noteworthy is TLY's integration of digital technology to create a comprehensive service process—from data collection and analysis to product transformation for customers—establishing an interconnected business ecosystem. Leveraging its rich resources and technical prowess, TLY has successfully ventured into diverse application scenarios, including urban, rural, and expressway settings. These efforts, coupled with academic research and field studies, have deepened TLY's engagement with end users, unveiling new market opportunities and fostering valuable trust and collaboration.

From TLY's entrepreneurial perspective, its evolving resource bundling strategy continually augments the company's data capabilities, advancing from initial data analysis proficiency to the development of data products and comprehensive data solution design. Deep market research and extensive

academia-industry collaboration have propelled the company from a data analysis startup to a leader in integrated road data solutions.

In the digital entrepreneurship landscape, TLY distinctly identifies data as its core product and meticulously crafts its resource bundling strategy to augment data capabilities. Through robust university collaborations, ongoing technological R&D, and insightful market analysis, TLY has developed an integrated data service capability, encompassing data collection, analysis, and the creation of high-value data products. This approach not only solidifies TLY's technological leadership but also cultivates profound market relationships, securing a formidable competitive stance in digital entrepreneurship.

In summary, this paper presents the following proposition:

****Proposition 2:**** In the context of digital entrepreneurship where data is the core product, an enterprise's resource bundling strategy is instrumental in cultivating comprehensive data capabilities. This includes capabilities in data collection and analysis, data product development, and integrated data services. This strategy ensures not just technological leadership but also a strong market presence and competitive advantage.

Table 4 Some typical evidence is cited for the resource bundling stage

Dimension	Theme	Concept identification	Some of the typical data
Resource Bundling	Stablization Resource Bundling	Participate in technology research and development to lay the technical	As a core member of the technical team of the university, the founder of TLY personally participated in the technology research and development, which provided a solid technical cornerstone for the whole project and ensured the forward-looking and practicality of the technology

		foundation of the project	direction.
		Obtain stable technology and talent support	We have established in-depth cooperation with TJ University to ensure a sustained and stable technology research and development and talent inflow, and form a benign ecology of technology and innovation.
		Maintain the technology leadership position	Through continuous technical research and update, TLY always stands in the forefront of the industry to ensure that it always maintains a leading position in the technical field.
	Enrich Resource Bundling	Enrich the contact with external investors	In order to achieve strategic expansion and capital operation, we actively connect with external investors and seek strategic cooperation and investment opportunities.
		Conduct product development and market validation	TLYyun pays attention to market orientation, not only fully considers the market demand in the product development stage, but also carries out market verification after the product launch to ensure that the product is highly compatible with the market demand.
		Provide multiple solutions	We do not simply provide products, but provide diversified solutions to meet the diverse needs of all types of customers.
	Pioneering Resource Bundling	Identify the opportunities and challenges	In the face of market changes, TLY always keenly identifies opportunities and challenges to ensure that the company always keeps pace with The Times.
		Integrated solution	Our integrated solution ensures that customers have the best experience and value in data collection, analysis, and application.
		Data product development for future situations	TLY insists on the research and development of data products for future situations to meet the changing market needs and technological trends.

5.3 The resource leverage strategy of TLY

In the realm of resource leverage, enterprises are tasked with effectively mobilizing, coordinating, and deploying their resources to achieve strategic objectives and secure competitive advantages. This study, in conjunction with the entrepreneurial trajectory of TLY, formulates a model for the resource leverage

strategy within digital entrepreneurship, as depicted in Figure 4. Illustrative examples of the resource leverage phase are presented in Table 5.

In mobilizing resources, TLY has engaged in profound industry-academia collaboration with TJ University, fully harnessing the resources and strengths of both entities. This partnership has facilitated TLY's access to the research and development capabilities and avant-garde technologies from the academic realm, while simultaneously providing the academic community with exposure to real-market environments and demands. Such a mode of cooperation has enabled the mobilization of more extensive and profound resources, expediting the process of technological R&D and market application. Furthermore, TLY's engagements with various stakeholders have not only established a commendable reputation in industry and academia but have also been instrumental in crafting its distinct brand image.

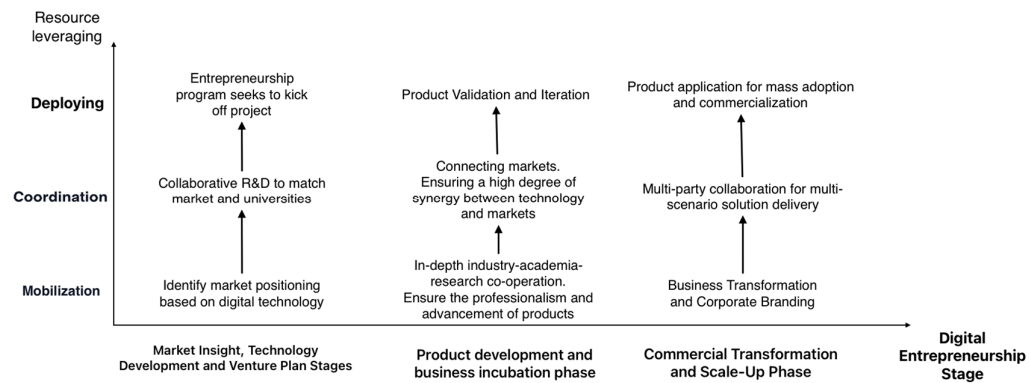


Figure 4 Resource leveraging strategy of land cloud resources

Table 5 Some typical evidence of the resource leverage stage is cited

Dimension	Theme	Concept	Some of the typical data
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		identification	
Resource Leveraging	Mobilization Resource Leveraging	Determine the market positioning based on digital technology	With the help of the advanced and extensive application of digital technology, the has accurately determined the market positioning to meet the needs of customers in specific fields.
		Ensure the professionalism and advancement of the product	We continue to focus on the cutting-edge technology, ensure that the products provided by TLY maintain a professional and leading position in the industry, and meet customers' expectations for high quality products.
		Business transformation and enterprise brand building	In the process of business transformation, we not only focus on products and technologies, but also are committed to the building and promotion of TLY brand, so as to establish a good reputation in the industry.
	Coordination Resource Leveraging	Docking between the market and universities	TLY actively connects with the market and universities, building a bridge to transform academic research into practical application, so as to accelerate the marketization of technology.
		Ensure high coordination of technology and market	We emphasize a high degree of synergy between technology and market, ensure that the direction of research and development is consistent with market demand, and avoid the disconnect between technology and market.
		Multi-scenario solution	By developing solutions for different scenarios, I have met the diversified needs of various customers and market environments.
	Deployed Resource Leveraging	Start-up project landing	Our entrepreneurial projects not only stop at concept and design, but also ensure that they are actually implemented to create real value for our customers.
		Product validation and iteration	After the product is put on the market, we continue to pay attention to its actual performance, and verify and iterate the product based on the feedback to provide a more complete solution.
		Realize large-scale application and commercialization	Through continuous optimization and upgrading, TLY has successfully realized the large-scale application and commercialization of its products, and provided high-quality data services for a large number of customers.

Coordinated resource leverage focuses on the organic amalgamation and synergistic efficacy of multiple resources through effective coordination and integration. From this perspective, the collaboration between TLY and universities has also facilitated the cultivation and attraction of more technical talent. The partnership extends beyond technological cooperation, ensuring continual innovation and technological advancement for the company and enhancing the synergistic effect of resources. It ensures that scientific research outcomes are not confined to publications and laboratories but are effectively translated into tangible products and solutions, realizing their commercial value.

Deployed resource leverage is about applying existing resources to new scenarios or markets to optimize benefits. For TLY, this is exemplified in the implementation of its business transformation strategy. TLY's systematic and insightful interpretation of market demands ensures a high degree of coordination between its technology R&D and market trends. Through deep customer engagement and detailed market research, TLY not only addresses current market needs but also anticipates and shapes future industry trends. This forward-looking approach in product innovation secures a competitive edge and creates ample opportunities for large-scale application of its products.

Considering TLY's resource leverage strategy within the fast-paced and evolving technological environment, it becomes evident that resource leverage in digital entrepreneurship differs from traditional industries. TLY's entrepreneurial practices demonstrate that deep industry-academia collaboration provides a solid

foundation for technological R&D and ensures alignment between the direction of technological development and market demand. Thus, this paper proposes the following:

****Proposition 3:**** In the digital entrepreneurship context, in-depth industry-academia collaboration to ensure a high congruence between technology R&D and market demand has emerged as a crucial strategy for resource leverage. This approach not only provides continual technical support for digital startups but also ensures they maintain a competitive advantage in the midst of intense market competition.

6. Conclusion and Discussion

6.1 Research Conclusions

To elucidate the resource orchestration strategy in digital entrepreneurship, this study employed a case study methodology, focusing on TLY to derive insights into the practices and strategies of resource orchestration. The key findings of this research are as follows: (1) The digital entrepreneurship journey of TLY is distilled into three primary stages: initial market insight, technology R&D, and business planning; the developmental phase of product innovation and corporate incubation; and the final stage of achievement transformation and large-scale application. (2) Utilizing the theoretical framework of resource orchestration, this study presents a detailed case analysis on the construction, bundling, and leveraging of resources in digital entrepreneurship. It emphasizes the importance of digital technology, data resources, talent, policy support, and market understanding. It also underscores the

role of data analysis, product development, and strategic partnerships in cultivating enterprise competitiveness. (3) Integrating insights from the digital entrepreneurship trajectory of TLY and resource orchestration theory, the study posits that in the digital entrepreneurship context, data emerges as a new type of asset. Building data capabilities becomes crucial for resource bundling, and fostering industry-academia collaboration is identified as a key strategy for leveraging resources and sustaining competitive advantages.

6.2 Theoretical Contribution

This in-depth case study provides a novel theoretical framework and practical insights for understanding the resource orchestration strategy in digital entrepreneurship. It contributes to the intersectional research on digital entrepreneurship and resource orchestration theory, offering valuable references for future scholars and practitioners. The theoretical contributions of this study are as follows: (1) Contrasting with prior research on the elements and mechanisms of digital entrepreneurship, this paper offers a fresh perspective on its dynamic process(Xiumei et al., 2020). It conceptualizes the digital entrepreneurship journey into three distinct, dynamic stages, providing clearer guidance for researchers and a systematic reference framework for further study. (2) Grounded in resource orchestration theory(Sirmon et al., 2011), this paper delves into the distinctiveness of digital entrepreneurship, presenting a comprehensive empirical discussion. It highlights the differences from traditional entrepreneurial resource allocation strategies and elucidates the unique resource bundling and leveraging strategies

inherent to digital entrepreneurship, thus broadening the application of resource orchestration theory in emerging domains. (3) Recognizing the escalating significance of data in modern enterprises, this research identifies it as a core asset in the digital entrepreneurship process. It delineates how, unlike traditional enterprises that accumulate data through digital transformation, legally obtained external data can be treated as an asset (Tao, Jianxin, Caixia, & Yongjiang., 2022). Through empirical cases, the paper underscores the pivotal role of data in resource bundling and proposes data capability as the driving force in the resource bundling process within digital entrepreneurship.

6.3 Management implication

This study offers significant insights for digital startups on how to construct, orchestrate, and leverage organizational resources effectively: (1) Consider Data as Core Assets: In the digital era, data transcends a mere information carrier to become a vital enterprise asset. Organizations should prioritize data, harnessing its value in decision-making, innovation, and competitive strategies. This entails a sustained investment in enhancing data collection, storage, and analysis capabilities. (2) Strengthen Collaboration with Academic Institutions: Partnerships with academia can yield cutting-edge technological insights, R&D outcomes, and a pipeline of high-quality talent. By forging stable collaborations with academic entities, enterprises can stay abreast of industry trends, expedite the transformation of research findings into practical applications, and cultivate essential technical expertise. (3) Adopt a Flexible Resource Orchestration Strategy: Digital

entrepreneurship necessitates a nimble and responsive resource orchestration approach to adapt to the evolving market and technological landscapes. Companies should continually reassess and reconfigure their resources in alignment with their core competencies and market positioning to navigate external challenges effectively. Close integration of technology R&D and market application is crucial; enterprises must remain vigilant to market shifts and user needs, ensuring their products and services resonate with market demands.

6.4 Limitations and Future Research Prospects

Despite providing an in-depth exploration of digital entrepreneurship and resource orchestration, this research has limitations that pave the way for future scholarly pursuits. (1) Case Study Specificity: This study predominantly focuses on TLY's case, which, while insightful, may not fully encapsulate the diverse entrepreneurial backgrounds, environments, and strategies across different enterprises. Future research should broaden the sample scope to include a variety of industries, cultures, and geographical contexts to enhance the generalizability and applicability of the findings. (2) Beyond Resource Orchestration: While this paper centers on TLY's resource orchestration strategy, it's important to note that resource orchestration is influenced by various internal factors such as organizational structure, culture, and leadership. Future studies could delve into how these internal dynamics interact with resource orchestration and how they are influenced by external environmental factors. (3) Integration with Other Theoretical Frameworks: The study primarily draws from resource orchestration theory. Future research

could integrate additional theoretical perspectives, such as entrepreneurial ecosystem theory, network theory, or innovation diffusion theory, to enrich the understanding of digital entrepreneurship. (4) Navigating Future Challenges: As technology and digitization continue to evolve, so too will the entrepreneurial landscape. For digital enterprises like TLY, understanding how to navigate the challenges and opportunities presented by rapid technological advancement, and how to foster continuous innovation and self-renewal, are crucial areas for future inquiry.

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