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How Does Digitization Affect Sports Industry Development and Public Health?

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ABSTRACT

Speeding up digital development and building "digital China" is an important strategic deployment of the "14th Five-Year Plan" and a concrete measure to promote the high-quality development of China's sports industry and national health. Based on provincial data in China from 2011 to 2019, an empirical model is used to analyze the relationship between digital construction, sports industry development and national health investment. The results show that digitalization is instrumental for sports industry development and the improvement of national health in China. Digitalization has promoted the healthy development of sports industry and national health by increasing the input of public science and technology.

KEYWORDS

Digitization; Sports industry development; National health; China

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1. Introduction

China attaches great importance to the construction of a strong sports country, always gives priority to the improvement of national health, and promotes the deep integration of sports industry development and national health. With the in-depth implementation of the strategy of national fitness, the construction of a healthy China and a strong sports country has taken new steps. At a new starting point, accelerating the construction of a strong sports country, continuously developing sports undertakings and constantly improving the national health level can deeply tap the comprehensive value and multiple functions of sports and make sports play a greater role in social and economic development (Al-Hazzaa et al., 2018). At the same time, with the application of the new generation of information technology, the digitalization process in various countries is accelerated (Jiang et al.,2021). Digitalization is fully integrated into all fields and the whole process of human economic, political, cultural, social and ecological civilization construction, which brings extensive and profound influence to human production and life (Hussain et al.,2022). For sports industry and national health, digitalization plays an important role in factors of sports industry development, structure optimization and benefit promotion, and it also has an impact on national health. China's "14th Five-Year Plan for Sports Development" clearly puts forward that the digitalization strategy of sports industry should be implemented, and the role of sports data as an innovation engine and basic resource should be brought into play (Wu et al., 2022). This paper attempts to use the statistical data before the epidemic to investigate the influence mechanism of digital transformation on regional sports development and health, as well as the differentiated influence in different urbanization development levels, regional types and Internet terminal levels. The conclusion of this paper is helpful to explore the effect of the guiding development of digital construction from the national macro perspective, and then provide theoretical reference for the strategic decision of building a digital system.

2. Research design

2.1. Variables

(1) Dependent variables: sports industry development and national health investment. The construction of sports facilities is the starting point of sports industry, and the expenditure for construction represents the development level of regional sports industry to some extent. Therefore, the natural logarithm of the amount of funds invested in public sports is adopted to measure the sports industry development. For national health investment, the natural logarithm of health investment in each province is used to measure the national health investment.

(2) Independent variable: digitization. Based on the evaluation indicators of Internet development proposed in the World Internet Development Report issued by the United Nations, and following the relevant, objective, data availability and timeliness principles, three first-level indicators and nine second-level indicators are selected as the measurement system of digitization level (see Table 1). Among them, digital infrastructure, digital application and digital industry development are the first-class indicators, so as to more comprehensively evaluate the digitization level of all provinces (cities) in China. There are mainly subjective evaluation methods and objective evaluation methods, among which the objective evaluation methods include principal component analysis and entropy method. Referring to Wu et al. (2022), we use entropy method considering time effect.

Table 1. Measurement indicators of digitization.

First-level index	Second-level index	Third-level index	Data source
Digitization	Digital infrastructure	Internet penetration (%)	*China Statistical Yearbook*
		Number of websites (ten thousand)	
		Domain name number (ten thousand)	
	Digital application	Digital life index（%）	National Information Center Global Information Society Development Report
		Digital life index（%）	
		Number of websites owned by enterprises（1 unit）	
	Digital industry development	Revenue from software products (10,000 yuan)	*China Statistical Yearbook*
		Software business income (10,000 yuan)	
		Information technology service income (10,000 yuan)	

(3) Control variables. Considering the influence of other factors on the development of sports industry and national health investment, referring to relevant research, the mortality rate (*Dr*), industrial structure (*Thr*), education development (*Edu*), population size (*Tp*) and infrastructure construction (*Inf*) of each province are selected as control variables. See Table 2 for the definition and calculation method of variables.

Table 2. Definition of variables.

Variables	Symbols	Definition
Dependent variables	*PE_invest*	Natural logarithm of sports investment
	Health_invest	Natural logarithm of national health investment
Independent variables	*Digital*	Digitization (entropy method)
	Pub_science	Natural logarithm of public expenditure on science and technology
Control variables	*Dr*	Mortality rate (%)
	Thr	Proportion of tertiary industry (%)
	Edu	Proportion of students with high school education or above (%)
	Tp	Natural logarithm of total population
	Inf	Index of infrastructure construction

2.2. Model

Model (1) is constructed to examine the impact of digitalization on the development of sports industry.

$$PE\_invest_{i,t} = \alpha_1 + c_1 \times Digital_{i,t} + \sum_{j=1}^{5} \beta_j Control_{i,t} + \varepsilon_{i,t} \quad (1)$$

Model (2) is constructed to examine the impact of digitalization on national health investment.

$$Health\_invest_{i,t} = \alpha_2 + c_2 \times Digital_{i,t} + \sum_{j=1}^{5} \beta_j Control_{i,t} + \varepsilon_{i,t} \quad (2)$$

2.3. Sample selection and data source

In this paper, the provinces of China from 2011 to 2019 are selected as the initial research objects, and the

original data are screened and processed as follows: (1) Eliminate the sample data with missing observations; (2) In order to control the influence of extreme values, continuous variables are winsorized at 1% and 99% levels. After the above processing, the unbalanced panel data are finally obtained. The data used in this paper come from *China Statistical Yearbook*, Global Information Society Development Report issued by National Information Center and WIND Terminal Database, and the data processing software used is Excel2013 and Stata16.0.

3. Empirical analysis

3.1. Regression results

According to Table 3, the results show that the improvement of digitalization has weakened the efficiency of sports industry development along with the constraints of control variables. However, digitalization is still positively related to *PE_invest*.

Table 3. Digitalization and sports industry development.

Variables	*PE_invest*					
	(1)	(2)	(3)	(4)	(5)	(6)
Digital	8.862***	8.678***	8.469***	7.201***	5.403***	4.259***
	(0.185)	(0.230)	(0.249)	(0.309)	(0.393)	(0.423)
Dr		0.061	0.086*	0.088**	0.056	0.072**
		(0.046)	(0.047)	(0.043)	(0.039)	(0.036)
Thr			-0.711**	-2.792***	-2.224***	-0.793*
			(0.340)	(0.462)	(0.426)	(0.477)
Edu				1.268***	0.766***	0.882***
				(0.208)	(0.203)	(0.190)
Tp					2.711***	3.698***
					(0.418)	(0.430)
Inf						-1.271***
						(0.236)
Constant	1.808***	1.760***	2.134***	-0.729	-21.358***	-29.001***
	(0.065)	(0.075)	(0.194)	(0.502)	(3.214)	(3.309)
Fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	208	208	208	208	208	208
R-squared	0.926	0.927	0.929	0.941	0.952	0.959

*Note: The standard error is in (), and *, * * and *** represent that the estimated coefficients are significant at 10%, 5% and 1% levels, respectively (The same below).*

Table 4 shows the impact of digitalization on national health investment. In Column (1), the fixed effects are controlled, *Digital* and *Health_ Invest* passed the significance test at 1% level and showed a positive correlation with it (coefficient is 1.125). After all control variables were added, the research results still showed that digitalization promoted national health investment.

Table 4. Digitalization and national health investment.

Variables	*Health_invest*					
	(1)	(2)	(3)	(4)	(5)	(6)
Digital	1.125***	1.948***	-0.024	1.000***	2.970***	1.941***
	(0.323)	(0.392)	(0.223)	(0.281)	(0.339)	(0.362)
Dr		-0.273***	-0.034	-0.036	-0.000	0.015
		(0.078)	(0.042)	(0.039)	(0.034)	(0.031)
Thr			-6.711***	-5.030***	-5.653***	-4.364***
			(0.304)	(0.421)	(0.368)	(0.409)

Edu				-1.024***	-0.474***	-0.370**
				(0.190)	(0.176)	(0.163)
Tp					-2.971***	-2.083***
					(0.361)	(0.369)
Inf						-1.144***
						(0.202)
Constant	4.798***	5.014***	8.551***	10.864***	33.474***	26.593***
	(0.114)	(0.127)	(0.173)	(0.458)	(2.775)	(2.837)
Fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	208	208	208	208	208	208
R-squared	0.062	0.122	0.762	0.795	0.851	0.874

3.2. Mechanism analysis

Digital construction needs a lot of capital investment. With the development of digitalization, the expenditure on public science and technology (PST) will increase correspondingly. With the increase of public expenditure on science and technology, sports industry has ushered in an era of excellent development. The specific development path is as follows: scientific and technological achievements are transformed into new products of sports industry, and the scientific and technological content of sports industry in China is enhanced, thus enhancing industrial vitality and international competitiveness, accompanied by the increase of national health investment. Therefore, digitalization has promoted the increase of PST, and further influenced the development of sports industry and national health investment in this area. Next, the above mechanism is tested. Therefore, Model (3) is constructed to examine the impact of digitalization on general public finance expenditure on science and technology.

$$Pub\_science_{i,t} = \alpha_3 + a \times Digital_{i,t} + \sum_{j=1}^{5} \beta_j Control_{i,t} + \varepsilon_{i,t} \quad (3)$$

We construct models (4) and (5), and combine models (1), (2) and (3) to set up an intermediary effect equation group to examine whether the intermediary effect of PST exists.

$$PE\_invest_{i,t} = \alpha_4 + c_1{}' \times Digital_{i,t} + b_1 \times Pub\_science_{i,t} + \sum_{j=1}^{5} \beta_j Control_{i,t} + \varepsilon_{i,t} \quad (4)$$

$$Health\_invest_{i,t} = \alpha_5 + c_2{}' \times Digital_{i,t} + b_2 \times Pub\_science_{i,t} + \sum_{j=1}^{5} \beta_j Control_{i,t} + \varepsilon_{i,t} \quad (5)$$

Models (1), (3) and (4) are intermediary effect equations with sports industry development as the dependent variable, and models (2), (3) and (5) are intermediary effect equations with the national health investment as the dependent variable. According to the definition of intermediary effect, $c_1$and c_2 respectively indicate the total effect of digitalization on the development of sports industry and national health investment; $c_1{}'$and $c_2{}'$ indicate the direct effect of digital level on sports industry investment and national health investment respectively after PST is controlled. The coefficients of *a* and *b* indicate the indirect effect of digitalization on sports industry development and national health investment. According to the stepwise regression coefficient method (Baron and Kenny, 1986), if *a*, *b* and *c* are significant at the same time, the intermediary effect is significant. As can be seen from Table 5, *Digital* in Column (1) is significantly positive, indicating that the higher the level of digitalization is, the greater the PST is. The results in Column (2) show that the coefficients of *Digital* and *Pub_science* are both significantly positive, which indicates that PST's influence on the development of sports industry is still positive, after control of the intermediary variable of public expenditure on science and technology; and the direct effect of *Digital* on sports PE_invest is also positive, with the size of 3.588. Column (3) shows that the input coefficients of *Digital* and

Pub_science to national health are still positive, indicating that after control of Digital, the effect of intermediary variable PST is still significant, and the direct effect of digitalization is also positive. Therefore, according to the stepwise regression coefficient method, it can be judged that the intermediary effect of PST is significant.

Table 5. Mechanism analysis results.

Variables	*Pub_science*	*PE_invest*	*Health_invest*
	(1)	(2)	(3)
Digital	2.878***	3.588***	1.343***
	(0.746)	(0.402)	(0.342)
Pub_science		0.233***	0.208***
		(0.039)	(0.033)
Dr	0.115*	0.046	-0.009
	(0.064)	(0.034)	(0.029)
Thr	-5.609***	0.516	-3.200***
	(0.842)	(0.487)	(0.414)
Edu	-0.138	0.914***	-0.341**
	(0.336)	(0.174)	(0.148)
Tp	-3.511***	4.517***	-1.354***
	(0.759)	(0.416)	(0.354)
Inf	-0.241	-1.215***	-1.094***
	(0.417)	(0.216)	(0.184)
Constant	33.197***	-36.747***	19.702***
	(5.841)	(3.286)	(2.796)
Fixed effect	Yes	Yes	Yes
Observations	208	208	208
R-squared	0.601	0.966	0.897

4. Conclusions

Based on the panel data of China's provinces in 2011-2019, this paper empirically tests the relationship between digitalization, sports industry development and national health investment in China. According to the research results, the following conclusions and suggestions are drawn. First, there is a positive correlation between digitalization and sports industry development. Second, digitalization is positively related to national health investment. Third, digitalization can influence sports and healthy development through the intermediary channel of general public finance expenditure on science and technology. Fourth, digital development should adhere to targeted reform, and strengthen the flexibility and inclusiveness of this initiative.

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Declaration of Competing Interest

All authors claim that the manuscript is completely original. The authors also declare no conflict of interests.

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