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Research Article

Assessing the Compliance and Competitive Prospects of China's Manufacturing Industry's Digital Transformation under the WTO Agreement on Trade-related Aspects of Intellectual Property Rights

Xiaoheng Zou [1*], Khairul Anuar Mohd Ali [2], Wan Mohd Hirwani Wan Hussain [3]

[1] Ph.D Candidate, Graduate School of Business, Universiti Kebangsaan Malaysia, Bangi, Malaysia
[2] Professor, Dr., UKM-Graduate School of Business, Universiti Kebangsaan Malaysia, Bangi, Malaysia
[3] Associate Professor, Dr., UKM-Graduate School of Business, Universiti Kebangsaan Malaysia, Bangi, Malaysia
* **Corresponding Author:** kabma@ukm.edu.my

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ABSTRACT

Digital transformation in Chinese manufacturing industries is a new phenomenon that is rapidly transforming China's industrial structures, which provides premised competitive edges in international markets while it has sparked controversy over WTO non-compliance. This paper aims to assess China's manufacturing industry's digital transformation regarding the WTO TRIPS Agreement. Regarding China's position to safeguard IP in the high-tech industries, traditional manufacturing industry, and SMEs, it looks at the legal and regulatory aspects. Through the evaluation of TRIPS commitments of China, this particular paper evaluates the compliance and competitiveness as reinforced through the protection of its IP rights including boosted innovations, foreign direct investment, and entry to the market. While noting that there has been much accomplished in overhauling China's IP Protection, the findings reveal that the major difficulties persist in the enforcement and in aligning laws with information communication technologies. The study thus establishes the need to adhere to IP protection and provides pointers of Porter's Grocery Model on China averts in order to embrace the global market. In this regard, the analysis aims to shed light on the challenging and promising aspects of harmonizing national digital transformation processes with the international framework of IP protection.

Keywords: China, Digital Transformation, Intellectual Property Rights, Manufacturing Policy, WTO Compliance.

INTRODUCTION

China in the last few decades has arguably become one of the most influential manufacturing giants in the world with a formidable industrial manufacturing power that has applied efficient strategic economic policies to drive the development of manufacturing industries resistant to various economic sectors (Haskamp, Dremel, Marx, & Uebernickel, 2021). The WTO Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) also has a central role in this transformation process given that standards for protection of IPRs are crucial for innovation as well as for free competition (Wood & Darling, 1993). The advanced use of digital platforms in the production line has pulled the manufacturing sector around the globe into a new light. They have ranged from automation of production lines and robotics to AI, and even big data in production, product differentiation and supply chain operations (Bello, 1996). To the Chinese, a country which once boasted one of the largest manufacturing industries in the world, digital transformation goes beyond making sure that it aligns with the developments of global powers but it means taking the lead in significant technological fields (OECD, 1998).

The high-tech manufacturing industry is one of the dynamic areas essential to the advancement of the digital technology in China. Petro affirmative action, high-tech facilities including 5G, IoT, super sentient robotics of Chinese firms have improved precision engineering, computer aided manufacturing, high-added value production (Kedia & Mukherji, 1999). However this change has not only enhanced the country's productivity but also contributed to its emergence as a significant market competitor in terms of the provision of high-impact technologies for the production of goods and services in the international market. Although more emphasis has been laid on high-tech manufactured goods, China's base for traditional manufactured goods remains active and essential for the country's economy (Yang, 2001). Knowledge intensive industries, which are involved in the production of technologically intensive capital goods and other high technology products. It requires effective IP protection, especially in view of the fact that operations in such industries are associated with high rates of product cycle and innovation coupled with considerable research and development expenditure (Guohua & Jin, 2001). In the case of traditional industries, the concern is the process of managing integration of digital technologies while maintaining industry norms and practices. The resource-limited SMEs must therefore find a way and means of adopting the use of digital tools while at the same time addressing the various provisions of TRIPS that seek to protect their innovations so that they can effectively compete within their various markets (Sachs & Woo, 2003). Technological solutions such as cloud adoption ERP, supply chain management, and integration of e-commerce have supported the transformation of supply chain of SMEs and exposed them to a broader market besides improving customer relations and satisfaction. Furthermore, government encouragement for digital up skilling and funding of innovation has also firmed up the SME progress in support of WTO's concept of maintaining inclusive economic opportunity (Chan, 2004). Chinese manufacturing digitization is not just a matter of technological progress but also of acknowledging rules and standards of trade which has been provided by WTO. Through the fair competition practices, the intellectual property rights, and transparent practices in trading activities, China aims to demonstrate its responsibility as a global player within the manufacturing industries (Princen, 2004). When analyzing the compliance and the competitiveness of these sectors under TRIPS agreement we need to consider the following factors: the adherence of these sectors to the principles and norms of IP, the realization of digitization initiatives and its impact on the competitiveness of the sectors (Gehlhar, Regmi, Stefanou, & Zoumas, 2006). In these aspects, China not only improves the factors and levels of productivity and efficiency across various sectors of manufacturing industries but also practices digital technologies for realizing inclusive economic growth more seriously and sticking to international rules and laws of trade (Zadek, 2006). This research lavers to provide useful information on the layers of the effects of digitization on China's manufacturing sector. The foundation for this formulation of effective strategies to shape manufacturing systems for the future world economy (Wilson, 2007).

This paper evaluates the level of compliance and the competitiveness of China's manufacturing industry digital transformation based on the WTO-TRIPS agreement on IP protection. It focuses on three key sectors: There are three types of manufacturing systems, namely high-tech manufacturing systems conventional manufacturing systems and manufacturing SMEs. The evaluation should establish the extent to which these sectors perform in relation to TRIPS regulations, especially the IPR. Besides, the study analyses the current opportunities and threats of these sectors in the international market as a result of digital transformation. As a result, by analyzing the specific case studies as well as the policies and data of the industry, the research will be able to determine the strengths and weaknesses of the approach. The current literature review will help to identify key policies that can be enacted at the moment, as well as define the best approaches to boosting compliance with them and increasing competitiveness in the context of developing digital environment.

While dramatic progress has been observed worldwide and in China in particular, the focus of the latter is somewhat depleted when it comes to the issue of compliance and competitive advantage considering the application of the WTO Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) pertaining to digital transformation. Prior research tends to investigate the topic as a whole either from the perspective of digital technology adoption or encompassing the idea of intellectual property rights separately without taking into consideration how the compliance with TRIPS influences different manufacturing sectors. In particular, there is a lack of focus on high-tech manufacturing sector, traditional manufacturing sector and small and medium enterprises, which have peculiarities in this regard. Furthermore, the relationship between DT and TRIPS compliance regarding competitive strategy in the international market is understudied. In this regard, this study intends to give a comprehensive analysis of compliance, focusing on peculiarities of the speciality, containing both general and sector-oriented recommendations for increasing the competitiveness in the world and meeting the requirements of TRIPS.

Here are the three research objectives for studying China's Digital Transformation in Manufacturing: Assessing WTO Compliance and Competitive Advantages in Global Markets.

- To assess the level of compliance with the WTO Agreement on Trade-Related Aspects of Intellectual

Property Rights (TRIPS) within China's high-tech manufacturing, traditional manufacturing, and SME sectors, identifying specific areas of adherence and non-compliance.

- To analyze the competitive prospects of China's manufacturing industry in the global market, focusing on how digital transformation initiatives impact the competitiveness of high-tech manufacturing, traditional manufacturing, and SMEs in the context of TRIPS compliance.
- To identify the unique challenges and opportunities faced by high-tech manufacturing, traditional manufacturing, and SMEs in navigating digital transformation while ensuring TRIPS compliance, providing strategic recommendations to enhance both compliance and global competitiveness.

LITERATURE REVIEW

China's digital transformation across manufacturing has attracted considerable focus, especially in the high–tech/traditional and SME contexts. Thus, research focuses on automation and smart technologies, but their impact on WTO and competitiveness of markets has not received enough attention and should be analyzed thoroughly with regard to these aspects.

Technological Innovation

The recent digitization of manufacturing industries in China is causing a shift of market in the global market for goods and services which can present compliance issues as well as market opportunities. With the help of AI, IoT, and big data China is redesigning its manufacturing industry to increase productivity as well as to cut costs and develop new products (Footer, 2007). This can also be seen in the high-tech manufacturing and the traditional industries tremendously affecting the SMEs. Higher tier manufacturing, especially in the use of tech and having smart industries such as robotics, semiconductors, and new age vehicles such as electrical cars, is at the apex of technology in China. Huawei and BYD are the pervading companies that are applying AI and IoT for the automation of their production line and the creation of smart products whose demand cuts across the international markets (Bauman, 2007). It not only increases the efficiency of the manufacturers but also significantly guarantees the adaptability of Chinese manufacturers to the detected market trends, which considerably contributes to the competitive advantage. It is also noteworthy that classical segments of manufacturing industries receive additional advantages from digital tools (Annavarjula & Mohan, 2009). If smart manufacturing principles are implemented it has been observed that corporations like textiles, steel, and automobile industry benefit from enhanced operational effectiveness and enhanced quality of the products. The synergy of collaborative intelligent application of predictive maintenance and self-sustaining supply chain systems consequently minimizes time wastage and strategically enhances resource utilization, thus addressing key imperatives outlined under China's "Made in China 2025" plan (Pillania, 2009). For medium and small-sized enterprises digital transformation creates a route for them to compete with big companies. The use of cloud computing services, online selling and marketing techniques helps these smaller firms to penetrate wider markets and work more effectively (Lau, Yam, & Tang, 2010). The Internet Plus strategy, for instance, helps the government in the process of facilitating the implementation of these technologies among the SMEs, hence embracing innovation and a more competitive environment. China's initiatives related to digital transformation present no issues concerning WTO's basic principles of equitable competition and non-reciprocity; however, there are issues such as intellectual property and market access (Yam, Lo, Tang, & Lau, 2011). However, the countries' adoption of digital manufacturing as a strategy puts it at a competitive edge with the global market and develops the means through which growth can be maintained and competitive advantages established (Colares, 2011).

Digital Transformation

Digital transformation in China's manufacturing sector has been a pivotal force reshaping the landscape across high-tech manufacturing, traditional industries, and SMEs, as documented in the study "China's Digital Transformation in Manufacturing: Toward this end, the paper is titled: "Global Market WTO Compatibility and Affirmative Competitive Edge Evaluation." This transformation is carried out through the use of newer technology systems including artificial intelligence (AI), big data analysis, Internet of Things (IoT), and automation, among others. High-tech manufacturing in China has integrated the use of technology in it so as to increase precision, efficiency, and innovation (Willmott, 2011). Huawei is a clear example that has introduced new innovations in telecommunications through the use of AI and IoT while DJI benefits from the same technology in creating better drones. Electronic manufacturing industries, one of the older industries especially in China, have adopted the digitization process in an attempt to cut down on expenses and enhance the quality of their products (Stanisavljev, Đorđević, & Ćoćkalo, 2012). For example, textile companies in places such as Guangdong have integrated IoT sensors on production lines to increase the efficiency of its use, thus cutting costs and extravagance. SMEs have

also been able to reap big from digital transformation agenda. Also, the advances in information technologies and e-commerce facilitated the access to global markets by overcoming the limitations of size and location common for SMEs (Hult, 2012). Firms such as Alibaba have brought in digital environments that enable SMEs to access applications for digital marketing, managing supplies, and communicating with customers. Besides, WTO regulations have remained instrumental within the country's digital evolution process as it strives to maintain fair trade with other nations even as it competes for the international market (Rugman, Oh, & Lim, 2012). In conclusion, China's approach to the new manufacturing revolution not only conforms to an international trade standard but also transforms sectors such as high-tech, traditional, and SME for continual growth and competitiveness in the world markets. This shift in paradigm reinforces the fact that the era of digital technologies heralds a new path of development both economically and industrially across the many segments of manufacturing (Cheng & Lin, 2012).

Intellectual Property Rights

China's manufacturing industry's digital transformation poses significant implications for intellectual property (IP) rights under the WTO Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS). This transformation impacts high-tech manufacturing, traditional manufacturing, and SMEs, necessitating rigorous compliance and competitive positioning in global markets (Kocoglu, Imamoglu, Ince, & Keskin, 2012). High-tech manufacturing sectors in China, characterized by rapid innovation and technological advancements, must align closely with TRIPS to safeguard their competitive edge. This involves stringent enforcement of patents, copyrights, and trade secrets, which are pivotal for protecting innovations in sectors like electronics and biotechnology (Lang, Lin, & Vy, 2012). This has helped China to produce superior quality products that are technically sounder within the affordable price which helps improve its exports and market share across the globe. Traditional manufacturing, which is being actively transformed in the conditions of digital transformation, remains a beneficiary of the process (Chi, 2012). Traditional manufacturing, while slower to digitalize, benefits from robust IP frameworks that protect incremental innovations and proprietary processes. Strengthened IP enforcement under TRIPS ensures these manufacturers can leverage digital tools without the risk of IP theft, enhancing their productivity and market reach. For instance, the protection of industrial designs and trademarks under TRIPS enables traditional manufacturers to maintain brand integrity and product differentiation in global markets. SMEs, the backbone of China's manufacturing sector, face unique challenges in IP compliance due to resource constraints (Shan & Jolly, 2013). However, TRIPS compliance provides SMEs with critical protections, enabling them to compete on a level playing field internationally. By securing their IP rights, SMEs can confidently engage in cross-border trade and collaborations, fostering innovation and growth. In conclusion, China's adherence to TRIPS is paramount for the digital transformation of its manufacturing industry (Alam, Arumugam, Mohd Nor, Kaliappan, & Fang, 2013). It not only ensures compliance with international IP standards but also enhances the competitive prospects of high-tech manufacturing, traditional manufacturing, and SMEs in the global market (Spilker, 2013).

WTO Compliance

China's digital transformation in manufacturing industries has put the country at a strategic level in the global market through technological manufacturing, conventional manufacturing and SMEs. This has been done in conformity with WTO compliance measures hence encouraging competition in regard to international markets (Bojnec & Ferto, 2014). China's high-tech manufacturing industry best demonstrates this shift since it actively incorporates services such as AI, big data, and IoT into manufacturing implementation. The 'Made in China 2025' plan is a typical example of this strategy that seeks to increase the sophistication of Chinese production by improving innovation and minimizing imports of technology (Zhang & Li, 2014). This has helped China to produce superior quality products that are technically sounder within an affordable price which helps improve its exports and market share across the globe (Nguyen, Dang-Van, Vo-Thanh, Do, & Pervan, 2024). Traditional manufacturing, which is being actively transformed in the conditions of digital transformation, remains a beneficiary of the process (Liu & Jiang, 2016). There have been improvements in the area of systems automation, manufacturing costs have been cut down and the quality of products enhanced (Camisón & Villar-López, 2014). For instance, the use of smart factories to coordinate production and supply chains has enhanced the efficiency of production lines in the Chinese economy to meet global markets demand promptly and at the most reasonable prices. These enhancements can still be attributed to China's WTO's Trade Facilitation Agreement that focuses on release of efficiency in trade systems processes (Urdinez & Masiero, 2015). It means that the enterprises of these regions must use the information technologies to improve the internal operations, customer relationship management, and product development which in turn critically contributes to Chinese economic growth and WTO compliance (Toscano-Jara, Loza-Aguirre, Segura, & Franco-Crespo, 2024). Therefore, the advancement of digital competence in manufacturing industries in China serves as an assurance of the country's compliance with its obligations in the WTO besides enhancing competitiveness in the global arena. Moreover, the extent to which

high-tech innovations have been integrated into each sector, especially in manufacturing SMEs indicates that China is on the right track to sustaining and even improving its economic might globally (Eglin, 2016).

Hypothesis Development

China's innovation in manufacturing has captured much interest as to how it impacts high-tech and traditional industries and SMEs. These papers detail the developments in automation and smart technologies, although the potential consequences of these technologies on WTO conformity and the competitiveness of global markets have not been given adequate attention in the literature, therefore calling for a concentrated discussion of these aspects.

The shift of China's manufacturing industry to the digital environment including high-tech industries, traditional industries, and SME industries has affected technological development tremendously (Sudirjo, 2023). Manufacturers of high tech products have employed certain tools through digital technologies to support competitiveness in automated manufacturing, AI, and the use of big data analysis (Rajapathirana & Hui, 2018). These improvements increase the company's production capacity, product differentiation and supply chain, putting the Chinese firms in a better place in the global market. On the other hand, physical manufacturing industries encounter issues with regulating WTO standards with the application of digital advancements. In relation to the technical change and consequent integration costs, compliance with trade regulations is rendered complex by these industries (Yildirim, Tyson Chatagnier, Poletti, & De Bièvre, 2018). However, the sensible use of technology in manufacturing could help in the cutting down on the various costs of operation, as well as quality assurance, thus, giving a renewed competitive frontier. SMEs are essential in China: while they adapt to the opportunities and risks of digital transformation, organizations are searching for approaches to cultivate resilience (Carroll, Hassan, Junglas, Hess, & Morgan, 2023). digital transformation propels the application of new technologies in manufacturing by using smart technologies like AI, IoT, and big data in production. Such technologies are essential to possession of strong R&D capabilities, and high-tech manufacturing industries utilize such technologies in increasing production efficiency, product quality as well as competitiveness in the market (Duerr, Holotiuk, Beimborn, Wagner, & Weitzel, 2018). Thus, innovation technology remains the key focus of China ' s manufacturing change impacted by the digitization process. Wireless Communications including 5G yielding Internet of Things gadgets, smart manufacturing platform investments prove Chinese manufacturing's emphasis on technology innovation to drive sustainable development of competitive manufacturing industries all industries (Rahim & Zainuddin, 2019). It is imperative to small high-tech manufacturers for the products that their innovations rely on patents and copyrights. When it comes to traditional manufacturers and SMEs, where IPR guarantees the former's inventions are not replicated by the latter, this facilitates a culture of constant innovation and improvement (Carroll et al., 2023). Even though WTO compliance requires China to adhere to TRIPS, it improves China's integration into the international economy. It also provides confidence to the foreign investors and partners in the country's disposition to guard IPR hence leading to technology transfer and partnerships (Teichert, 2019).

H1: Digital transformation has an impact on technological innovation.

H2: Intellectual property rights have an impact on technological innovation.

H3: WTO compliance has an impact on technological innovation.

On the basis of this evidence, we proposed our hypothesis on this framework which shows the relationship in Figure 1.

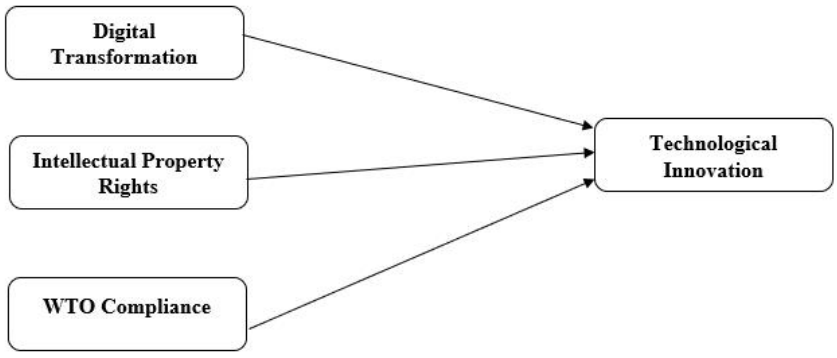

Figure 1. Conceptual Framework

METHODOLOGY

The use of a given methodology in regard to the particular study can be deemed as a primary and compulsory phase of the study as it demonstrates how science contributes to the achievement of the objectives and goals that have been met. The analysis parameter can be explained in terms of the math expectation, the obtained data and observations in the study, the priority knowledge, the beliefs and the course observation on the behavior of the respondent. Under the broad label of research two general operations are carried out and they include discovery and interpretation.

Research Design

The research method of this study is a quantitative research approach, with the help of AMOS 24 and SPSS 24, to analyze the path model between China's compliance with TRIPS and the competitiveness of its manufacturing industry. To establish the effects of TRIPS compliance on innovation, IP enforcement, and competitive advantages in Hi-Tech, traditional manufacturing, and SMEs, SEM analysis is used in the study. Primary data is obtained from structured questionnaires from 350 firms and is used to make inferences and recommendations towards improving China's global competitiveness.

Study Population

The present research involves multi-technological manufacturing firms, traditional manufacturing firms, and Small and Medium-sized enterprises as the respondents. This study set also employs this specific population since the population is reasonable and significant, appreciating the rationale behind this study. The information is collected by means of many sources that can be divided into traditional Internet. Out of 400 participants that were given the questionnaire only 350 participants responded to the questionnaires and this gave us a completion rate of 87.5% response rate. The type of sampling used in the study is convenient sampling according to the study. As for the data collection in this study, the researcher employed a cross-sectional survey of a structured questionnaire.

RESULTS

Exploratory Factor Analysis

Principal components analysis with a Varimax pattern rotation is employed for the examination of the structure of factors and the inter-item correlation of the measure included in the scale. The results of KMO and Bartlett's Test are provided in Table 1.

Table 1. KMO and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.906
Bartlett's Test of Sphericity	Approx. Chi-Square	6054.796
	df	300
	Sig.	0.0001

Table 1 presents results from the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy is 0.918, indicating excellent suitability of the data for factor analysis. Bartlett's Test of Sphericity shows a Chi-Square value of 60.54.796 with 300 degrees of freedom and a significance level of 0.0001. This significant result ($p < 0.05$) indicates that the correlation matrix is not an identity matrix, supporting the appropriateness of factor analysis for this data.

Confirmatory Factor Analysis

Arbuckel notes that AMOS version 24 is normally used to do the Confirmatory Factor Analysis as done in this study. To check the reliability of this model it is examined related to the construct validity by testing the convergent validity and discriminant validity. Below is Figure 2 final CFA model on CFA draw and the model calculated at the end as shown in Table 2.

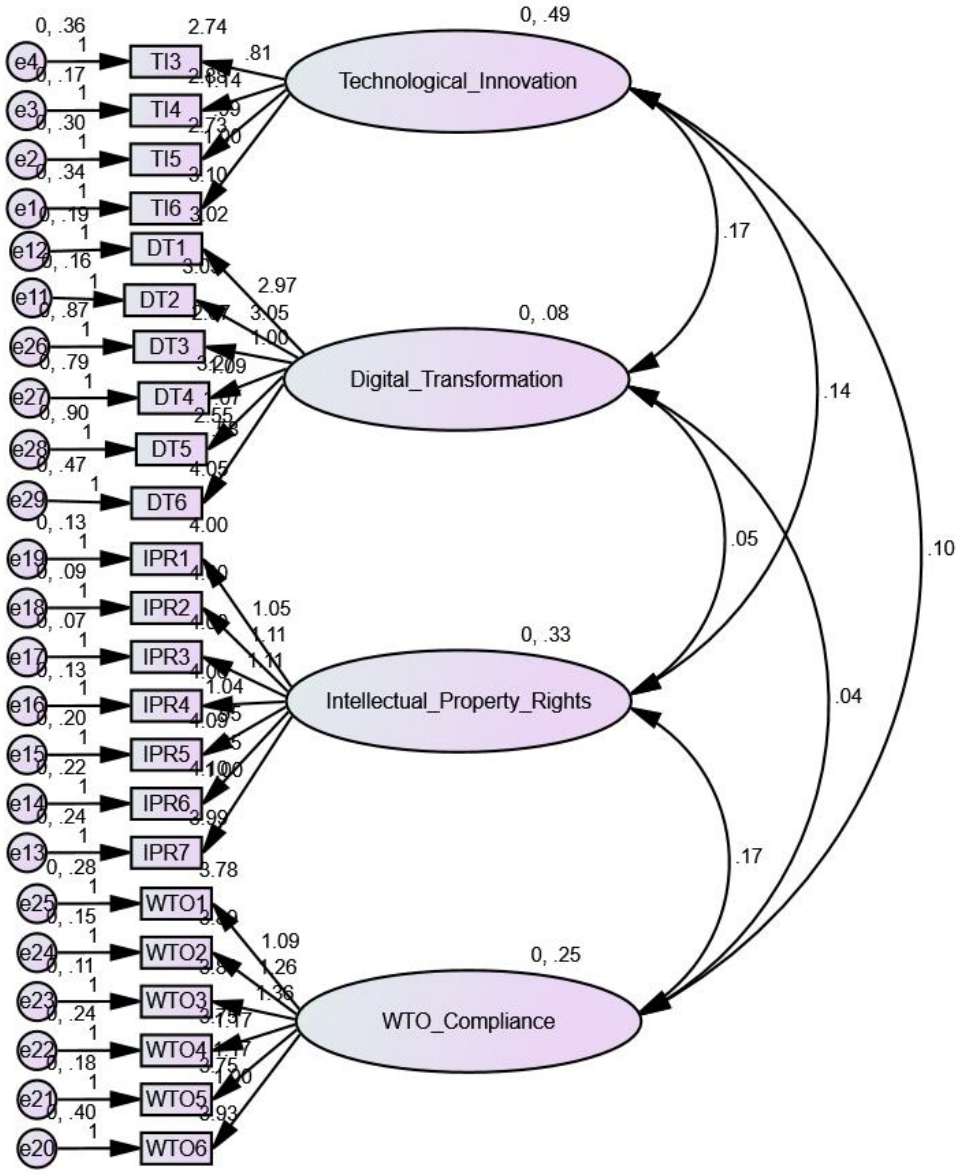

Figure 2. Final CFA Model

Table 2. Reliability and Convergent Validity

Variables/Constructs	Items	Standardized Factor Loadings	Cronbach Alpha	Composite Reliability	Average Variance Extracted	Average Shared Variance
Technological Innovation	TI6	0.77	0.903	0.906	0.612	0.167
	TI5	0.784				
	TI4	0.886				
	TI3	0.688				
Digital Transformation	DT6	0.922	0.865	0.867	0.617	0.321
	DT5	0.656				
	DT4	0.558				
	DT3	0.789				
	DT2	0.754				
	DT1	0.886				
Intellectual Property Rights	CGM7	0.762	0.937	0.940	0.691	0.318
	CGM6	0.718				
	CGM5	0.773				
	CGM4	0.855				
	CGM3	0.927				
	CGM2	0.9				

Variables/Constructs	Items	Standardized Factor Loadings	Cronbach Alpha	Composite Reliability	Average Variance Extracted	Average Shared Variance
	CGM1	0.86				
WTO Compliance	WTO6	0.62	0.94	0.90	0.69	0.19
	WTO5	0.809				
	WTO4	0.766				
	WTO3	0.898				
	WTO2	0.854				
	WTO1	0.716				
Model Fitness: X2=1307.281, df=224, X2/df= 5.836, RMSEA=.272, RMR=.118, GFI=.971, CFI=.817						

Table 2 assesses the CFA results for four constructs: Technological Innovation (TI), Digital Transformation (DT), Intellectual Property Rights (CGM), and WTO Compliance (WTO). All constructs exhibit high internal consistency, with Cronbach's Alpha values ranging from 0.865 to 0.94, and Composite Reliability (CR) values from 0.867 to 0.940. The Average Variance Extracted (AVE) is above the 0.50 threshold for all constructs, with TI at 0.612, DT at 0.617, CGM at 0.691, and WTO at 0.69, indicating that a significant portion of variance is explained by the constructs. However, **DT** has some lower factor loadings (e.g., DT4 at 0.558), suggesting potential areas for refinement. Despite this, the constructs are well-defined, distinct, and suitable for further analysis, as evidenced by the consistently lower Average Shared Variance (ASV) values.

Table 3. Discriminant Validity

WTO Compliance	Technological Innovation	Digital Transformation	Intellectual Property Rights
0.783			
0.278	0.885		
0.272	0.876	0.742	
0.592	0.344	0.336	0.831

Table 3 shows discriminant validity is generally supported in the provided correlation matrix as the square roots of the Average Variance Extracted (AVE) for each construct exceed the correlations between that construct and others. Specifically, WTO Compliance (0.783), Technological Innovation (0.885), Digital Transformation (0.742), and Intellectual Property Rights (0.831) all show that their respective AVE values are greater than their correlations with other constructs. However, high correlations between Technological Innovation and Digital Transformation, and between WTO Compliance and Intellectual Property Rights, suggest some overlap and may indicate areas for potential refinement to ensure full discriminant validity.

Hypotheses Testing (Structural Model)

Please the analysis of big data analytic techniques, innovation strategies and audience satisfaction, Factor structure, Reliability and validity, and Research model for the Structural Equation Modeling Analysis for measuring the relationships studies were estimated using the AMOS path analysis by imputing the Factor Score from CFA using AMOS. During hypothesis testing the content creation was established as a mediator. Below is the structural model that is followed by the Actual Results Actual Mean Square and the Expected Results in Figures 3 & 4.

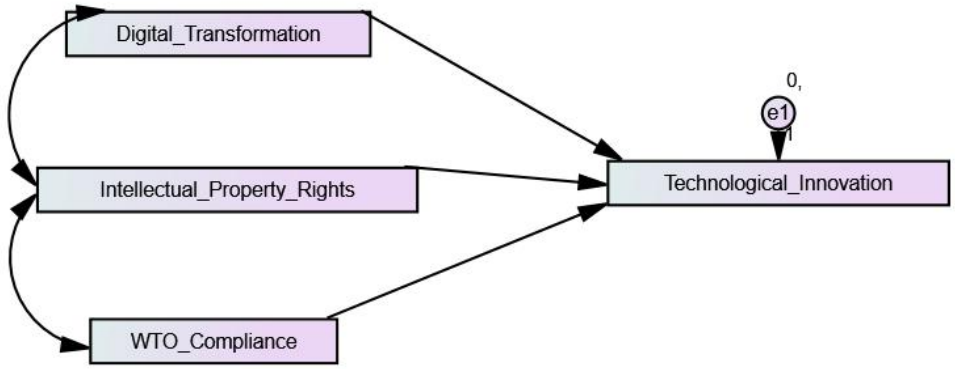

Figure 3. Proposed Structural Model for Hypotheses Testing

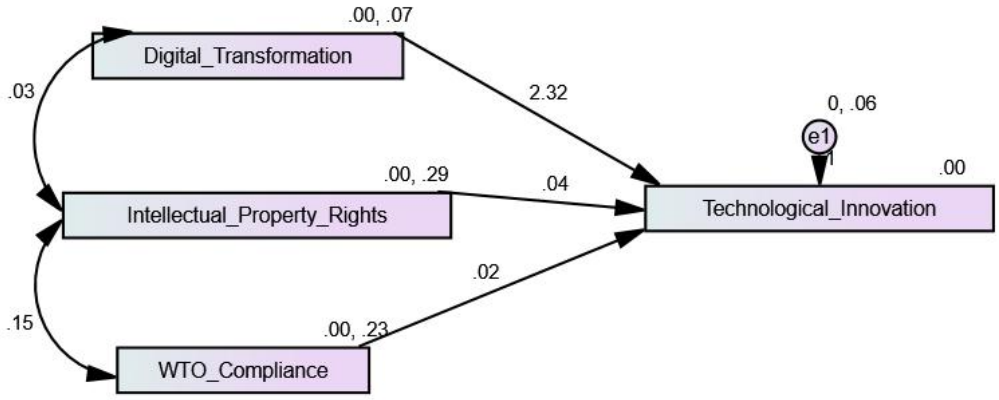

Figure 4. Measurement Model-Results

Table 4. Regression Weights

Hypothesis	Relationship			Estimate	S.E.	C.R.	P	Remarks
H1	Technological Innovation	<---	Digital Transformation	2.322	0.05	46.121	***	Supported
H2	Technological Innovation	<---	Intellectual Property Rights	0.038	0.031	1.251	0.211	Not Supported
H3	Technological Innovation	<---	WTO Compliance	0.016	0.034	0.463	0.643	Not Supported

Based on the hypothesis testing results in Table 4 only H1 the impact of Digital Transformation on Technological Innovation is statistically significant, with a strong positive estimate and p-value less than 0.001. H2 (the effect of Intellectual Property Rights on Technological Innovation) and H3(the effect of WTO Compliance on Technological Innovation) are not statistically significant, with p-values of 0.211 and 0.643, respectively.

DISCUSSION

From the hypothesis testing, we are able to gain a deeper understanding of the connections between Digital Transformation, Intellectual Property Rights, WTO Compliance, Technological Innovation. The results can provide a sophisticated perspective on how these factors affect Technological Innovation and may reveal some gaps in existing research. Significant and positive of DT and TI (H1) indicated that digital transformation is an essential aspect of technological innovation. According to the latest population statistics, about 2. 322 and a critical ratio or C.R. of 46. 121 the conclusion shows that greater initiatives in digital transformation improve Technological Innovation significantly. This is consistent with the prior theoretical research that states that digital technologies that include artificial intelligence, big data, cloud computing, among others can help to foster innovation through new business models, efficiency in operations, and possibility to prototype and test ideas faster. Digital Transformation includes using information technology in every corporate process, reshaping the organizational strategies and patterns of value creation. Such a change is not a one-off event but evokes a cultural shift in the organization's ways of operating and dealing with its clients, therefore promoting innovation. For instance, through implementing sophisticated digital technology, the institutions adapt more to the market demands and customer requirements, thus, promoting innovation practices and solutions. On the other hand, the correlation between Intellectual Property Rights (IPR) and Technological Innovation (H2) is insignificant with the estimate of, 0. 038, and if it does we have a p-value of 0. 211. From this analysis, one is left with the impression that in this case, IPRs did not provide a substantial direct boost to TI. Even though many people believe that IPR is an important factor that motivates innovation since inventors receive legal protection and promotions for research and development, the results suggest that there could be other factors at play in this context of this study than IPR. This, of course, makes the possibility of concluding that IPR has an effect on innovation clouded by the presence of other unseen factors. For example, the extent of the use of IPR in encouraging inventions may be constrained by the sector, the compliance measures in place and the technology type. Furthermore, there are other off-the-shelf funding criteria such as market needs or digital literacy where investing in IPR may not be a priority for organisations. Altogether, there is no significant effect of WTO Compliance on Technological Innovation as per H3 which has an estimate of 0. 016 and a p-value of 0. 643. This result implies that WTO compliance is not a determinant for Technological Innovation in this case. WTO Compliance in most cases is the

observance of rules and standards towards international trade, which in theory can affect innovation by affecting market access, competition and trade policies. However, there is not much evidence of stronger significance in this regard, pointing to the fact that WTO Compliance directly affects innovation to some limited extent or there are other factors which are way more influential like domestic rules or the dynamics of the markets. They also admitted that there could be other mediating effects of WTO Compliance on innovation, that might have been missed due to this kind of analysis. In sum, the results shed light on the significance of Digital Transformation for Technological Innovation in general, and indicate that Intellectual Property Rights and WTO Compliance may not be equally relevant in the given case. The large impact of the factorial Digital Transformation strengthens the calls for the utilization of digital solutions in organizational models to enable change. On the other hand, the insignificant findings on the effects of IPR and WTO compliance on innovation imply that the role of such variables requires a rather deeper analysis. Subsequent research studies could elaborate the aforementioned relations with additional variables and also investigate the nature of influences in different industries to gain a deeper understanding of the sources of Technological Innovation.

This paper posits that China's obligations under the WTO Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) signify an important role in determining the prospects of the digital evolution of and competitiveness of manufacturing industry in China. The compliance with TRIPS improves the strong IP regime, promotes technology development and helps to build confidence in China's high-tech industrial production (Sudirjo, 2023). Robust IP rights encourage innovation and creativity electronics, robotics, and biotechnology industries advance in the technology sector and bring market dominance in the global markets (Carroll et al., 2023). As it has been observed in the traditional manufacturing sectors, the compliance with TRIPS has led to the use of new technology in packaging for better and sustainable results. Thus, the integration of such advanced systems still poses a big problem to the resource scarce traditional firms (Carroll et al., 2023). The current government policies to promote digital transformation and IP compliance in international markets pave way for such sectors to upgrade and conform to these standards (Rahim & Zainuddin, 2019). Many concerns related to SMEs were introduced by TRIPS such as high compliance expenses and restricted fortunes for selling its research and development. However, digital tools help SMEs to manage operations and be members of global supply chains. Thus, governments stimulate SMEs through subsidies and technical cooperation to adapt to requirements and use digitalization to improve competitiveness (Teichert, 2019).

CONCLUSION

Some of the findings and conclusions that are worthy of note in these results and discussion sections are: Thus, the presented results provide practical and theoretical insights into which factors may contribute importantly to the generation of innovation and what may require more focus in the future. Digital Transformation was identified as a key force behind Technological Innovation, as the comparison showcased a positive association that was both significant and even exceedingly strong. The large ES and the high value of CR also point to the importance of using digital technologies for improving innovation. This finding is in line with the extant literature advocating that technology such as AI, big data, and cloud computing shifts the business operations and structures, generates novel ways through which organizations conduct their business, and enhances operational efficiency. Thus, the greater the level of digital tools' adoption, the more innovation has improved, organizations have adapted to market shifts, and satisfy the emerging customer requirements. This result brings further attention to the subject of how organizations should ensure that they establish themselves and develop strategic capabilities in the digital space. On the other hand, Authority, Awareness, Legal Protection, and Confidence were significantly related to Technological Innovation while the level of significance with Technological Innovation was not significant with the level of IPR. As in the case of IPR, which has always been in charge of giving legal security and motivations for research and development, the results seem to suggest that its straight impact on Technological Innovation in this scenario may not be particularly significant. This implies that the relationship between IPR and innovation may not be so straightforward or direct, and may be indirect in some ways, possibly being related to some other conditions such as market factors or firm level approaches. Future studies may investigate these indirect routes and the circumstances when IPR may be a more sensible determinant of innovation. Equally, the WTO Compliance variable did not establish a strong relationship concerning the Technological Innovation factor. This result implies that compliance with IFAN standards is important for the general conventional trade and regulatory convergence may not affect Innovation in the short-run. WTO Compliance may have had a less direct influence on innovation, and some possible effects may either be indirect or might not be discernible in the short term. All in all, the study establishes the significance of Digital Transformation for Technological Innovation while identifying some domains in which the impact of IPR and WTO Compliance is likely to be less direct. Managers should realize that it is high time that organizations strive to

exploit developments in digital technologies as a source of innovation, given that there are other aspects of the organizational environment, such as IPR and international trade compliance that may differently impact innovation. Further studies should investigate these relations by presenting more variables and conditions so that the explanation of Technological Innovation in various contexts could be enhanced in the future.

IMPLICATIONS

Practical Implications

The implications of the study are that China needs to integrate digital transformation as the strategic approach through which the manufacturing sector boosts technology advancement and global competitiveness. It is recommended that companies embrace technological advancement, and the appropriate technologies are AI, big data, and IoT since they will help enhance production along with the quality of the products in the market. Also, there is an emphasis on the need to improve measures for the protection of IPRs, with the war on piracy noted as a significant factor. Thus, policymakers should emphasize innovation safety by strengthening institutional protection of innovators' initiatives. Furthermore, although China must follow WTO standards, the latter requires the exact outlined targeted policies that encourage innovations in the country. These entail support and funding systems to promote an innovative climate within a country or region. In this sense, by tackling these practicalities, China could improve the outlook of its manufacturing sector on the international stage.

Theoretical Implications

The above practical considerations provide profound theoretical lessons regarding the relationships between digital transformation, IPR, and innovation. The central place that digital transformation occupies in the process of driving innovation means that the subsequent theoretical concepts should take this factor into account as the main driver of innovation results in manufacturing. The insignificant findings regarding the effects of IPR and WTO compliance on the reported innovation-related challenges question theories that state comprehensive regulations as the determinants of innovation. This suggests that the research requires a better understanding of Protection of IPR and compliance with International regulation on the one hand and the Market as well as Policy implications on innovation on the other. Moreover, the conclusions support the theoretical proposals which account for the state and particulars of the Chinese manufacturing context including enforcement effectiveness and stimulus to innovation. This approach offers a more holistic scheme of studying DT, IPR, and innovation in emerging economies.

LIMITATIONS

Of course, this study has some limitations that may affect the generalization of the research results. Firstly, the study is carried out based on the context of manufacturing industries in China only, which limits the extendibility to other industries or countries. Second, the insignificance of IPR and WTO compliance to innovation raises implications about the measurement of these constructs as it is possible that these constructs could have moderative effects that were not measured in this study. Also, the study is based on cross-sectional data, which can cause problems connected with the definition of the causal relationships and the analysis of changes in time. Further research could be more useful and valuable in case it is long-term and would focus on the changes in the digital transformation process and the role of the regulating factors during the longer time span. Finally, the application-based implications can be different based on the regional or specific industrial conditions in China, which might need further research.

FUTURE SUGGESTIONS

Future studies should endeavor to resolve such shortcomings that beset the current study; this would entail using a larger cross section of sectors as well as countries to increase the extensiveness of the study. Theoretically, the scope could be extended to deals with other industries and regions to offer more general insights into the effects of the process on innovation all around the world. Further research should differentiate IPR and WTO in their components and examine how these aspects affect innovation. Perhaps, using longitudinal research designs could provide the temporal dimension of how DT, IPR, and compliance interact with one another. However, studying the context in different regions of China and other emerging economies might reveal issues and opportunity specifics. Such an approach would enable systematic and accurate policy prescriptions and intervention recommendations based on the specific environment.

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