

Research on the Path of Digital Capacity Building of Small and Medium-sized Enterprises in Smart Government Environment

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Abstract

Nowadays, smart government, as an important practice of public governance modernization, is building a new type of government-enterprise interaction ecology with data sharing, intelligent decision-making and precise service as the core. As capillaries of the national economy, SMEs' digitalization ability not only concerns their own survival and development, but also affects the overall resilience of the industry chain. However, most SMEs have significant shortcomings in technical reserves, capital investment and strategic planning, and traditional support policies are difficult to accurately match their transformation needs. Smart government provides new possibilities for SMEs to break through the resource shackles by building an open data platform, optimizing the policy supply model and strengthening the digital infrastructure. Against this backdrop, exploring the digital capacity building path of government-enterprise collaboration is not only the key to unleash the innovation potential of SMEs, but also the core proposition for realizing the inclusive growth of the digital economy.

Keywords

smart government, small and medium enterprises, digital capacity building

1. Introduction

As the wave of digital transformation sweeps across the world, small and medium-sized enterprises (SMEs) are under double stress from technology iteration and market restructuring. By reconfiguring the logic for government services and changing the policy tools from the previous unidirectional supply to a new dimension of bi-directional empowerment, the area of developing smart government has constructed a “buffer zone” and “gas pedal” for SMEs to address the digital transformation. Recent literature has tended to cover either macro-policies or the single technology dimension without addressing the more in-depth mechanisms for the co-constructing aspect of government-enterprise capability. Small and medium-sized enterprises (SMEs) are often at risk of falling into the dilemma of “not daring to turn or not knowing how to turn” due to cognitive biases and resource constraints in the complexities of operating their enterprises. During this time, the platformed-oriented governance model of the smart government should provide a new method of connecting enterprise demands and public services. This paper will expose the synergistic

evolution of the smart government and SMEs digitalization capability through this tension, and systematically provide a solution for the transformation crisis (Fähndrich & Pedell, 2024).

2. Analysis of the Impact of Smart Government Environment on Digital Capacity Building of SMEs

The intelligent government environment has a deep impact on the evolution of SMEs' digital capabilities through the change of the logic of government-enterprises interaction. The data-driven governance model has eliminated administrative silos and tailored SMEs to access high-value information related to policy changes, industry developments and market needs in real-time in a manner that shortens the decision response cycle. The open government service platform facilitates enterprises' access to public sector resources and reduces transaction costs associated with the two sectors connecting, while also creating new business models such as supply chain collaboration and cross-regional partnerships. The intelligent policy matching function has transformed traditional stimulus programs providing ad hoc fiscal and tax incentives, technology and talent subsidy programs, into targeted, drip irrigation digital alternatives for SMEs to navigate the resource allocation and ownership landscape. Consequently, this shift has compelled enterprises to reassess the strategic value associated with achieving progress in their digital transformation process. Some leading enterprises have successfully accomplished reengineering of their business processes utilizing the cloud services infrastructure provided by the government, but many SMEs are still reluctant to engage with the public digital ecosystem due to concerns surrounding data security and inadequate capabilities to digest new technologies (Sima et al., 2024). This contradiction reflects the gap between the construction of smart government and the actual needs of enterprises, which not only tests the degree of refinement of policy tools, but also exposes the cognitive gap between traditional industrial thinking and modern digital governance paradigm.

3. Problems in the Digital Capacity Building of SMEs

3.1 Insufficient Awareness of Digital Transformation

The difficulties faced by SMEs in terms of their lack of awareness of digital transformation come from several cognitive fault lines. The management only appreciates the role of digitalization to the point of substituting tools that can be better digitally, and does not elevate the understanding to enterprise strategic restructuring and fragmentation of resource allocation. Some enterprises in traditional industries have the concept of path dependence with the value of digitalization being a ritual of cost consumption than value creation and wanting to keep decisions around the same production model. The operational inertia of grassroots employees makes this even worse, with the use of inefficient work such as ledgers and manual statistics, all of which are deeply ingrained into the culture of the organization, creates a micro-barrier to digital transformation. This cognitive bias is further exacerbated in the family business sector, where decision makers are prone to overly rely on empirical judgment and consequently have an inherent wariness of a data-driven management revolution. The stark differences in the digitalization process amongst industries further contributes to the wait-and-see mentality, and manufacturing firms on the tail end of the industry chain are often misdiagnosing the urgency of their own transformation, therefore missing the policy dividend window. Consciousness lag directly triggered by slow action, some enterprises even if the purchase of intelligent equipment is only used for image display, failed to open the data collection, analysis and decision-making optimization of the closed loop, and ultimately fell into the “equipment intelligence, management mechanization” of the transformation of the trap (Li & Pang, 2023).

3.2 Limited Capital Investment

The financial challenges experienced by small and medium-sized enterprises as they operate on a digital transformation trail are indicative of the structural contradictions as part of the economic ecology of society. The relationship between very low profit margins versus high costs to undergo a transformation is quite stark, if not impossible, and most companies are forced to constrain their digitization budgets under the pressures for survival. This clash is made worse due to the inability to access capital in all its types and forms. Existing

traditional credit evaluation systems can barely qualify the potential for long term value for a company for any one of the many digitization projects they participate in, aside from the characteristic of asset-light operations itself that simply by nature of operation rules a company out of traditional financing service. Then we have hidden costs, also as hidden costs added to the expense of hardware and software, the cost of introducing talent, and the every increasing unknown cost of system maintenance that causes the compound pressure. Some companies decide to simply procure various solutions in a piecemeal fashion to get at some kind of resolution of surface lying pain points; and then as expected are often again compensating for their weak link due to the lack of systems working together with one another. There is also some disparity between the operational mode of most SMEs and the declaration threshold of stated policy subsidies, or even special funding basically take a long time for approval, and there are always stipulations placed on the eventual outcome anyway, which would not be sufficient to produce a sustainable support in any aspect of whatever is desired to take place. This funding dilemma has given rise to the deformed state of “semi-digitalization”, where enterprises are neither able to return to the traditional model nor complete in-depth transformation, and consume limited resources in the fault zone of equipment renewal and data governance. The lack of a medium- and long-term assessment mechanism for the value of digitization by financial institutions has further magnified the distortionary effect of market resource allocation.

3.3 Weak Technological Innovation Capability

Several capacity shortcomings are the cause of the weak position of SMEs in technological innovation. First, without a core R&D team, it is challenging for enterprises to create a technology framework that is independent, and many enterprises rely on the introduction of external technology without the ability to digest and absorb that technology which leads to a long-term separation between system deployment and business scenarios. Second, restricted R&D budgets forces businesses to think in terms of “off-the-shelf” solutions, and, in turn, these standardized products can never be flexible in meeting the uniqueness of sector specific needs. This leads to the observation of the phenomenon “technological levitation.” Third, the weakness of technology accumulation is revealed in the context of industry chain collaboration; again, the frequent incompatibility challenges between the data interfaces of upstream suppliers and the smart devices of downstream customers adds to the marginal costs of technology applications. The discrepancy between the fast-evolving digital technology and the slow pace of organizational change has left some businesses with cutting-edge technology but stuck on operations and maintenance, and the technological dividend has not yet been converted into true value. This structural inadequacy in capabilities to innovate is notably serious in strategic areas such as industrial software and intelligent algorithms, and businesses are locked into a vicious wheel of “buying - lagging - buying again”, with deep technological dependence eroding their ability to effectively compete in the market. The lack of patent protection awareness continues to hinder innovation, and some companies opt to imitate technology to eliminate R&D risk, while they become stuck in the mire of homogenized competition (Zhang, 2022).

3.4 Lack of Effective Digitalization Construction Planning

An unstructured digital construction of SMEs has created multiple development conflicts. The short-sightedness of strategic planning practices add to the random nature of avoidance of technology deployment decisions – organizations purchase technology equipment only to discover that in the purchasing process the technology will form “system silos.” Decision maker's perspectives regarding technology and digitization are still limited to only module transformation, without a cosmopolitan view to upgrade production processes, organizational structural to governance of data. The lack of operational systematic planning takes shape when we examine the internal and external cross-department collaboration. On the sales side the customer management system and on the production side the enterprise resource planning (ERP) have been separated for along term leading to challenges realizing the value of data assets. A number of organizations engage in planning programs, however; because of the lack of real business need the plan becomes marketing plans for display without unnecessary technologies with time lag to the pace of market changes. The fragility of the organizations planning capability is especially evident when interfacing with the various levels of government intelligence platforms, many organizations miss the opportunity of fused public data resources through lack of data standards and interface design reserving. Businesses in traditional sectors do

occasionally fall into a state of passive transformation of “fixing the head when there is a headache” that may mistake digitization for merely connecting equipment to a network to increase access to data, but do not build a digital thread across the entire supply chain. This dilemma surrounding planning problems and planning inertia is intensified specifically within family-owned businesses, where managers have a tendency to rely too much on their subjective views of technological processes, and empirical testing often leads to declining technology directions recommended by professional consulting firms. The absence of planning has left some alma maters to duplicate resources, and the digital technology used by other businesses is essentially electronic scrap metal simply because the enterprise's top-level decisions were not thought out.

4. Path Construction of SME Digital Capacity Building in Smart Government Environment

4.1 Policy Guidance and Resource Support Path

The foundation of enhancing the digital capacity of SMEs in a smart government context is the effective combination of policy instruments and market resources. The government must establish a tiered and classified policy framework, and identify different support plans according to different industry characteristics and lifecycle of enterprise, otherwise the “one size fits all” policies will create a misallocation of resources. A subsidy approach will no longer work, so a dedicated fund pool must be created, and there must be a combination of “subsidies for infrastructure performance incentive” supporting the construction of data centers and transformations of core business systems. To enable greater access to finance, the government must work collaboratively with the market mechanism to address the anxiety of financing for enterprises, thereby developing, widgets to allow the creation of special credit products for digitization, while also exploring innovative modes of financing through property pledges to solve the guarantee problems of light-asset enterprises “making the business case”. Enhancements to tax incentives need to focus on the deduction of R&D expenses and the pooling of technology introduction costs, and a dynamic adjustment mechanism that will accommodate the development of rapidly iterating digital technologies. It is emphasized that public digital infrastructure will be important in an open-sharing context, and the smart government platform can provide enterprises with standardized data interface and common technology modules which will help reduce the threshold of SMEs' underlying technology development. A government-enterprise linked digital talent training system should be established, relying on industrial parks to establish a “technology consulting officer” system among SMEs, and then operationalizing the technology roadmap from policy dividends. The maturity of digital transformation should be regularly assessed, and after such assessments, a closed loop management system of “diagnosis-improvement-verification” should be established to ensure that any support resources actually translates into endogenous enterprise capabilities. This three-dimensional policy structure must break through department barriers, and provide targeted openness of cross-level government data within the construct of data security; this allows for real-time and reliable public data support for enterprises' digital decision-making capabilities (Harris et al., 2024).

4.2 Data Sharing and Platform Empowerment Path

The data-sharing mechanism in an intelligent government environment should address the dual dilemma of “data chimneys” and “value islands.” The selective opening of the government data platform should create a dynamic authorization mechanism that allows compliant enterprises to obtain public data resources such as industry sentiment indexes and regional consumption characteristics in a safe framework, to address the pain point of SMEs not having enough intel about potential markets. Create an industry data center as a sharing hub that can consolidate fragmented data across market supervision and management, taxation, logistics, and other related departments, and convert it into standardized information products to provide enterprises with accurate representations and decision support. The platform empowerment model needs to break through the traditional technical service boundaries for enterprises of different sizes by developing a micro-service component catalog to combine common technologies (artificial intelligence, blockchain, etc.) into pluggable functional modules that reduce the technical application threshold. The absence of a mechanism for allocating data rights and interests limits the depth of sharing, thus there is a need to explore a data value assessment model based on contributions and rely on smart contract technology to achieve data rights and revenue allocation. The construction of cross-departmental data sandboxes could help to balance security and

efficiency, as companies could train algorithmic models in an isolated environment while protecting core data from leakage. Platform empowerment should also be extended to the level of industrial chain synergy, led by the government to build industrial digital maps to guide small and medium sized enterprises to access the production capacity data pool of upstream and downstream enterprises, and dynamically optimize supply chain configuration. This platform empowerment system should be supported by the construction of a digital capacity certification center to conduct a graded assessment of the level of data governance of enterprises, ensuring that the shared resources and receiving capacity can be accurately matched. Ultimately, a virtuous cycle of data flow-value creation-capacity enhancement will be formed to comprehensively transform public data resources into organic nutrients for the core competitiveness of enterprises.

4.3 Talent Cultivation and Intellectual Support Path

The break in the supply chain of digital talents is restricting the transformation process of small and medium-sized enterprises, and the construction of an intellectual support system that integrates the “education chain-industry chain-innovation chain” has become the key to breaking the deadlock. The government-led industry-teaching integration base needs to break the boundaries of traditional disciplines, develop a modular digital skills curriculum system, and allow enterprises to customize training programs according to their needs. Establish a regional digital talent sharing pool to alleviate the recruitment and retention problems of small and medium-sized enterprises, implement the “sharing engineer” system to realize cross-enterprise mobility of technical talents, and provide incentives for participating enterprises to add deduction to their R&D expenses. The vocational qualification certification system needs to be reformed, and new digital skill certifications such as intelligent manufacturing system operation and maintenance and industrial data labeling should be added to guide vocational colleges and universities to dynamically adjust the content of practical training. The construction of enterprise digital training mechanism needs policy support, the establishment of a special training fund to encourage the creation of “digital artisan studio”, the implementation of the credit bank system to accumulate employees' continuous learning achievements. The intellectual resources of universities and research institutes should be mechanized, exploring the system of “technical specialists” stationed in enterprises, and incorporating the effectiveness of scientific research results into the title evaluation system. It is especially important to build a digital leadership training system, develop digital transformation sand table simulation courses for SME managers, and improve the digital thinking and change management ability of strategic decision makers (Morelli et al., 2023). This intellectual support system needs to be embedded in the regional innovation ecosystem, and a “digital skills dojo” should be set up in industrial parks to provide practical training scenarios combining reality and reality, and help enterprises cross the talent ability fault. Eventually, a virtuous cycle of knowledge flow and capability growth will be formed, making human resources become the core kinetic energy of digital transformation.

4.4 Technology Application and Innovation Drive Path

Small and medium-sized enterprises (SMEs) face the overlapping challenges of “innovation fear” and “capability gap” at the level of technology application, and the way to crack the problem lies in building a graded technology adaptation system. Smart government-led open labs can provide a technology validation sandbox environment, allowing enterprises to test the applicability of emerging technologies such as industrial IoT and digital twins at minimal cost, reducing the risk of trial and error. Establish an industry-level technology roadmap guideline system to break down common technologies into executable technology module packages to help enterprises choose the appropriate innovation path according to their development stage. Focus on promoting the “micro-innovation” improvement model, encouraging enterprises to embed intelligent sensors in existing equipment to realize data collection, rather than blindly pursuing the transformation of fully automated production lines. The innovation of collaborative R&D mechanism is especially critical, forming a technology research consortium of “leading enterprises + scientific research institutions + small and medium-sized enterprises (SMEs)”, and the government subsidizes SMEs to participate in major special projects in the form of innovation vouchers. The improvement of technology intermediary service system needs to cultivate specialized technology brokers, and build a patent navigation platform to help enterprises identify transformable military-civilian integration technology achievements. Deepening the application of intellectual property pledge financing mode can activate the liquidity of

innovation factors, incorporate technology patent evaluation into the bank credit system, and alleviate the pressure on the R&D capital chain. Against the background of accelerated technology iteration, a dynamic technology early warning system has been established, and industry technology maturity curve reports are regularly released to assist enterprises in avoiding technology bubble traps. This innovation-driven path needs to be embedded in regional industrial innovation ecosystems, and shared technology pilot bases should be constructed in specialty industry clusters to promote the rapid diffusion and application of common technology achievements, forming a benign mutual feeding mechanism between technology application and value creation.

5. Conclusion

The digital capacity enhancement of intelligent government and small and medium-sized enterprises (SMEs) represents a mutually beneficial process of bilateral empowerment. Policy guidance is required to transcend the traditional subsidy mindset to construct an ecological web of data circulation, talent sharing, and technology dissemination. Enterprises are obliged to break free from the role of passive recipients and proactively integrate into the digital infrastructure erected by the government. Future research can further concentrate on the dynamic adaptation mechanism of the path within the context of regional disparities, along with the potential for the localization and transplantation of international experience. Only by attaining the organic integration of policy precision, technological inclusivity, and enterprise proactivity can the public value of the intelligent government be converted into perpetual impetus for the high-quality development of SMEs.

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Funding

This research received no external funding

Conflicts of Interest

The authors declare no conflict of interest.

Acknowledgment

This paper is an output of the science project.

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