# Digital Transformation Framework Inspired by Organisational Semiotics: An Analysis Based a Chinese SOE Manufacturer

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Abstract: This study examines the process of digital transformation (DT) in a Chinese state-owned enterprise (SOE) using the Organisational Onion Model (OOM) alignment framework inspired by Organisational Semiotics (OS). The research explores how alignments among technical, formal, and informal layers contribute to successful DT. It proposed an OMM alignment model and applied in a case of a Chinese SOE manufacturer, where strategic priorities initiated a top-down approach to adopt new digital systems and reengineer business processes. These changes subsequently influenced organisational culture and employee engagement. Key findings highlight the role of iterative adjustments and feedback loops in achieving alignment, emphasising the interplay between strategy, culture, technology, and process. Three propositions are proposed: alignments can occur at any stage of DT, can be led by different layers in both top-down and bottom-up directions, and are facilitated by digital champions. While the study primarily focuses on the initial stages of DT, future research is encouraged to explore complete DT journeys and identify additional elements in each organisational layer to deepen understanding of alignment dynamics and their impacts.

# 1 INTRODUCTION

Digital transformation (DT) has emerged as a critical driver of innovation and competitiveness across industries. It refers to a strategic shift inspired by new technologies within organisations to seize new opportunities in a changing environment (McAfee, 2009). For example, many businesses have adopted cloud computing to reduce operating costs by transitioning from CAPEX to OPEX, while others view generative AI as a mean to enhance service capabilities and expand their business scope (Krishna, 2024). Even traditional industries like mass manufacturing are gradually evolving their business operations with the power of digital technology. Data-driven decision making can help predict the changes in market demands in the future and guide the design of current production schedule.

However, DT is more than just a change in technology, but also achieving an alignment between technology and other non-technical aspects, such as business process. Polakova (2023) pinpoints misalignment between IT and business during the process of DT tends to be a major factor causing the failure of DT project. Thus, addressing these challenges requires a holistic approach that aligns technological advancements with organisational goals, stakeholder needs, and cultural dynamics.

Inspired by Stamper (1993) and Liu and Li (2015), Organisational Semiotics (OS), a theoretical framework rooted in the study of signs and their interpretation in organisational contexts, offers a unique perspective for tackling these challenges. OS provides valuable insights into how information flows within an organisational. Especially, organisational onion model (OOM), as an important model in OS, offers a morphological view of an organisation, conceptualises organisations as multilayered entities encompassing technical, formal and informal parts. Achieving alignment among these layers ensures coherence and sustainability in DT efforts.

As extended research of Lie et al. (2017) which pinpoints the alignment initiated from informal layer, and then extended to technical and formal layers, this research further discovers the IT-business alignment process in a context of state-own manufacturer, in order to understand the major stages and content.

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Specifically, this research will look into the alignments took place among different layers and component in the organisational context.

## 2 THEORETICAL UNDERPINNINGS: ORGANISATIONAL SEMIOTICS AND ORGANISATIONAL ONION

Organisational Semiotics (OS), as a doctrine of signs in the context of organisations, offers an inspiring perspective on understanding how information can be delivered and comprehended within organisations (Stamper, 1997). It highlights the making sense of information not only depended on the physical media, but also driven by the shared understanding, purposes and social contexts. Then OS has been applied to understand how an information system can be adapted in an organisation, especially highlighting the alignment between its technical and social systems (Liu and Li, 2015).

Organisational onion model (OOM), was derived from the OS fundamental principle of IT and social system alignment. It further contributes a comprehensive view of understanding the structure of a business organisation. As a breakthrough of traditional view of an organisation by functions e.g. organisational chart and structure, it defines an organisational as a social system and divide it to three layers by the nature of information content and communication (Stamper, 1996). The inner layer is technical layer, which refers to the hardware and software for automating business activities and facilitate communication within and between organisations. It acts a fundamental media in an organisation for exchanging information. The middle layer is formal part, which refers the written rules and procedure to guide people's behaviours within an organisation. It plays a key role to guide people's actions to make sure of technical systems for achieving the best performance. The outer layer is informal part, which refers the non-written rules in an organisation, such as strategy and values. It can shape people's behaviour and understanding on the process (Figure 1).



Figure 1: Organisational Onion with alignments (derived from Stamper, 1996 and Guo and Liu, 2023).

Inspired by Liu et al., (2016), OOM has been applied in understanding IT-business alignment, by highlighting the alignment between IT and business process tends to a key contributor to the success of DT. Business strategy also shapes this alignment in long run, where the shift on technology and process should serve the long-term objectives in business strategy. In addition, Liu et al. (2017) specifies the alignment among different layers of OOM in a topdown pattern. It underscores that DT can be led by its business strategy, and then lead to introducing new technologies and new business processes. Therefore, this research will further explore the process of alignment among three layers and then understand its sequence and focuses on each layer.

# 3 OOM ALIGNMENT MODEL FOR DIGITAL TRANSFORMATION

Based on OOM, an organisation can be viewed in three layers, including technical, formal and informal. Developed from Liu et al. (2017), the alignments can also be defined into three categories (Figure 1). Alignment 1 refers the informal-technical alignment, where strategy or organisational culture leads the introduction of new technology, and the development of new technology impulse the emergence of new business strategic focuses or new feature in organisational culture. Alignment 2 refers to informal-formal alignment, where a strategy shapes business process or the evolution of business process inspires the shift of strategic focuses. Alignment 3 refers to formal-technical alignment, where introduction of new technology improves the efficiency of business process. Alternatively, the business process might need to the restructured in order to lever the power of new technologies. Alignment 4 refers to the internal alignment within the informal layer, where the strategic focus(s) needs to align with the organisational culture. In order

words, the proposed strategic focus(s) can be recognised and accepted by the employees, and they are willing to put in practice. Specially, the alignment process can be divided into four stages.

#### 3.1 Stage One: Top-down Approach

In Figure 2, DT can be initialised a strategic focus from the top management team in a company e.g. to control operational risks by enhancing the capacity of data-driven decision making. Then the strategic initiative can trigger the purchase of new infrastructure and software for collecting, storing and analysing data, for the purposes of ensuring the available data for analysis (1). Meanwhile, the strategic focus led to the design of a new business process (2), which requires employees to input, analyse, and retrieve information on the different steps during the business process. Finally, strategic focus will can be communicated to all employees via announcement and employee training programme, in order to let them understand the business value of adapting data-driven decision making and enhance their skills to make use of data analysis software and follow the required business process (3). Overall, the first stage demonstrates a top-down approach to lead the changes on technical, formal and informal layers with a strategic focus.



Figure 2: Top-down approach to digital transformation across organisational layers.

# 3.2 Stage Two: Conflict and Compromise

In Figure 3, based on the experience of using the newly introduced system, the workable working process, referring to working process implemented in the reality, can be drifted away from the pre-defined to-be process (4). Since the to-be process was designed based on past experience and strategic focus, which might not be fully in line with the real scenario. For example, when it comes to identify

valuable customers, to-be process emphasises to assess the default risks based on the quantified financial data from customers. However, in the reality, it is also necessary to consider the customers' long-term strategy and business lifecycle in order to measure their business potential. Thus, due to the limitations on the technical layer, the business process can be compromised from the to-be one to the actual one (5.2). In addition, some successful and useful practices will also be inherited from the as-is process on which employees are very familiar and proficient (5.1). Especially it defines the weight of different measures when engaging them into decision making. As a result, the actual working process can be adapted from to-be process, also being influenced by the actual experience of using the new system and the successful practices from as-is process.

In this stage, employees can experience the conflicts between to-be and workable process, and compromise from as-is process by taking good practices from the experience, which can shape their understanding of the DT project (6). For example, the perceived improvement on work efficiency can motive them to recognise the value of DT, and embrace the change, which is aligned with what was promoted with the strategic focus in stage 1. employees' frustration However, caused the limitations of technical system and mismatching between technical system and business processes will cause the resistance emotion, where employees cannot recognise the value of data transformation and then refuse to accept the change.



Figure 3: Conflict and Compromise in Digital Transformation across organisational layers.

#### **3.3** Stage Three: Bottom-up Approach

With an increasing amount of experience to using and being engaged in the new system, the feedback from technical layers and formal layers can inspire an evolution on the strategic focus (informal layer) (Figure 4). Different from the top-down approach of being instructed by the strategic focus, the feedback from technical layer can offer a different possible strategic focus. For example, a technical feature e.g. big data analysis can help identify new details which have never been discovered before, and then it can contribute a new insight to seize a business opportunity (7). In addition, based on the experience of conflicts and compromises in stage 2, although the workable process might be different from pre-defined to-be process, it can indicate some initiatives in the to-be process might not be feasible in the reality, and then strategic focus needs to be adjusted to be more closed to the reality (8.1). Also, alternative changes in the business process can be proposed in order to better fulfil the strategic focus (8.2). Finally, with time goes by, new knowledge accumulated in the practice of working with the new system, and then it can constitute some new approaches which can spark new innovations on strategic focus (9). Therefore, this model raises the following two propositions related to timing and directions of alignment.

Proposition 1: Alignment(s) can be happened any stages during the process of digital transformation. It can be initialised at the start, but with different maneuverers and adjustment in the following stages.

Proposition 2: Alignment(s) can be led by different layers, including both directions of top-down and bottom-up.



Figure 4: Bottom-Up Approach to Strategic Evolution in Digital Transformation.

#### **3.4** Stage Four: Strategic Alignment(s)

In the long term, other than directly promoting the changes on technical and formal layers, it is important to align the top management team's strategic focuses with culture perceived by all employees (Figure 5). For example, the achievement of accepting and implementing the new system should be recognised and then awarded for encouraging more employees to participate in the transformation. On the contrary, the challenges and difficulties of engaging in the new system should be identified and analyse, and then more support and necessary adjustment need to be allocated to help employees overcome the barriers. In addition, skill gaps should also be investigated, and appropriate training should be scheduled to empower employees to make use of the new system (10).

Resulted from the alignment between strategic focus and culture, employees can feel more motivated to embrace the new technology (11.2), as well as being engaged in the new working process (11.2). Then increasing active employees' engagement in technical, formal and informal layer can contribute to more feedback to inform and enrich the content of strategic focus (10). It constitutes a loop of continuous improvement to maximise the outcome of DT.

Thus, this model raises another proposition based on key actions in alignment. Proposition 3: Digital Champions, from both roles of leadership and operations, facilitate the alignment(s) among three layers in long run.



Figure 5: Strategic Alignments for Continuous Improvement in Digital Transformation.

## 4 ANALYSE A DIGITAL TRANSFORMATION PROJECT IN A CHINESE MANUFACTURER VIA OOM ALIGNMENT MODEL

Based on Piccolo and Roberto (2017), OOM can be indirectly influenced by the general environment where the organisation operates. The observation in this research is based on a state-owned manufacturer in China. Therefore, it is necessary to acknowledge that the observation results can be shaped by the Chinese SEO cultural context with the characteristics of high-power distance culture, long-term orientation and collectivism, based on Hofstede dimensions (Giacobbe-Miller et al., 2003).

Observation was based on an ongoing DT project of developing a digital production cluster with a highlight of developing data-drive production system. The data input was mainly based on the authors' analysis and interpretation on project plan and unstructured interview with the CIO in the manufacturer.

The observation mainly focuses on the first stage of DT. It begins with a top-down strategy, emphasising the need to establish a clear direction and commitment from organisational leadership. This stage focuses on the Technical IS layer, where the decision to purchase new digital systems is made. Such a decision is often driven by strategic priorities that aim to enhance organisational efficiency and competitiveness through technological advancements. The introduction of these systems serves as the foundation for subsequent changes in business processes and organisational culture.

A key aspect of this stage is aligning the technical implementation with broader organisational objectives. Leadership plays a vital role in communicating the rationale behind the adoption of new systems, ensuring that the investment aligns with the long-term vision of the organisation. By initiating change at the technical level, this stage sets the groundwork for reshaping the Formal IS and Informal IS layers in subsequent stages. This structured, hierarchical approach ensures that the DT process begins with a solid technological foundation, guided by strategic imperatives.



Figure 6: Step 1-3 in digital transformation.

## 4.1 Step 1 - Building a Digital Foundation with Strategic Investments

In the DT project of this Chinese engineering equipment manufacturer, the decision to purchase a new system was not merely a conventional acquisition of isolated technological tools. Instead, the organisation undertook a more ambitious initiative: the construction of an entirely new smart industrial city, built entirely on advanced digital systems. This approach represents a comprehensive, top-down strategy to establish a cutting-edge digital infrastructure, aligning with the Technical IS layer in the Organisational Onion model. The creation of the smart industrial city reflects a shift from traditional system procurement to a systemic overhaul, where the entire operational and organisational framework is designed around digital technologies. This initiative integrates advanced systems such as IoT, AI, and big data analytics into a cohesive platform, enabling seamless digitalisation across the enterprise. By constructing a new, technology-driven ecosystem, the organisation not only addressed its immediate operational needs but also laid the groundwork for adaptive, intelligent business processes and future scalability.

This strategic move exemplifies a luxury-level approach to system acquisition, where the focus extends beyond technical functionality to encompass organisational alignment and transformation. The smart industrial city serves as a foundational enabler for subsequent stages of DT, including business process reengineering (Formal IS) and cultural adaptation to digital innovation (Informal IS). This systemic perspective ensures that technical advancements are integrated with organisational objectives, fostering long-term value creation.

Through the construction of the smart industrial city, the organisation established itself as a pioneer in DT, leveraging an ambitious technical foundation to drive comprehensive changes across its operations, processes, and culture. This approach underscores the critical role of strategic, large-scale system adoption in achieving alignment and enabling the transition toward an intelligent, digitally enabled future.

#### 4.2 Step 2 - Redesigning Business Processes for Digital Integration

The phase of instructing a new business process focuses on the systematic reengineering and optimisation of organisational workflows to align with the capabilities of newly adopted digital systems. This stage involves the redesign and integration of core business processes, ensuring seamless coordination across organisational units while leveraging advanced digital tools for execution.

A key aspect of this phase is process integration, where traditional linear workflows are transformed into interconnected, data-driven processes. By employing frameworks such as the RACI model, the organisation establishes clear roles and responsibilities, ensuring transparency and accountability in process execution. This structured approach facilitates the alignment of strategic objectives with operational outcomes, creating a robust foundation for DT.

The integration of IT and OT technologies, along with the adoption of Industry 4.0 principles, further supports the dynamic realignment of business processes. Data-driven mechanisms, such as KPI monitoring and intelligent control towers, enable realtime visibility and continuous optimisation of workflows. This ensures that new business processes are not only efficient but also adaptable to changing operational demands.

Moreover, the restructured processes integrate product design, supply chain management, and manufacturing operations into a unified value chain. Systems such as BOM and MES establish seamless connections across planning, execution, and feedback loops, enabling the realisation of an end-to-end digital ecosystem. This holistic approach to business process design ensures that operational efficiency is maximised while fostering a culture of continuous improvement and responsiveness to external and internal challenges.

### 4.3 Step 3 - Driving Cultural and Managerial Shifts Through Data

Insights drawn from an interview with the organisation's Chief Information Officer (CIO) emphasise that the essence of DT lies in shifting from experience-based to data-driven decision-making across all organisational levels. The CIO highlighted that digitalisation is not merely about adopting advanced systems or platforms but fundamentally about transforming the enterprise's decision-making processes. This shift enables organisations to make more objective and precise decisions, enhancing their ability to navigate complex market environments.

The CIO provided a practical example, explaining how, in the past, sales personnel relied on subjective experience to evaluate customer credit, predict payment capabilities, and assess sales costs and returns. While such methods could be effective in specific scenarios, they often lacked scientific rigour and carried inherent limitations due to the variability of individual experience. Through digitalisation, the organisation systematically collects and analyses data such as customer credit reports and annual statements, building accurate, data-based customer models. These models provide objective insights, allowing the organisation to manage risks more effectively and make more reliable business decisions.

The interview further highlighted how DT impacts employees at different levels of the organisation. For senior management, the value lies in accessing comprehensive, data-driven insights that

support strategic decision-making. Middle-level managers benefit from improved visibility and realtime monitoring of operational performance, enabling them to adjust strategies effectively. Grassroots employees experience increased efficiency through automation and reduced manual workload, allowing them to focus on critical tasks and improve productivity.

The CIO also acknowledged the challenges of embedding digitalisation into the organisational culture. Resistance to change and the reliance on traditional decision-making methods can impede the adoption of a data-driven paradigm. To address this, the organisation prioritises training programs, crossdepartmental collaboration, and the establishment of unified data standards. These initiatives aim to build trust in digital tools and foster a culture of innovation that aligns with the organisation's strategic focus.

This analysis demonstrates how the organisation leverages digitalisation not only as a technological advancement but also as a cultural and managerial shift. By effectively communicating the value of DT and aligning it with both strategic objectives and employee engagement, the organisation lays a strong foundation for sustained innovation and long-term competitiveness.

## 4.4 Step 4 & 5 - Achieving Alignment Through Iterative Adjustments

In the organisation's DT journey, the introduction of new technologies (Technical IS) necessitated iterative adjustments to align existing business processes ("as-is") with the envisioned target processes ("to-be"). This process was characterised by resolving conflicts through optimisation and compromise, leading to the development of functional "workable processes" that balanced technical capabilities with operational realities.

One significant challenge the organisation faced involved the integration of its production planning and execution systems. Gaps between the enterprise resource planning (ERP) system and the manufacturing execution system (MES) created inefficiencies, particularly in synchronising production schedules with real-time operational data. For example, discrepancies in data flow between these systems prevented the seamless adaptation of production schedules to actual shop floor conditions. To address this, the organisation restructured its workflows, prioritising the synchronisation of ERPgenerated plans with feedback from MES. This adjustment ensured that existing processes adapted to the new digital framework, enabling smoother

operations and better alignment with technological advancements.

The organisation also encountered challenges in achieving the ambitious goals set for its target processes. These "to-be" processes envisioned a fully integrated factory system that unified factory layout, material flows, and production systems under a comprehensive digital blueprint. However, practical constraints such as incomplete data connectivity and limited IT-OT (information technology and operational technology) integration necessitated compromises. For instance, the initial plan to establish real-time feedback loops between digital twins and production lines had to be revised. Instead, the organisation adopted a phased approach, achieving partial connectivity milestones while continuing to refine its systems. This compromise ensured that progress was maintained while addressing the limitations of current technology and resources.

Through these adjustments, the organisation successfully transformed its business processes into "workable processes" that aligned with both its operational needs and DT goals. These iterative refinements allowed the organisation to optimise resource allocation, enhance efficiency, and reduce systemic bottlenecks, demonstrating the importance of flexibility and compromise in navigating the complexities of large-scale DT.



Figure 7: Step 4-5 in digital transformation.

## 5 CONCLUSIONS AND FURTHER STUDY

This research focuses on the alignments among three layers of OMM during the process of DT. Developed from Liu et al. (2017), it proposed an OOM alignment framework to highlights the alignments among different components in technical, formal and informal layers, and explained the process where alignments took place. Overall, the DT can be initialised by the strategic focuses, and then lead to the change in IT systems, formal processes, culture to embrace DT (stage 1). Based on the actual use of new IT systems, employees will adopt a workable process, derived from as-is process and the actual experience of using the new IT systems, which can further shape the culture of digitalisation within the organisation e.g. acceptance or resistance (stage 2). In the stage 3, the feedback from each layer, such as new features from IT systems, user experience of being engaged in the workable process, and new digitalisation culture, can help influence the strategic focuses. Finally, the shift of strategic focus will re-align with the digitalisation culture in order to promote more employees' acceptance on the new IT system and compliance with the new work process (stage 4).

Then three highlighted propositions about alignments in DT process can be summarised as follows.

Proposition 1: Alignment(s) can be happened any stages during the process of digital transformation. It can be initialised at the start, but with different maneuverers and adjustment in the following stages.

Proposition 2: Alignment(s) can be led by different layers, including both directions of top-down and bottom-up.

Proposition 3: Digital champions, from both roles of leadership and operations, facilitate the alignment(s) among three layers in long run.

However, the limitations in this research can be articulated below, followed by suggestions for future studies.

Firstly, although a 4-stage OMM-inspired alignment framework has been proposed in this research, the interview in the Chinese SOE merely illustrated the first and second stage. Thus, stage 3-4 has not been witnessed in a real case. In order words, this research has not yet found evidence to support the process of stage 2-4 which were developed based on the reasoning on the original OMM and OS theories. For future studies, they can consider conducting a longitudinal study, either by analysing a complete process of a DT case, or by following a company through its complete journey of DT. Then they will be able to articulate how the alignment process happened in a real scenario and justify if it follows the propositions raised in this research.

Secondly, although this research identified some elements in each layer of OMM, such as strategic focuses from top management team and digitalisation culture conveyed by employees, more elements can be specified on different layers when more in-depth interviews have been incorporated in this research in order to understand the challenges the SOE encountered in the reality. For example, OOM alignment model indicates influenced by as-is process and experience of using new IT systems, the employees will adopt a workable process, which is different from the predefined the to-be process. However, in the reality, there might be different process where some of them can be easily complied and some not, and then they could influence the digitalisation culture on different extents. Then the conflicts and compromises might be happened more on some processes than others, which can be further discovered in the future studies.

#### REFERENCES

- Giacobbe-Miller, J. K., Miller, D. J., Zhang, W., & Victorov, V. I. (2003). Country and organizationallevel adaptation to foreign workplace ideologies: A comparative study of distributive justice values in China, Russia, and the United States. Journal of International Business Studies, 34(4), 389–406.
- Guo, H., & Liu, K. (2024). The chasm of technology innovation in digital transformation: A study from the perspective of transformation informatics. Business, Management and Economics. IntechOpen. https://doi.org/10.5772/intechopen.111793
- Liu, K., & Li, W. (2015). Organisational semiotics and business informatics. Routledge.
- Krishna, S. H., Kumar, G. P., Reddy, Y. M., Ayarekar, S., & Lourens, M. (2024, May). Generative AI in business analytics by digital transformation of artificial intelligence techniques. In 2024 International Conference on Communication, Computer Sciences and Engineering (IC3SE) (pp. 1532–1536). IEEE.
- Li, W., Liu, K., Tang, Y., & Belitski, M. (2017). Eleadership for SMEs in the digital age. In F. X. de Faria, C. A. Cruz, & C. Vieira (Eds.), The Palgrave handbook of managing continuous business transformation (pp. 375–416). Palgrave Macmillan.
- McAfee, A. (2009). Enterprise 2.0: New collaborative tools for your organization's toughest challenges. Harvard Business Press.
- Piccolo, L. S. G., & Pereira, R. (2017). Culture-based artefacts to inform ICT design: Foundations and practice. AI & Society, 34(3), 437–453. https://doi.org/10.1007/s00146-017-0743-2
- Poláková-Kersten, M., Khanagha, S., van den Hooff, B., & Khapova, S. N. (2023). Digital transformation in highreliability organizations: A longitudinal study of the micro-foundations of failure. The Journal of Strategic Information Systems, 32(1), Article 101756.
- Stamper, R. (1996). Signs, information, norms, and systems. In B. Holmqvist (Ed.), Signs of work (pp. 349–399). Elsevier Science.
- Stamper, R. (1997). Organisational semiotics. In J. Mingers & F. Stowell (Eds.), Information systems: An emerging discipline (pp. 267–283). McGraw-Hill.

Stamper, R. K. (1993, September). A semiotic theory of information and information systems. In Joint ICL/University of Newcastle Seminar on the Teaching of Computer Science 1993: Part IX: Information (pp. 1–33). University of Newcastle.