

A Study on the Impact of Digitization-driven Corporate Green Innovation --a Mediating Perspective Based on Absorptive Capacity

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Abstract. Given the increasing environmental challenges and rapid advancements in digital technologies, there has been significant interest in promoting green innovation and digital transformation among enterprises. However, there are not many articles linking the two. Therefore, this paper uses data from 2017-2021, ordinary least squares is applied to verify whether corporate digitization can positively affect green innovation and to explore the role of absorptive capacity in the existence between the two. It is also found that AC plays a different role in ED for different types of GI.

Keywords: Green innovation; Absorptive capacity; Enterprise digitalization; Green substantive innovation; Green strategic innovation

1 Introduction

With the in-depth development of the new round of technological revolution and the increasing prominence of environmental problems, people are beginning to pay attention to the impact of ED on GI. However, the interaction between green innovation and digitalization of enterprises in China is still at a preliminary stage. Considering enterprise innovation from the perspective of innovation chain, the resource integration dilemma, innovation cost dilemma and power output dilemma of enterprises are all important factors that restrict the synergistic development of digitalization and greenization, therefore, how to use digitalization to empower and accelerate the transformation and development of Chinese enterprises towards digitalization, intelligence and greenization It becomes a major issue at present.

1.1 Enterprise digitalization and Green innovation

ED can improve sustainable GI in enterprises^[1], and ED can encourage enterprises to combine GI activities with digital technologies, reducing enterprise energy consumption^[2], and achieving cost reduction and efficiency^[3; 4], and provide technical support and financial guarantee for sustainable green innovation^[5]. Therefore, H1 is as follows.

H1: Digitalization can help companies increase their level of green innovation.

1.2 Enterprise digitalization, Absorptive capacity and Green innovation

Through digitization, facilitating the acquisition, absorption, and application of external knowledge by firms^[6; 7]. Specifically, digital technologies fundamentally change the way companies interact with their external environment^[8]. In summary, we argue that digitization can increase absorptive capacity, proposing hypothesis 2:

H2: ED has a positive impact on AC.

H3: AC positively influences GI.

Based on this, this paper also tries to put forward the following contents:

H4: AC mediates the relationship between ED and GI.

2 Study Design

2.1 Sample selection and Variable definition

The research sample selected for this paper is: 2017-2021 Chinese A-share listed companies, and excluding financial excluding ST or PT. The variables are shown in Table 1 below.

Table 1. Variables and measurements.

Variable Type	Variable Name	Symbol	Variable Definition
Dependent variable	Green innovation	GI	The number of independent green patents obtained by enterprises + 1 takes the natural logarithm
Independent variable	Enterprise digitalization	ED	Drawing on the research ideas of Wu Fei et al. (2021) and Yuan Chun et al.
Mediating variables	Absorptive capacity	AC	(R&D expenditure divided by revenue) *100
Control variables	Enterprise Age	ListAge	Ln(Year plus 1 minus year of listing)
	Enterprise size	Size	Natural logarithm of total assets
	Nature of ownership	SOE	Dummy variables: 1 = state-owned, 0 = other
	Concentration of ownership	Top1	The number of shares held by the largest shareholder divided by the total
	Financial leverage	Lev	Total liabilities / total assets
	Earnings Capacity	ROA	Net profit/total assets

2.2 Model construction

The following mediating effect model is constructed in this paper^[9], where CON is the control variable; INT is the mediating variable.

$$GI_{i,t} = \alpha_0 + \alpha_1 DIG_{i,t} + \beta CON_{i,t} + \varepsilon_{i,t} \quad (1)$$

$$INT_{i,t} = b_0 + b_1 DIG_{i,t} + \beta CON_{i,t} + \varepsilon_i \quad (2)$$

$$Res_{i,t} = c_0 + \lambda INT_{i,t} + c_1 DIG_{i,t} + \beta CON_{i,t} + \varepsilon_{i,t} \quad (3)$$

3 Empirical Analysis

3.1 Descriptive statistics

Table 2. Descriptive statistics.

variable	N	mean	p50	sd	min	max
ED	12680,000	1,820	1,609	1,473	0,000	6,306
GI	12680,000	0,370	0,000	0,753	0,000	6,213
AC	12680,000	5,130	3,929	5,156	0,000	76,350
Size	12680,000	22,311	22,125	1,307	19,213	28,502
ListAge	12680,000	2,144	2,197	0,805	0,000	3,367
SOE	12680,000	0,270	0,000	0,444	0,000	1,000
Top1	12680,000	0,324	0,302	0,142	0,024	0,891
Lev	12680,000	0,408	0,404	0,187	0,008	1,081
ROA	12680,000	0,042	0,042	0,080	-0,931	0,880

This is shown in Table 2 that: there is a large variation in corporate GI, with a mean value of 0.37 for GI. The mean value of GI is 0.37. In addition. The level of absorptive capacity also shows a large difference in different enterprises, with a mean value of 3.929.

3.2 Regression analysis

Table 3. Regression results (1).

	(1) GI	(2) GI	(3) GI	(4) AC
ED		0,036*** (0,0044)	0,020*** (0,0046)	0,956*** (0,0285)
AC			0,016*** (0,0014)	
Size	0,143*** (0,0069)	0,137*** (0,0069)	0,141*** (0,0068)	-0,221*** (0,0440)
List Age	-0,110*** (0,0102)	-0,110*** (0,0102)	-0,102*** (0,0102)	-0,468*** (0,0654)
SOE	-0,005 (0,0172)	0,005 (0,0172)	0,010 (0,0171)	-0,310** (0,1098)
Top1	-0,192*** (0,0489)	-0,150** (0,0490)	-0,077 (0,0491)	-4,445*** (0,3136)
Lev	0,364***	0,380***	0,482***	-6,179***

	(0,0435)	(0,0434)	(0,0440)	(0,2780)
ROA	0,108	0,166	0,261**	-5,740***
	(0,0902)	(0,0902)	(0,0901)	(0,5772)
_cons	-2,671***	-2,640***	-2,864***	13,621***
	(0,1343)	(0,1340)	(0,1346)	(0,8575)
N	12680	12680	12680	12680

This is shown in Table 3 that Size and Lev have a positive effect on GI, and List Age and Top1 have a negative effect on GI. The results show that ED has a positive effect on AC, thus supporting H2. The results also show that both ED and AC have a positive effect on GI. These effects are significant. So H3 and H4 are confirmed.

3.3 Robustness test

The measure of the degree of digitalization of replacement firms was used to further verify the robustness of the empirical results^[10], and the test results are shown in Table 4 below. Overall, the regression results are not significantly different from the previous findings, indicating that the conclusions are more robust.

Table 4. Regression results (2).

	(1)	(2)	(3)	(4)
	GI	GI	GI	AC
ED-B		0,039***	0,019**	1,142***
		(0,0058)	(0,0060)	(0,0374)
AC			0,017***	
			(0,0014)	
Size	0,143***	0,138***	0,141***	-0,232***
	(0,0069)	(0,0069)	(0,0069)	(0,0444)
ListAge	-0,110***	-0,109***	-0,101***	-0,435***
	(0,0102)	(0,0102)	(0,0102)	(0,0659)
SOE	-0,005	0,003	0,009	-0,348**
	(0,0172)	(0,0172)	(0,0171)	(0,1106)
Top1	-0,192***	-0,157**	-0,080	-4,554***
	(0,0489)	(0,0490)	(0,0492)	(0,3158)
Lev	0,364***	0,368***	0,478***	-6,499***
	(0,0435)	(0,0434)	(0,0441)	(0,2797)
ROA	0,108	0,148	0,252**	-6,117***
	(0,0902)	(0,0902)	(0,0900)	(0,5808)
_cons	-2,671***	-2,703***	-2,904***	11,857***
	(0,1343)	(0,1342)	(0,1343)	(0,8638)
N	12680	12680	12680	12680

4 Further analysis

In order to further analyze the influence mechanism of ED on GI, This paper makes the following research with reference to relevant literature^[11; 12]. As shown in Table 5 below, ED promotes both, and AC mediates between the two. The mediating effect of AC on GSI-1 is higher than that of GSI-2. At the same time, it can be found that the mediating role of AC between ED and GSI-1 is higher than that between GSI-2.

Table 5. Regression results (3).

	(1) Green substantive innovation (GSI-1)	(2) Green substantive innovation (GSI-1)	(3) AC	(4) Green strategic innovation (GSI-2)	(5) Green strategic innovation (GSI-2)
ED	0,146*** (0,0306)	0,107*** (0,0319)	0,956*** (0,0285)	0,093* (0,0420)	0,067 (0,0439)
AC		0,040*** (0,0095)			0,027* (0,0131)
Size	1,000*** (0,0472)	1,009*** (0,0472)	-0,221*** (0,0440)	0,930*** (0,0649)	0,936*** (0,0650)
ListAge	-0,446*** (0,0702)	-0,428*** (0,0703)	-0,468*** (0,0654)	-0,474*** (0,0965)	-0,462*** (0,0967)
SOE	-0,089 (0,1179)	-0,077 (0,1179)	-0,310** (0,1098)	-0,342* (0,1622)	-0,333* (0,1622)
Top1	-2,200*** (0,3368)	-2,021*** (0,3392)	-4,445*** (0,3136)	-1,591*** (0,4632)	-1,472** (0,4668)
Lev	-0,655* (0,2985)	-0,407 (0,3040)	-6,179*** (0,2780)	1,250** (0,4105)	1,416*** (0,4184)
ROA	-0,693 (0,6198)	-0,462 (0,6218)	-5,740*** (0,5772)	0,694 (0,8525)	0,848 (0,8557)
_cons	-19,946*** (0,9208)	-20,495*** (0,9292)	13,621*** (0,8575)	-18,808*** (1,2664)	-19,173*** (1,2787)
N	12680	12680	12680	12680	12680

5 Conclusions

This article explores the relationship between ED, AC, and GI. Using companies from 2017-2021, the paper's empirical analysis finds that ED can positively contribute to GI, while AC mediates this relationship. This paper also reveals the differences in the impact of digitalization on different types of green innovation.

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