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# How Digital Business Penetration Influences Farmers' Sense of Economic Gain: The Role of Farmers' Entrepreneurial Orientation and Market Responsiveness

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**ABSTRACT** The extensive development of digital business in the countryside has had explicit and implicit influences on farmers' production, lifestyle and cognitive mode and has had an impact on their sense of economic gain (SEG). This study aims to determine whether digital business penetration (DBP) improves farmers' SEG in traditional villages in western China, and if significant, this study seeks to determine the mechanism. Based on questionnaire responses from 343 farmers, the empirical results indicate the principle in three ways. First, farmers' SEG grows with business digitization, especially in traditional minority villages. Second, farmers' entrepreneurial orientation (EO) partially mediates DBP's positive effect on SEG. Third, farmers' market response capacity (MRC) plays a positive moderating role, which indicates that in comparison with farmers who have a lower response to market changes, farmers who have a higher response to market changes have a higher SEG promoted by DBP. Furthermore, DBP's impact on farmers' SEG is upgraded throughout their EO, boosted by their MRC. Thus, farmers' MRC is a significant influencing factor for improving their entrepreneurial intention, enhancing their attitude toward digitization and increasing their SEG.

**INDEX TERMS** Digital business penetration, sense of economic gain, entrepreneurial orientation, market responsiveness, farmers.

## I. INTRODUCTION

With the progress of information technology and the popularization of the Internet, an increasing number of scholars have begun to pay attention to the impact of digital business on farmers' sense of economic gain (SEG). At present, most studies mainly focus on the explicit influence of digital business on farmer incomes by people's increased inclination to start digital businesses or improve the performance of new enterprises by improving digital literacy to increase their incomes [1]–[5]. Some scholars further provide empirical evidence that concludes that farmers' participation in e-commerce could increase their SEG [6]. Nonetheless, the implicit mechanism of digital business's influence on farmers' SEG is not revealed. We find that, in reality, improvements in infrastructure, the popularization of smartphones, and the rapid development of digital ventures have quietly changed the production and lives of farmers

(such as changes in the commodity purchase channel, the patterns of payment, reading habits, and even investment behavior); nevertheless, most farmers do not have digital literacy [7]. We regard this influence as digital business penetration (DBP), which refers to the extent to which farmers have developed new digital business awareness due to changes in their production and lives as digital business spreads into the countryside. DBP does not directly promote farmer entrepreneurship. However, it will help farmers become better embedded in the rural entrepreneurship ecosystem (e.g., they will become an integral part of the agricultural products supply chain) by influencing their business awareness and changing their production and sales modes [8], [9].

This situation has occurred under China's unique rural management system.<sup>1</sup> China is a typical small-scale

<sup>1</sup>The dual management system characteristic of centralization and decentralization based on the family contractual operation is an introductory Chinese countryside management system. One aspect is family contract management, and the other is collective management.

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peasant society. The primary production and management units in rural areas are peasant households similar to those in other countries [10]–[12]. However, China's agriculture-related indicators are significantly lower than their averages worldwide.<sup>2</sup> Although many studies have shown that entrepreneurship is a crucial way to reduce poverty [13], [14], it is difficult for a fragmented, small household (e.g., in China) to reduce poverty in that way because it lacks the endowment and conditions needed to start a successful business compared with the resources of richer (endowed) households [15], [16]. Therefore, the rural cooperative, which refers to an agricultural venture composed of a mass of small households in a village, is a community economic organization being vigorously developed in China. Farmers only participate in the production process; the sales process is handed over to the cooperative. This organizational form reduces the production and management risks for individual farmers to achieve economic scale. In recent years, many rural cooperatives in China have boosted farmers' incomes through the vigorous development of e-commerce. Cooperatives are more motivated and capable than farmers to increase their entrepreneurial performance by improving their digital literacy.

Therefore, we believe that digital business's impact on farmers' SEG can be summarized into two aspects: (1) Farmers obtain a greater SEG by acquiring more digital technological capabilities that increase their entrepreneurial orientation (EO) and entrepreneurial performance; (2) farmers increase their SEG by DBP, which enables them to change their production and management philosophy and methods, thus triggering them to embed themselves in the rural digital entrepreneurial ecosystem. However, the present studies mainly focus on the first aspect (as mentioned above), and the second aspect is still ignored. However, we believe that the latter may be more realistic in reducing rural poverty, which is an essential aspect of assessing the inclusiveness of digital business development. This study aims to provide an analytical framework to explain "how digital penetration affects farmers' SEG." In this process, farmers' EO and MRC will play a mediating role. It is worth noting that EO here does not refer to the motivation and willingness of people to pursue entrepreneurial opportunities [27] but to the motivation and willingness of farmers to join the digital entrepreneurial ecosystem.

Furthermore, this article selected five villages in Guizhou Province, China, to carry out an 8-month survey (from October 2019 to June 2020). Guizhou is located in southwest China with rudimentary economic and agricultural development modes. However, with the rise of the big data industry in Guizhou in recent years, DBP from the city to the countryside at an unprecedented speed has a strong impact on traditional agriculture. Therefore, Guizhou's unique development

<sup>2</sup> [http://finance.sina.com.cn/worldmac/indicator\\_AG.LND.ARBL.HA.PC.shtml](http://finance.sina.com.cn/worldmac/indicator_AG.LND.ARBL.HA.PC.shtml)

environment effectively provides a natural laboratory. Our objectives are as follows:

- (1) To postulate that DBP improves the SEG of farmers in traditional villages in western China.
- (2) To determine whether the EO of farmers has a mediating role between DBP and farmers' SEG.
- (3) To prove that the MRC of farmers moderates the role of DBP on farmers' SEG.

The remainder of the study is structured as follows. In section 1, we review the related literature to identify the relationship between DBP and farmers' SEG, and the mediating and moderating roles of EO and MRC are explored. Next, we employ mature scales to measure each variable and conduct the empirical analysis to examine six hypotheses. The results are shown in the next section, followed by a detailed discussion. In the final part, we put forward theoretical contributions, managerial implications, and limitations.

## II. THEORETICAL DEVELOPMENT AND HYPOTHESES

### A. DBP AND FARMERS' SEG

Digital business can be defined as "transforming the way you do business by taking advantage of the new strategic options enabled by digital technologies" [17] or how "information and communication technologies facilitate businesses to carry out their existing processes faster and more globally" [17]. Digital businesses originated and have flourished in cities. Thus, this study defines DBP as the coverage of digital technology in rural areas. As farmers have begun to more widely adopt digital technologies, new management consciousness and new professional roles have come into being. On the basis of existing studies, we assume two dimensions to measure DBP. The first aspect refers to the richness of business data that farmers receive. Large amounts of data can bring meaningful business opportunities [18], [19]. The second aspect is the data-absorbing capacity of farmers, which we define as farmers' proficiency at deriving knowledge from classifying and integrating a large amount of data.

The concept of sense of gain is that of improving people's living standards and their subjective satisfaction [20]. One crucial dimension of sense of gain is SEG, which refers to individuals' subjective satisfaction based on actual economic income [21]. In China, where farmers are conservative, SEG does not necessarily mean that their income will increase but rather that their income will be stable, which can boost their confidence and give them a stronger SEG. Furthermore, scholars have posited three components of SEG: (1) subjective judgment based on comparison with others' incomes; (2) the personal feeling derived from the comparison of current and past economic conditions; and (3) expected income and the subjective feeling that comes from realizing that income [20].

Can DBP improve farmers' SEG? In the context of China, digital business is operated through offline stores on e-commerce platforms and then adopted and accepted by farmers. Such a mode can promote order-based production and sales by farmers, reduce their market risk, and stabilize

their income, consequently improving their SEG. From the perspective of the mechanism, improvements in the ability to analyze big data and popularization of the Internet have formed a new resource allocation mechanism. As a mechanism of resource allocation, digital business will have different influences on farmers' SEG. Remarkably, by reducing intermediate links, buyers and sellers can reduce costs and increase profits, which promotes improvement of their SEG [18]. China has a typical small-scale peasant economic system, making it difficult for farmers to participate in the commercial operations of agricultural products individually, and thus farmers have low incomes. By contrast, digital business can act as a driving force that brings greater opportunities for individuals who depend on agriculture to participate in economic activities [6], [22], subsequently improving the economic benefits of farmers and making them personally feel those benefits [6]. To that end, we propose the following hypothesis:

**H1: DBP improves farmers' SEG**

### B. MEDIATING ROLE OF FARMERS' EO

Entrepreneurship is widely appreciated as a key to alleviating income poverty and fostering development in impoverished contexts [23]–[25]. This notion has attracted extensive attention from scholars who study farmers' behavioral domains. Researchers have posited various definitions of farmers' EO. Generally, farmers' EO can be characterized as discovering, evaluating, and adopting new agricultural products and services [26]. Briefly, it means farmers' motivation and willingness to pursue entrepreneurial opportunities [27]. Furthermore, researchers believe that motivation is more significant than entrepreneurial behavior because EO is not only a key influencing factor on the entrepreneurial process but also determines whether a new project will be successful [27]. Specifically, empirical evidence exists of a positive relationship between EO and farmers' performance [28].

Therefore, EO is a crucial factor that is not only affected by rapidly changing external factors but also affects entrepreneurship and plays a vital role in the prosperity of farmers [29]. Previous studies have discussed the antecedent variables and the consequences of farmers' EO. Nambisan [5] noted that the combination of digital technology and entrepreneurship will lead to a digital EO because digital technology can reduce uncertainty. Meanwhile, the absorption of new technologies and the acquisition of digital abilities improve people's enthusiasm for entrepreneurship since these two factors can reduce the cost and risk of starting a business [16], especially for groups at lower income levels. Thus, improvements in the utilization of digital technology will exert a substantial impact on entrepreneurial results.

In addition, some scholars have studied the orientation of farmers' entrepreneurship as a mediating variable. Yang and He examined the mediating effect of farmers' EO between the external factor of the village chief's authority and farmers' incomes [30]. Accordingly, we believe that digital

business penetration is one of the most rapidly changing external factors that will influence farmers' EO and incomes (represented by SEG). Hence, we assume that it should be a mediator between two variables and thus construct the following hypotheses:

**H2: DBP has a positive effect on farmers' EO.**

**H3: Farmers' EO positively affects their SEG.**

**H4: Farmers' EO plays an intermediary role in DBP's positive influence on farmers' SEG.**

### C. MODERATING ROLE OF FARMERS' MRC

A person or an organization's behavior will be affected by uncertain circumstances. Covin and Slevin and Lumpkin and Dess reported that in a dynamic, unpredictable environment, people's thinking and behavior is more sensitive to effectively respond to changes in environmental conditions [31], [32]. Scholars have proposed that the concept of MRC usually refers to the ability to explore, evaluate, and predict market changes and adapt to market conditions. Harraf *et al.* [33] defined MRC as human brain activity derived from perception, analysis, judgment, and decision-making ability related to external information. Chakravarty *et al.* [34] believed that the MRC has two essential functions: one is perception and exploration, which is manifested in innovative actions to obtain new competitive advantages and make a breakthrough, such as developing new products, services, and business models, and the other is the role of a timely response as an ability to adjust to threats or opportunities (e.g., industry environment, consumer preference, and production technology).

Many studies have shown that MRC has a positive effect on individual and organizational performance. Hair *et al.* [35] verified that a person's strong market orientation is an essential factor for the success of digital entrepreneurship. In comparison, Grewal and Tansuhaj [36] proved that market reaction would negatively affect the performance of enterprises after the economic crisis. Inman *et al.* [37] found that the stronger an organization's capacity to respond to the market is, the more effective it will be at improving its behavior. This finding was also verified by Tallon and Pinsonneault [38]. In the Chinese context, Chen *et al.* [39] proved that an organization's market sensitivity is conducive to fully utilizing external opportunities and promoting the ability to innovate. Some scholars have also deemed that the interaction between the external environment (especially information) and MRC will influence most organizations and individuals. Asikha [40] analyzed the samples of 198 enterprise employees and concluded that the degree of a firm's response to the e-commerce market moderates the positive influence of competitiveness on the firm's performance. Narver *et al.* [41] deemed that a diversity of information with sensitivity to the market will form an interaction ability that forces the organization to change. Sinkula [42] claimed that absorption of information is based on people's sensitivity to and intelligence about the market and finally improves decision-making efficiency and quality [42]. Anderson [43]

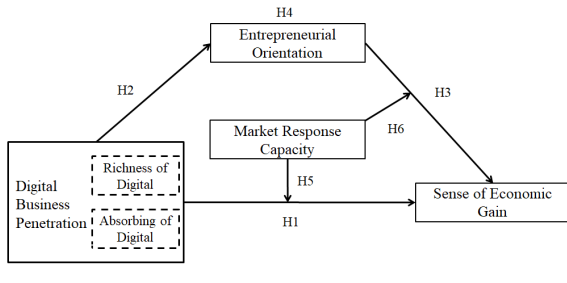


FIGURE 1. Research Model.

tested the moderating role of MRC between EO and strategic learning capacity. Based on existing research designs, we hypothesize the following:

**H5: Farmers' MRC positively moderates the effect of DBP on farmers' SEG.**

**H6: Farmers' MRC positively moderates farmers' EO, promoting the positive effect of digital penetration on farmers' sense of gain.**

Based on the analysis above, the research model is presented in Figure 1.

### III. METHODS

#### A. MEASUREMENT

In this study, the measurement was based on individual subjective cognition, including DBP and others from mature scales. We designed questionnaires that were completed by farmers from Guizhou Province, China. The first section of the questionnaire measured four variables: DBP, EO, MRC, and SEG. The second section measured demographic information, including gender, age, nationality, education, party membership, and service in the villages. The measurement of the questionnaire items in this study used a seven-point Likert scale ranging from strongly disagree to strongly agree. To ensure the validity of the scale used in the survey, we adapted the items from relevant research and existing literature to fit this study's theme and context.

DBP was measured with the scale developed by Davis [44], which consists of 15 items, including "If the e-commerce platform is available, then I will choose to use it" and "I think e-commerce platforms are easy to use." EO was measured using a nine-item scale from Covin and Slevin [31]. The items include "I really enjoy making new products instead of just selling what is already on the market" and "In the past five years, the produce or small handmade products I sell are not the same as before."

We refer to Wang et al. [45] in measuring the SEG. Our scale consisted of eight items, including "I never worry about not having a house to live in" and "My standard of living is similar to that of other villagers." In terms of MRC, we adopted the two-item scale developed by Anderson [43]: (1) When I know what the people in the city want, I sell it to them quickly; and (2) I can find out more quickly than the rest of the village what kind of products people in the city want.

TABLE 1. Respondent demographics (N = 343).

Items	Classification	Number of Samples	Percentage (%)
Gender	Male	221	64.4
	Female	122	35.6
Age	<20	15	4.4
	21–30	75	21.9
	31–40	105	30.6
	41–50	105	30.6
	51–60	33	9.6
	61 and above	10	2.9
Nationality <sup>3</sup>	Han	108	31.5

#### B. DATA COLLECTION AND SAMPLE

A total of 400 questionnaires were obtained in this study. We filtrated the questionnaires based on the completeness of the information and whether the answers to the options were regular. Finally, 343 valid questionnaires remained, with an effective recovery rate of 85.75%. As shown in Table 1, more than half of the participants (64.4%) were male, and most of the respondents were aged between 31 and 50, accounting for 61.2%. The majority of the participants (86%) had attended junior high school or above, and the others were below the degree of primary school. More than 60% of the participants were not members of the Communist Party of China or did not serve in the village.

### IV. EMPIRICAL RESULTS

#### A. RELIABILITY AND VALIDITY ANALYSIS

Mplus 8.0 was used to analyze the reliability and validity of each part of the construct. Table 2 shows the factor loading of each latent variable, composite reliability (CR), convergent validity (AVE), and discriminant validity. The results of the reliability test show that the values of composite reliability for all variables were above 0.7, matching the criterion suggested by Fornell and Larcker (CR>0.6) and showing good reliability of the designed items. Convergent validity and discriminant validity were used to analyze construct validity. The results show that the AVEs of the four variables were all greater than 0.5, whereas all the CRs exceeded 0.7, indicating significant convergent validity. Additionally, given that the AVE for each construct exceeded the corresponding correlations between that specific construct and other constructs, all of the items were discriminant with each other. Moreover, in contrast with any of the alternative nested models, the hypothesized four-factor model was best fitted, supporting the distinctiveness of the constructs.

#### B. COMMON-METHOD VARIANCE

The questionnaires were completed by farmers, which gives rise to common-method bias. To avoid this problem, we designed reverse questions in each construct and applied

**TABLE 2. Reliability and validity analysis.**

Dim.	Items	Item Reliability	Composite Reliability	Convergence Validity		Discriminate Validity		
		Std. Loading	CR	AVE	Response	DBP	Gain	EO
MRC	2	0.775–0.776	0.751	0.601	<b>0.875</b>			
DBP	7	0.716–0.922	0.949	0.727	0.412	<b>0.853</b>		
SEG	3	0.691–0.813	0.793	0.563	0.390	0.572	<b>0.750</b>	
EO	5	0.745–0.849	0.899	0.640	0.421	0.618	0.654	<b>0.800</b>

Note: MRC=MRC; DBP=DBP; SEG=SEG; and EO=EO

**TABLE 3. Structural validity analysis.**

Model	$\chi^2$	DF	$\chi^2/DF$	CFI	TLI	RMSEA	SRMR
Four-factor model (DBP, MRC, EO, and SEG)	307.695	113	2.723	0.956	0.948	0.071	0.035
Three-factor model (DBP+EO, MRC, and SEG)	410.220	116	3.536	0.934	0.923	0.086	0.040
Three-factor model (DBP+MRC, EO, and SEG)	441.043	116	3.802	0.927	0.915	0.090	0.053
Two-factor model (DBP+MRC+EO and SEG)	540.786	118	4.583	0.906	0.891	0.102	0.056
Single-factor model (DBP+MRC+EO+SEG)	723.809	119	6.082	0.865	0.846	0.122	0.070

**TABLE 4. Descriptive statistics and correlation analysis.**

Variables	M	SD	1	2	3	4	5	6	7	8	9	10
1. Gender	1.36	0.479	-									
2. Age	3.28	1.128	-0.233***	-								
3. Nationality	1.69	0.465	-0.152***	-0.032	-							
4. Education	4.16	1.678	-0.008	-0.328***	0.022	-						
5. Party Member	1.67	0.472	0.149***	-0.226***	-0.065	-0.259***	-					
6. Serve in Village	1.69	0.465	0.045	-0.077	0.054	-0.101	0.388***	-				
7. DBP	2.68	1.681	0.001	0.063	0.189***	-0.164***	0.049	0.118**	(0.948)			
8. EO	2.97	1.718	0.002	0.052	0.250***	-0.149***	0.030	0.101	0.855***	(0.898)		
9. MRC	4.01	1.622	0.116**	0.055	0.115**	-0.060	0.048	0.082	0.357***	0.347***	(0.751)	
10. SEG	2.01	1.364	0.012	-0.118**	0.160***	0.044	0.044	0.102	0.520***	0.567***	0.300***	(0.778)

Note: \*\*\*  $p < 0.01$ ; \*\*  $p < 0.05$ ; \*  $p < 0.1$

the single-factor exploratory analysis method of Harman to test the effect of our work. The results showed that the initial eigenvalue of the first factor was 44.894%, which is less than the 50% that Hair suggests. Thus, the common-method problem was not serious in this study. Moreover, the correlation coefficient matrix showed that all of the values were below 0.9 (Table 4), which further proved that common-method variance was within the acceptable range.

**C. DESCRIPTIVE STATISTICS AND CORRELATION ANALYSIS**

Table 4 presents the means, standard deviations, and correlations among the study and control variables. The correlation analysis indicated that DBP was significantly

positively correlated with SEG ( $r = 0.520, p < 0.01$ ) and EO ( $r = 0.855, p < 0.01$ ). Furthermore, EO was positively correlated with SEG ( $r = 0.567, p < 0.01$ )

**D. HYPOTHESIS TESTING**

1) MAIN EFFECT ANALYSIS

To examine the main effect of the theoretical model, we applied regression analysis in Mplus 8.0 software, and the estimator was maximum likelihood (ML). The results of the main effects analysis are shown in Table 5, and the regression equations are shown as functions M1, M2, and M3. The following functions were proposed: SEG EO, DBP, MRC, C1 (gender), C2 (age), C3 (nationality), C4 (education),

TABLE 5. Results of main effect analysis.

Model and Path	M1	M2	M3
	DBP-->SEG	DBP-->EO	EO-->SEG
Path Coefficients	0.595***	0.995***	0.641***
$\chi^2/df$	2.266	2.355	2.264
Model Fit Index			
CFI	0.960	0.958	0.948
TLI	0.952	0.951	0.936
RMSEA	0.061	0.063	0.061
SRMR	0.063	0.064	0.065

C5 (party member), C6 (serve in the village),  $\beta$  (path coefficient),  $\varepsilon$  (error).

Regarding H1 and H2, business data penetration

$$SEG = \alpha_0 + \beta_1 C_1 + \beta_2 C_2 + \beta_3 C_3 + \beta_4 C_4 + \beta_5 C_5 + \beta_6 C_6 + \beta_7 DBP + \varepsilon(M1)$$

$$EO = \alpha_0 + \beta_1 C_1 + \beta_2 C_2 + \beta_3 C_3 + \beta_4 C_4 + \beta_5 C_5 + \beta_6 C_6 + \beta_7 DBP + \varepsilon(M2)$$

$$SEG = \alpha_0 + \beta_1 C_1 + \beta_2 C_2 + \beta_3 C_3 + \beta_4 C_4 + \beta_5 C_5 + \beta_6 C_6 + \beta_7 EO + \varepsilon(M3)$$

positively influenced the sense of gain ( $\beta = 0.595, p < 0.01$ ) and EO ( $\beta = 0.995, p < 0.01$ ), which supports the two hypotheses. EO was also confirmed to have a significantly positive effect ( $\beta = 0.641, p < 0.01$ ) on farmers' sense of gain; thus, H3 is supported. The findings revealed that the greater the amount of business data that penetrates the countryside, the stronger the SEG will be and the more that farmers will exhibit an intent to engage in entrepreneurship. Similarly, enhancing farmers' willingness to start a business could bring a greater sense of gain.

2) MEDIATING EFFECT ANALYSIS

We utilized the bootstrap confidence interval (1000 times) to verify EO's mediating effect between DBP and SEG. The results are shown in Table 6 (see Function 4 and M4 in Table 6).

$$SEG = \alpha_0 + \beta_1 C_1 + \beta_2 C_2 + \beta_3 C_3 + \beta_4 C_4 + \beta_5 C_5 + \beta_6 C_6 + \beta_7 DBP + \beta_8 EO + \varepsilon(M4)$$

Regarding H4, we predicted that farmers' EO mediated the relationship between DBP and SEG. The bootstrap analysis with a confidence interval that did not include zero (bias-corrected 95% CI = 0.274–1.509; percentile 95% CI = 0.293–1.542) indicated that the indirect effect of DBP on farmers' SEG existed and was significantly positive.

TABLE 6. EO's mediated effect between DBP and SEG.

Effect Point (M4)	Estimate	SE.	Est./S.E.	P-Value	Bootstrapping (1000 Times)			
					Bias-corrected 95% CI		Percentile 95% CI	
					Lower	Upper	Lower	Upper
Total	0.607	0.085	7.162	***	0.455	0.797	0.455	0.792
Indirect (M4)	0.808	0.318	2.543	**	0.274	1.509	0.293	1.542
Direct	-0.201	0.322	-0.624	0.532	-0.925	0.352	-0.977	0.336

3) MODERATING EFFECT ANALYSIS

We used hierarchical regression to examine the moderating role of MRC. The regression equations are as follows:

$$SEG = \alpha_0 + \beta_1 C_1 + \beta_2 C_2 + \beta_3 C_3 + \beta_4 C_4 + \beta_5 C_5 + \beta_6 C_6 + \varepsilon(M5)$$

$$SEG = \alpha_0 + \beta_1 C_1 + \beta_2 C_2 + \beta_3 C_3 + \beta_4 C_4 + \beta_5 C_5 + \beta_6 C_6 + \beta_7 DBP + \beta_8 MRC + \varepsilon(M6)$$

$$SEG = \alpha_0 + \beta_1 C_1 + \beta_2 C_2 + \beta_3 C_3 + \beta_4 C_4 + \beta_5 C_5 + \beta_6 C_6 + \beta_7 DBP + \beta_8 MRC + \beta_9 DBP \times MRC + \varepsilon(M7)$$

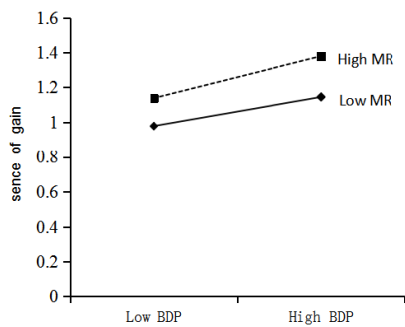
The first step (M1) in the analysis included all the control variables. The results showed that age negatively affected farmers' SEG, possibly because digital business mainly targets young people, and greater penetration of business data will increase the SEG among youths, whereas older people treat it with indifference. The second step (M2) included the independent variable and the moderator, and the results reported in Table 7 confirmed that DBP and MRC were positively related to SEG. In the final step (M3) of the moderation analysis, the interaction term of DBP and MRC was regressed on SEG. As expected, the results confirmed that MRC positively moderated the relationship between DBP and SEG, which supports H5. Moreover, this moderating effect is presented in Figure 2. As shown, the plot of the interaction term shows that DBP was significantly related to SEG in individuals with high MRC. Therefore, Hypothesis 5 is fully supported.

Furthermore, we applied a simple slope analysis to verify the moderating effect, and the graph is shown in Figure 2. According to the data test, the slope of the group with high MRC is 1.21 and that of the group with low MRC is 1.17. Thus, the slope of the two groups does have a significant difference, which provides a more detailed basis for the existence of the moderating effect.

To further understand MRC's moderating role, the conditional indirect effects at different values of the moderator variable were estimated and examined using bootstrapping. On the basis of the study of Cohen, we defined the high and low values as plus and minus one standard deviation

**TABLE 7. Moderating effect analysis of MRC.**

Step	Variables and Models	SEG			
		M5	M6	M7	
①	Gender	0.058	-0.072	-0.102	
	Age	-0.175**	-0.206***	-0.200***	
	Nationality	0.491	0.148	0.145	
	Control Variables	Education	-0.016	0.060	0.052
	Party Member	-0.045	-0.025	-0.033	
	Serve in the Village	0.325*	0.150	0.145	
②	IV	BDP	0.515***	0.451***	
	Moderator	MRC	0.198***	0.225***	
③	Moderate Effect	DBP×MRC		0.079*	



**FIGURE 2. DBP and SEG by MRC.**

**TABLE 8. Moderated mediating effect analysis of MR.**

Situation	Point Estimate	SE.	Est./S.E.	P-Value	Bootstrapping (1000 Times)			
					Bias-corrected 95% CI		Percentile 95% CI	
					Lower	Upper	Lower	Upper
+1SD	0.325	0.108	3.002	***	0.065	0.493	0.080	0.506
-1SD	0.312	0.107	2.930	***	0.054	0.476	0.070	0.491

from the mean of MRC. Table 8 shows the results of the moderated mediating effect analysis. The results showed that in the different levels of MRC, the conditional indirect effects completely vary, which supports H6.

**V. DISCUSSION AND CONCLUSION**

This study aims to expand how DBP affects farmers' SEG. The data analysis results indicated that farmers feel their

economic gain growing along with business digitization, especially in traditional minority villages, including their income compared with that of the past and with that of others and their higher expectations for the future. Additionally, farmers' EO partially mediated the positive effect of DBP on SEG. That is, the stronger the intentions of individuals are to start a business, the greater their realization of the importance of the relationship between digitization and their potential gain. Digitization penetration also promotes farmers' SEG directly and objectively. For instance, lower prices through daily use of the Internet could reduce their living costs. Meanwhile, their MRC ability plays a positive moderating contextual role, which indicates that farmers with a higher response to market changes have a higher SEG, promoted by commercial digital penetration, than farmers with a lower response to market changes. Furthermore, through market EO, boosted by MRC, DBP's influence on their sense of gain is also promoted. Thus, farmers' MRC ability is a significant influencing factor to improve their entrepreneurial intention, enhance their attitude toward digitization, and increase their SEG.

**A. THEORETICAL IMPLICATIONS**

The empirical test results expand the research on digital business and farmers' SEG, and its theoretical contribution mainly lies in three aspects. First, we emphasize that an essential role of DBP is to enhance the SEG of villagers who are less educated (in the context of China). In rural China, many villagers engage in precision production and sales driven by the e-commerce stores near where they live, such as Rural Taobao and Jingdong Fresh. They do not possess the digital ability (or digital literacy) themselves, so they are more likely to indirectly take advantage of DBP's opportunities in rural areas. At the same time, they do not start a business. Nevertheless, they engage in traditional work, while their labor mode shifts from production-oriented to user-oriented, that is, order-oriented production, which reduces their risks and increases their profits [16]. In addition, Neumeyer *et al.* [16] noted that for people under poor conditions, improvement of digital literacy can provide them with better entrepreneurial opportunities. Accordingly, a new academic understanding of digital technology and entrepreneurial motivation at a micro level has been revealed. That is, despite the lack of investment capital and education to learn new technologies in rural China, farmers will find a way to reduce risks and increase incomes through imitation and comparison due to the penetration of digital technologies into rural areas. Moreover, as an increasing number of farmers are involved in the use of digital technology at a macro level, benefits are obtained. To go further, it will encourage them to improve their digital literacy, which makes some of them change their professional roles and become new farmers or businesspeople in new industries. Therefore, the penetration of business data has also changed the division of labor in rural professions, created many new business forms and occupational groups, enriched the types of rural occupations, and led to greater

TABLE 9. Construct and measurement.

Construct	Items	Resource
Business Data Penetration	BDP1: If the e-data in our village is available, I will choose to get in touch with Rural Taobao agency around.	[44]
	BDP2: With the help of the Rural Taobao's staff, I think it is easy to use e-data in our village	
	BDP3: With the increasing familiarity with e-data, my work performance also improves	
	BDP4: Under the influence of e-data platform, my work efficiency also increases	
EO	EO1: I truly enjoy planting new crops instead of just selling what's already on the market	[31]
	EO2: In the past five years, the produce or small handmade crops I sell are not the same as before	
	EO3: Compared with other villagers, I was always the first to introduce new planting techniques	
	EO4: In general, I have a strong preference for high-risk things because of their high return opportunities	
	EO5: In general, I believe that, by the nature of the external environment, it is necessary to take risks to gain more money	
MRC	MRC1: When I know what people in the city want, I can quickly sell them the products	[43]
	MRC2: I can more easily get what people in the city want comparing with the rest of the villagers	
SEG	SEG1: I never worry about not having a steady income	[45]
	SEG2: I do not have to worry about my safety and living standard in our village	
	SEG3: People in our village are harmonious because our income is always increasing	

prosperity for the rural economy. Driven by this, the government will increasingly invest in data facilities and digital education, forming a virtuous cycle for the rural economy.

Second, the results propose a critical mechanism that explains the positive effect of business digitalization on improving farmers' SEG, revealing a partial mediation role of farmers' EO as a bridge linking DBP and farmers' SEG. However, scholars have gradually attached importance to the big data environment's influence on people's sense of gain [6], especially SEG. Nevertheless, most studies are based on cities or rural samples with a higher degree of urbanization, such as Taobao Village in the coastal region of China, and discussion in the context of the traditional countryside (villages that almost rely on agriculture for livelihood) remains scarce. Furthermore, academic research on farmers' entrepreneurial mediating effect has not been fully discussed [23], [29].

Third, this study promotes individuals' market responsiveness, which plays a moderating role in the relationship between the big data environment and farmers' SEG and thus extends the existing studies. Furthermore, this work reveals that market responsiveness can not only positively moderate the effect of digital business on farmers' economic gain but can also strengthen the mediating effect of farmers' EO. Market responsiveness also promotes DBP's positive impact on farmers' SEG, which is not consistent with results from previous studies. Existing research mainly regards market responsiveness as an antecedent variable of organizations' behavior and neglects its moderating and mediating effects [38], [41], [43].

## B. PRACTICAL IMPLICATIONS

This study also has some implications and references for policymakers and decision-makers for reducing rural poverty in small-scale peasant societies. The results indicate that the higher the number of businesses that penetrate rural areas is, the higher the SEG of farmers will be, in which EO plays a positive mediating role. Accordingly, policymakers should increase the construction of big data platforms, facilities, and related infrastructure in traditional agricultural regions to promote the penetration and dissemination of big data environments from urban to rural areas. The partial mediation role of farmers' EO indicates that even if farmers have no entrepreneurial intention, they can also improve their SEG from business digitization penetration. However, if farmers are willing to start their own businesses, the SEG is stronger. Therefore, policymakers may adopt more ways and measures to encourage farmers to start their own businesses or improve their entrepreneurial willingness. For example, policymakers can reward and subsidize rural entrepreneurs (e.g., rural online celebrities who sell goods in rural areas) to form an example of successful entrepreneurship through digitized tools. Another example is to construct a better entrepreneurial atmosphere by introducing entrepreneurial ventures in traditional rural areas. Moreover, the study proposes the importance of farmers' MRC because it not only can directly promote the improvement of business digitization on farmers' SEG but also can strengthen the intermediary role of EO. From the Chinese experience, farmers' market awareness or their market responsiveness is weaker in more



impoverished regions. Therefore, policymakers can start by improving farmers' market awareness and then induce, educate, and especially transform them to concentrate on production into the market. Urban dwellers, for example, are currently increasingly concerned with their health and prefer more ecological agricultural products. Such a market shift should determine farmers' choices about what to plant or raise rather than simply producing familiar but excessively competitive products. Additionally, policymakers should make better use of the environment of big data, improve analytical abilities, design and plan suitable projects for villages, and provide reliable market information to farmers more accurately.

## VI. LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

This study has two limitations. The conclusions we have verified are still not universally identified. First, the research model we constructed includes DBP, farmers' sense of gain, farmers' EO, and MRC ability, and the validation of the model is obtained from the results of the statistical data of traditional villages in western China. Whether such results are universal still needs to be verified in different regions and countries. More samples should be collected in future studies, and materials should be drawn from more countries and regions to test and determine whether different influencing mechanisms exist. Second, our study reveals the mechanism of DBP's influence on farmers' SEG; however, there may be some mediating or moderating factors that have not been discovered, such as farmers' homesickness for their villages and their perception of self-efficacy. In the future, we will consider the effects of these variables.

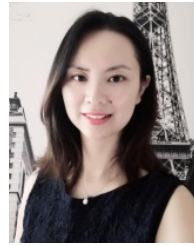
## APPENDIX

See Table 9.

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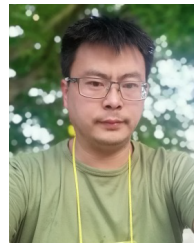
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