Journal of Modern Management
Shinawatra University
Vol. 2 No. 3 July – September 2024

A STUDY OF THE IMPACT OF SALES INTENSITY AND R&D INVESTMENT ON ENTERPRISE PERFORMANCE IN THE PHARMACEUTICAL INDUSTRY

Jiao Dai[1], Busaya Chaysuriya[2]
mba11JiaoDai@163.com[1], busaya.c@siu.ac.th[2]
Faculty of Management, Shinawatra University[1], Faculty of Management, Shinawatra University[2]
Email (Corresponding Author): busaya.c@siu.ac.th[2]

Received 6 August, 2024
Revised 23 September, 2024
Accepted 26 September, 2024

Abstract

Pharmaceutical industry is an industry that all countries in the world focus on, and the development and progress of pharmaceutical science and technology represent a country's scientific research strength, which can promote economic development and social progress. Research and development investment and sales intensity are two crucial aspects of pharmaceutical enterprises, in order to explore the impact of pharmaceutical enterprises' research and development investment and sales costs on the current period of corporate performance.

The objectives of this study are to examine the impact of &D investment intensity and sales intensity on profitability and development capability of listed pharmaceutical companies, and next to examine the differences in sales intensity and R&D investment intensity on the performance of listed pharmaceutical companies across industry types.

This study takes the public financial data of listed enterprises in China's pharmaceutical industry as the research object, and selects the top 50 enterprises in the industry rankings among the A-share listed chemical pharmaceutical enterprises, the top 69 enterprises in the return on net assets rankings in 2022 among the traditional Chinese medicine pharmaceutical enterprises, and the representative 49 enterprises among the biopharmaceutical pharmaceutical enterprises, for a total of 168 representative pharmaceutical enterprises to establish a regression model from the data of 2012-2022. In summary, listed companies in the pharmaceutical industry should maintain high sales intensity and R&D investment intensity, but the implementation needs to take into account the differences in the type of industry, which will help companies better respond to market changes and improve profitability and development.

Keywords: Sales Intensity, R&D Investment, Enterprise Performance

Journal of Modern Management
Shinawatra University
Vol. 2 No. 3 July – September 2024

Introduction

With the rapid development of science and technology, scientific and technological innovation has gradually become an important factor in promoting national and regional economic growth. Only by making good use of new areas of scientific and technological innovation can we be perceived by the rest of the world and take the initiative in the pattern of globalized economic competition. For enterprises, if they want to improve their competitiveness in the international market, then R&D investment and sales intensity are indispensable factors to promote technological innovation and enterprise development. R&D investment means the future innovation ability of the enterprise, which is related to the future development prospect of the enterprise, and is also vital to the enterprise. However, R&D investment will take up a large amount of the enterprise's existing capital, and there is often a large uncertainty, therefore, large-scale R&D investment is undoubtedly a double-edged sword for enterprises. On the other hand, an enterprise's sales intensity is an important factor in its sales, and in the face of fierce market competition, large-scale sales expenditures are the key to market capture for many enterprises.

Pharmaceutical industry has always been an important industry for human needs, medicine not only has an important role in people's life and health, the innovative development of pharmaceutical science and technology also represents a country's scientific research strength and comprehensive strength. Research and development investment and sales are two crucial parts of pharmaceutical enterprises, in order to explore the impact of pharmaceutical enterprises' research and development investment and its sales cost investment on the current period of enterprise performance, this paper selected 168 representative pharmaceutical enterprises listed in the A-share market of chemical pharmaceutical enterprises, traditional Chinese medicine pharmaceutical enterprises, biopharmaceutical enterprises of these three types of enterprises as an object of analysis and research, to explore and analyze the impact of R&D investment and its sales intensity on the enterprise performance. The impact of R&D investment and sales cost investment on enterprise performance is explored and analyzed. This paper explores and analyzes the impact of R&D investment and its sales intensity on enterprise performance. This paper discusses and analyzes the impact of R&D investment and its sales intensity on enterprise performance, which is of certain significance from both theoretical and practical perspectives.

Theoretical Analysis and Research Hypothesis

Impact of Sales Intensity on Profitability and Growth of Listed Companies in the Pharmaceutical Industry

Sales intensity is the ratio of a company's selling expenses to its sales revenues and reflects the extent to which a company invests in sales and marketing. Amit18 et al. (2004) argued that spending on advertising aspect of selling expenses has a positive impact on firm value and conducted an empirical study on the US manufacturing industry.

Journal of Modern Management
Shinawatra University
Vol. 2 No. 3 July – September 2024

Chen, Waters (2017) found that increasing the investment in selling expenses can significantly increase corporate profits. Joshi, Hanssens (2018) found that sales expenditures have a positive impact on firms' short-term profits.Zhou, Lorraine (2018) took listed companies in China's manufacturing industry from 2013 to 2015 as the research object and concluded that marketing investment can enhance corporate performance.. In terms of the company's selling expenses, foreign scholars believe that advertising costs account for a large proportion of the company's selling expenses, because the company can advertise their company's selling expenses. company can advertise their company's products through advertising, which in turn stimulates consumption, increases the company's sales revenues, and improves profits. and improves profits.This paper hypothesizes that firms with high sales intensity are likely to be more sensitive to the market and able to adapt more flexibly to changes in market demand, which in turn drives firm growth. This includes product innovation, expanding market share, and expanding into new markets. By increasing sales investment, firms are expected to achieve higher sales growth rates, which in turn enhances the overall growth of the firm.Therefore this paper proposes the following hypotheses:

H1.1 Sales intensity of listed companies in the pharmaceutical industry positively affects the profitability of enterprises

H1.2 Sales intensity of listed companies in the pharmaceutical industry has a positive impact on the development ability of enterprises

Impact of R&D Investment on Profitability and Development Ability of Listed Companies in Pharmaceutical Industry

R&D investment intensity refers to the ratio of R&D investment to the total revenue of a firm, reflecting the extent of the firm's investment in innovation and technology development.Hsieh et al. (2003), in "Returns to R&D and Capital Expenditures in the Pharmaceutical and Chemical Industry", found that in the pharmaceutical manufacturing industry, when firms increase their R&D investment, the financial performance of the firms increases positively, and therefore argued that increasing the R&D investment of pharmaceutical firms can effectively enhance the market competitiveness of enterprises. Miao Jixiang et al. (2020) analyzed the panel data of 34 listed Chinese medicine companies in China from 2014-2018, and the results showed that R&D investment has a significant positive relationship with enterprise performance. This paper hypothesizes that enterprises with high R&D investment intensity are more capable of promoting scientific and technological innovation, and by increasing R&D investment, enterprises are expected to achieve higher technological levels, promote the continuous updating of product lines, improve market competitiveness, and then enhance the overall development ability of enterprises.Therefore, this paper proposes the following hypotheses:

H2.1 The intensity of R&D investment of listed companies in the pharmaceutical industry has a positive impact on the profitability of enterprises

Journal of Modern Management
Shinawatra University
Vol. 2 No. 3 July – September 2024

H2.2 The intensity of R&D investment of listed companies in the pharmaceutical industry has a positive impact on the development ability of enterprises

The Impact of Sales Intensity on Profitability and Development Capacity of Different Types of Listed Companies in the Pharmaceutical Industry

This paper focuses on three types of listed companies in the pharmaceutical industry, i.e., chemical pharmaceutical companies, traditional Chinese medicine pharmaceutical companies and biopharmaceutical companies. There are differences in the efficiency and strategies of different types of firms in promoting their products and expanding their market share, leading to different correlations between sales intensity and profitability. Different types of enterprises have different focuses and strategies in market expansion and other aspects, leading to different impacts of sales intensity on profitability and development capability. In order to explore the performance of different types of firms in depth, this paper proposes the following hypotheses:

H3.1 The impact of sales intensity on the profitability of companies listed in different pharmaceutical industry types is different

H3.2 The impact of sales intensity on the growth ability of firms listed in different pharmaceutical industry types is different

The Impact of R&D Investment Intensity on Profitability and Development Capacity of Different Types of Listed Companies in the Pharmaceutical Industry

Chemical pharmaceutical companies may focus on the innovation of synthetic drugs, Chinese medicine pharmaceutical companies may focus on the research and development of traditional medicinal herbs, and biopharmaceutical companies may focus more on innovation in the field of biotechnology. These characteristics may lead to differences in the relationship between R&D investment intensity and profitability across different types of firms. In addition, chemical pharmaceutical firms, traditional Chinese medicine pharmaceutical firms and biopharmaceutical firms each have their own focus and strengths in terms of R&D strategy, technological innovation and new product development. In order to explore the performance of different types of firms in depth, the following hypotheses are proposed in this paper:

H4.1 The intensity of R&D investment in listed companies of different pharmaceutical industry types has different impacts on company profitability.

H4.2 The impact of R&D investment intensity on corporate development capability of listed companies of different pharmaceutical industry types is different.

Journal of Modern Management
Shinawatra University
Vol. 2 No. 3 July – September 2024

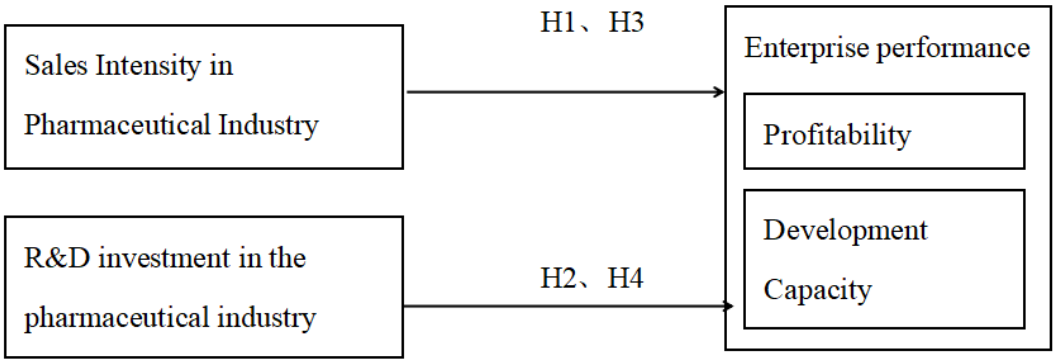

Figure1.1 Conceptual framework

Research Methodology

Research Design

In this paper, we will use quantitative analysis method to analyze the input-output relationship by taking the profitability and development capacity of the company as the indicators to measure the performance of the company as the dependent variable, while the R&D input intensity and sales expense intensity are used as the independent variables to explain the performance of the company.

Variable Design

Independent Variable:

Sales Intensity (Si): The sales expense ratio measures the proportion of sales expenses to operating income and is calculated by dividing sales expenses by operating income. This indicator reflects the extent of a company's investment in sales and marketing efforts, with a higher sales expense ratio potentially indicating greater expenditures on market promotion.

R&D Investment Intensity (Rd): R&D investment intensity is the ratio of R&D investment to operating income, reflecting the level of investment a company makes in innovation and technological research and development. A higher R&D investment intensity may suggest a company's focus on technological innovation and efforts to enhance product technological content and competitiveness.

Implicit Variable:

Profitability:

Operating Margin (OM): operating margin is the ratio of a firm's profit to its sales revenue, reflecting the level of profit a firm earns from its normal business activities. A higher operating margin usually indicates that a business is able to control costs more effectively during the sales process and realize higher profitability.

Development capacity:

Journal of Modern Management
Shinawatra University
Vol. 2 No. 3 July – September 2024

Operating Growth Rate (OIGR): The OIGR is the percentage of annual growth in a firm's operating revenues and reflects a firm's ability to expand the scale of its business. A higher OIGR may represent a stronger ability to expand markets and promote products.

Control Variables:

Gearing ratio (Lcv): the gearing ratio is the ratio of total liabilities to total assets of a firm, and is used to measure the extent to which a firm's assets are financed.

Firm size (Size): firm size is expressed as the natural logarithm of the total amount of assets and reflects the size of the firm.

Earnings per share (EPS): EPS is net profit divided by the total number of shares and indicates the profit per share attributable to shareholders.

Book-to-market ratio (PB): Book-to-market ratio is the ratio of market value to book value and is used to measure the valuation level of a company.

Current Ratio (CR): Current Ratio is the ratio of a company's current assets to its current liabilities and is used to measure a company's solvency.

Age of the company (Age): Age of the company indicates the number of years the company has been in business from its inception to the current time.

Top Ten Shareholders' Equity Concentration (Inc): Top Ten Shareholders' Equity Concentration reflects the degree of concentration of a company's equity distribution.

Model Construction

The profitability of a company can be linked to, among other things, the performance of the company. Therefore, this paper selects operating margin (OM) as the variable of corporate performance. The development ability of the enterprise is mainly selected as the indicator of revenue growth rate (OIGR), and sales intensity (Si) and R&D investment intensity (Rd) are selected as the independent variables. In addition, this paper selects the gearing ratio (Lcv), company size (Size), earnings per share (EPS), book-to-market ratio (PB), current ratio (CR), company age (Age), and top ten shareholders' shareholding concentration (Inc) as the control variables, and the final expressions are shown in 3-1 to 3-4.

$$OM_{i,t} = \beta_0 + \beta_1 Rd_{i,t} ++ \beta_2 Lcv_{i,t} + \beta_2 Size_{i,t} + \beta_4 EPS_{i,t} + \beta_5 PB_{i,t} + \beta_6 CR_{i,t} + \beta_7 Age_{i,t} + \beta_7 Inc_{i,t} + \mu \quad (3\text{-}1)$$

$$OM_{i,t} = \beta_0 + \beta_1 Si_{i,t} ++ \beta_2 Lcv_{i,t} + \beta_2 Size_{i,t} + \beta_4 EPS_{i,t} + \beta_5 PB_{i,t} + \beta_6 CR_{i,t} + \beta_7 Age_{i,t} + \beta_7 Inc_{i,t} + \mu \quad (3\text{-}2)$$

$$OIGR_{i,t} = \beta_0 + \beta_1 Rd_{i,t} ++ \beta_2 Lcv_{i,t} + \beta_2 Size_{i,t} + \beta_4 EPS_{i,t} + \beta_5 PB_{i,t} + \beta_6 CR_{i,t} + \beta_7 Age_{i,t} + \beta_7 Inc_{i,t} + \mu \quad (3\text{-}3)$$

Journal of Modern Management
Shinawatra University
Vol. 2 No. 3 July – September 2024

$$OIGR_{i,t} = \beta_0 + \beta_1 Si_{i,t} ++ \beta_2 Lcv_{i,t} + \beta_2 Size_{i,t} + \beta_4 EPS_{i,t} + \beta_5 PB_{i,t} + \beta_6 CR_{i,t} + \beta_7 Age_{i,t} + \beta_7 Inc_{i,t} + \mu \quad (3\text{-}4)$$

Population and Sample size

The overall number of pharmaceutical and medicine enterprises selected for this thesis is 1,284, of which 441 are chemical pharmaceutical enterprises, 573 are traditional Chinese medicine pharmaceutical enterprises, and 270 are biopharmaceutical enterprises, and the sampling samples are selected from pharmaceutical enterprises listed on China's A-share market, and listed companies that have access to a complete ten-year economic data are the objects of the study so that there is enough economic data for analysis, and at the same time, these pharmaceutical enterprises in the pharmaceutical industry have their own characteristics or representativeness in the industry. When selecting the samples, we deleted the enterprises whose main business is medical devices and medical services, deleted the enterprises whose main business is veterinary medicine, and also deleted the enterprises whose economic data changed a lot due to quality problems or negative information, and mainly referred to the "Wind Industry Classification Standard", and finally retained 50 chemical pharmaceutical enterprises, 49 biopharmaceutical enterprises, and 69 traditional Chinese medicine pharmaceutical enterprises, which are 168 enterprises in total. Finally, 50 chemical pharmaceutical companies, 49 biopharmaceutical companies and 69 Chinese medicine pharmaceutical companies, totaling 168 companies, are retained as the research objects of this thesis.

Empirical Results and Analysis

Descriptive Analysis

In Table 1, descriptive statistics of key industry-wide indicators present the overall financial performance. First, for profitability (OM), the mean is 0.1311, indicating that the industry as a whole has a fair level of profitability, but with some fluctuations. The average value of the growth rate of total operating income (OIGR) is 0.3235, but the standard deviation is large, indicating that the growth difference between enterprises is more significant.

Table 1：*Descriptive Statistics for the Entire Industry*

variable	N	mean	sd	min	max
OM	1284	0.1311	0.1766	-1.7778	1.2089
OIGR	1284	0.3235	4.8284	-0.8591	171.7453
si	1284	0.2636	0.1596	0.0021	0.9157
si1	1284	0.2568	0.1591	0.0020	0.9157
Rd	1284	0.0592	0.0806	0.0000	1.6404
Rd1	1284	0.0678	0.4839	0.0001	17.2192
Lcv	1284	0.3155	0.1689	0.0143	0.8858

Journal of Modern Management
Shinawatra University
Vol. 2 No. 3 July – September 2024

size	1284	22.2887	0.9602	19.9096	25.3976
EPS	1284	0.8368	2.4162	-10.1800	41.0000
PB	1284	0.3359	0.1629	0.0137	1.1814
CR	1284	3.4395	3.9375	0.2893	54.3728
Age	1284	11.9502	7.3924	0.0000	29.0000
INC	1284	33.5571	13.3746	4.1835	71.5573

Correlation Analysis

The table below shows the correlation results between the variables.The correlation coefficient measures the strength of the linear relationship between two variables and ranges from -1 to 1, with positive values indicating a positive correlation and negative values indicating a negative correlation. From the table, it can be seen that there is a significant positive correlation between profitability (OM) and the variables of sales intensity (si), R&D investment intensity (Rd), firm size (size), earnings per share (EPS), current ratio (CR), and top ten shareholders' equity concentration (INC). This means that in these cases, an increase in profitability may be accompanied by an increase in these variables. Secondly, profitability (OM) is negatively correlated with variables such as gearing ratio (Lcv) and age (Age). This indicates that in these cases, an increase in profitability may be accompanied by a decrease in these variables. Similarly, there is a significant positive correlation between the growth rate of total operating income (OIGR) and the variables of research and development investment intensity (Rd), earnings per share (EPS) top ten shareholders' equity concentration (INC), and there is a significant negative correlation between the growth rate of total operating income (OIGR) and age (Age).

Table 2：*Correlation Analysis Results*

	OM	OIGR	si	Rd	Lcv	size	EPS	PB	CR	Age	INC
OM	1										
OIGR	0.16*	1									
si	0.09*	0.02	1								
Rd	0.21*	0.07*	0.15*	1							
Lcv	-0.37*	0.00	-0.16*	-0.09*	1						
size	0.07*	-0.02	-0.21*	0.10*	0.27*	1					
EPS	0.32*	0.21*	-0.10*	-0.05*	-0.10*	0.14*	1				
PB	-0.01	-0.04	0.05	-0.08*	-0.28*	0.14*	0.04	1			
CR	0.28*	-0.04	-0.07*	0.03	-0.57*	-0.13*	0.04	0.08*	1		
Age	-0.06*	-0.11*	-0.06*	-0.16*	0.23*	0.42*	-0.04	-0.00	-0.20*	1	
INC	0.12*	0.06*	-0.01	-0.08*	-0.07*	0.05*	-0.00	-0.02	0.05*	-0.14*	1

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Journal of Modern Management
Shinawatra University
Vol. 2 No. 3 July – September 2024

Regression Analysis

1. Regression analysis of sales intensity, R&D investment intensity and profitability

Table 2 demonstrates the results of regression analysis between sales intensity, R&D investment intensity and profitability of listed companies in pharmaceutical industry. The numbers in the table indicate the effect of each independent variable on the dependent variable, and the numbers in parentheses indicate standard errors.The table shows the regression coefficients of profitability operating margin (OM) with each variable. Among them, the coefficient of gearing ratio (Lcv) is negative and the significance level reaches a very high level ($p < 0.01$), which means that profitability shows a decreasing trend with the increase of gearing ratio. From the point of view of control variables, it is also reasonable that the effect of firm size (size) on profitability is positively correlated. As firm size increases, firms may be able to better utilize economies of scale, thereby increasing profitability. The positive correlation coefficient of earnings per share (EPS) suggests that as EPS increases, profitability is also expected to increase. This can be interpreted to mean that higher EPS may reflect a firm's solid performance in terms of profitability. The book-to-market ratio (PB) and current ratio (CR) show negative and positive correlation respectively. This implies that profitability may decrease as the book-to-market ratio increases, while profitability may increase as the current ratio increases. Firm age (Age) is negatively associated with profitability but the estimated coefficient is -0.000, which reflects the performance of young firms in terms of rapid growth and innovation, but the effect is small. Equity concentration of the ten largest shareholders (INC) has a significant positive impact on profitability, but the coefficient is small and the impact is weak.

From the perspective of sales intensity and R&D investment intensity, it can be seen that: sales intensity (si) has a higher level of significance ($p < 0.01$) on profitability with a coefficient of 0.088. this indicates that sales intensity has a significant positive effect on profitability under the current research conditions. The coefficient of research and development investment intensity (Rd) is 0.683 with a very high level of significance ($p < 0.01$). This implies that higher R&D investment is significantly associated with rising earnings. This result implies that firms' investment in R&D may have a significant positive face effect on earnings under the current research conditions.

For the lagged one period variables si1 and Rd1, their coefficients are 0.020 and 0.294 respectively, but sales intensity lagged one period (si1) does not reach significance level at significance level 0.1 ($p > 0.1$), and R&D investment intensity lagged one period (Rd1) reaches a very high level of significance ($p<0.01$). This suggests that sales intensity does not immediately have a significant impact on profitability in the early period and may require some time lag. However, R&D investment intensity has a significant positive impact on profitability both at this stage and upfront.

Journal of Modern Management
Shinawatra University
Vol. 2 No. 3 July – September 2024

Table 3：

Regression Analysis of Sales Intensity, R&D Investment Intensity, and Profitability of Listed Companies in the Pharmaceutical Industry

	(1)	(2)	(3)	(4)
	OM	OM	OM	OM
Lcv	-0.411***	-0.461***	-0.394***	-0.415***
	(0.035)	(0.033)	(0.035)	(0.035)
size	0.027***	0.047***	0.029***	0.035***
	(0.005)	(0.005)	(0.005)	(0.006)
EPS	0.020***	0.018***	0.021***	0.020***
	(0.002)	(0.002)	(0.002)	(0.002)
PB	-0.169***	-0.228***	-0.170***	-0.193***
	(0.029)	(0.028)	(0.029)	(0.030)
CR	0.003**	0.003*	0.004**	0.003**
	(0.001)	(0.001)	(0.001)	(0.001)
Age	-0.000	-0.002***	-0.000	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
INC	0.001***	0.000	0.001***	0.001**
	(0.000)	(0.000)	(0.000)	(0.000)
si	0.088***			
	(0.029)			
Rd		0.683***		
		(0.058)		
si1			0.020	
			(0.029)	
Rd1				0.294***
				(0.089)
_cons	-0.328***	-0.671***	-0.398***	-0.492***
	(0.115)	(0.108)	(0.115)	(0.114)
N	1171.000	1171.000	1171.000	1171.000
r2	0.280	0.351	0.274	0.281
ar2				

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

2. Regression analysis of sales intensity, R&D investment intensity and development capacity

Table 3 demonstrates the results of regression analysis between sales intensity, R&D investment intensity and development capability of listed companies in pharmaceutical industry. The numbers in the table indicate the effect of each independent variable on the dependent variable, while the numbers in parentheses indicate the standard errors. The table shows the regression coefficients of OIGR (growth rate of

Journal of Modern Management
Shinawatra University
Vol. 2 No. 3 July – September 2024

gross operating income) and each variable in the development capability index. Among them, the gearing ratio (Lcv) does not show significance in all four regressions, indicating that the gearing ratio does not have a significant impact on the growth rate of gross operating income. Firm size likewise does not have a significant effect on the growth rate of total operating income. Earnings per share (EPS) shows a significant positive effect on OIGR in all regressions, which may reflect the positive relationship between corporate profitability and growth. The book-to-market ratio (PB) showed a significant negative correlation in the regression of research and development investment intensity (Rd) on OIGR, and did not show a significant correlation in the other regressions. Both current ratio (CR) and firm age (Age) have a significant negative effect on the growth rate of total operating income, indicating that low current ratio and younger firms are more likely to achieve high growth.

The effect of sales intensity (si) on OIGR (operating income growth rate) is not significant. Specifically, the coefficient of si is 0.029 ($p > 0.1$). This indicates that sales intensity is not effective in predicting the movement of OIGR under the current model. However, in the one period lagged test, sales intensity lagged one period (si1) has a significant positive effect on the OIGR (growth rate of gross operating income). Specifically, the coefficient of si is 0.639 ($p<0.01$), which indicates that sales intensity has a positive predictive effect on future gross operating income growth in the past period, suggesting that the impact of marketing activities may be somewhat delayed in time.

Research and development investment intensity (Rd) is positively correlated in the regression of OIGR, as indicated by a coefficient of 0.230 ($p < 0.05$). This implies that increasing R&D investment may have a positive impact on the growth of the company's total operating income and this relationship is statistically significant. Meanwhile, in the lagged one period test, R&D investment intensity one period after (Rd1) is still positively correlated in the regression of OIGR, as evidenced by a coefficient of 0.306 ($p < 0.05$).

Table 4:

Regression Analysis of Sales Intensity, R&D Investment Intensity, and Development Capability

	(1)	(2)	(3)	(4)
	OIGR	OIGR	OIGR	OIGR
Lcv	0.030	-0.030	-0.021	0.064
	(0.136)	(0.135)	(0.136)	(0.137)
size	-0.010	0.007	-0.015	-0.015
	(0.021)	(0.022)	(0.021)	(0.022)

Journal of Modern Management
Shinawatra University
Vol. 2 No. 3 July – September 2024

EPS	0.057***	0.054***	0.056***	0.057***
	(0.008)	(0.008)	(0.008)	(0.008)
PB	-0.135	-0.189*	-0.134	-0.111
	(0.112)	(0.113)	(0.111)	(0.115)
CR	-0.010*	-0.011**	-0.012**	-0.009*
	(0.005)	(0.005)	(0.005)	(0.005)
Age	-0.009***	-0.011***	-0.009***	-0.008***
	(0.003)	(0.003)	(0.003)	(0.003)
INC	0.002	0.002	0.002	0.002*
	(0.001)	(0.001)	(0.001)	(0.001)
si	0.029			
	(0.111)			
Rd		0.639***		
		(0.237)		
si1			0.230**	
			(0.110)	
Rd1				0.306**
				(0.344)
_cons	0.468	0.201	0.648	0.518
	(0.448)	(0.442)	(0.445)	(0.443)
N	1171.000	1171.000	1171.000	1171.000
r2	0.063	0.069	0.066	0.064
ar2				

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Heterogeneity Analysis

Table 4 demonstrates the results of regression analysis between sales intensity, R&D investment intensity and profitability and development capacity of listed companies in different pharmaceutical industries (chemical pharmaceuticals, traditional Chinese medicine and biopharmaceuticals). The following are the effects of major variables on profitability (OM) and ability to grow (OIGR) for each industry. In chemical-pharmaceutical industry, sales intensity (si) has a significant positive effect ($p<0.05$) on both OM and OIGR, while the coefficients of R&D investment intensity (Rd) on OM and OIGR are 0.031 and 0.388, respectively, but they do not pass the test of significance level. This suggests that the effect of R&D investment intensity on these two capabilities of this chemical-pharmaceutical industry may be more limited. This result can be explained by the fact that sales intensity contributes significantly to the profitability and growth capacity of this industry, while the effect of R&D investment intensity is relatively weak. This may reflect the fact that marketing and sales activities are more critical in this pharmaceutical industry, while R&D investment has not yet fully demonstrated a

Journal of Modern Management
Shinawatra University
Vol. 2 No. 3 July – September 2024

significant impact on profitability and growth capacity in the short term. In the TCM pharmaceutical industry, sales intensity (si) has no significant positive effect ($p>0.1$) on both OM and OIGR, while the coefficients of R&D investment intensity (Rd) on OM and OIGR fail the significance level test, i.e., they do not have a significant effect. This indicates that intensity of sales activities and intensity of R&D investment have no statistically significant effect on profitability and growth of the industry. The possible explanation is that the profitability and growth of the industry is more influenced by other factors such as market demand, policy environment, etc., while sales intensity and R&D investment failed to translate significantly into real impact on profitability and growth in the short run. In the biopharmaceutical industry, sales intensity (si) has a significant positive effect on both OM and OIGR ($p<0.05$), while the coefficients of R&D investment intensity (Rd) on both OM and OIGR pass the significance level test, with coefficients greater than 0, i.e., the coefficients of R&D investment intensity (Rd) have a significant positive effect on both OM and OIGR. This indicates that sales intensity and R&D investment intensity have significant positive correlation on profitability and growth of the industry. This may reflect the peculiarities of the biopharmaceutical industry where not only marketing and sales activities are critical for profitability and growth, but also sustained R&D investment plays an important role in improving profitability and driving growth in the industry.Overall, there are differences in the impact of marketing intensity and R&D investment intensity on the profitability and growth of different pharmaceutical industries, reflecting the operating characteristics and environmental conditions of each industry.

Table 5：*Regression analysis of sales intensity and R&D investment intensity with profitability and development ability in different pharmaceutical industries*

Standard errors in parentheses

	Chemical Pharmaceutical Industry				Chinese Medicine Pharmaceutical Industry				Biopharmaceutical industry			
	OM	OM	OIGR	OIGR	OM	OM	OIGR	OIGR	OM	OM	OIGR	OIGR
Lcv	-0.212***	-0.212***	0.258	0.185	-0.235***	-0.230***	0.255	0.125	-0.625***	-0.634***	-0.556**	-0.482*
	(0.039)	(0.041)	(0.182)	(0.192)	(0.048)	(0.047)	(0.295)	(0.291)	(0.113)	(0.093)	(0.273)	(0.262)
size	0.013**	0.013**	-0.005	0.007	-0.002	-0.002	-0.054	-0.055	-0.002	0.045***	-0.015	0.034
	(0.006)	(0.007)	(0.030)	(0.031)	(0.007)	(0.007)	(0.044)	(0.044)	(0.018)	(0.016)	(0.044)	(0.045)
EPS	0.102***	0.102***	0.080**	0.078**	0.102***	0.103***	0.069	0.054	0.015***	0.011***	0.047***	0.045***
	(0.007)	(0.007)	(0.032)	(0.032)	(0.009)	(0.009)	(0.054)	(0.054)	(0.003)	(0.003)	(0.008)	(0.008)
PB	-0.157***	-0.157***	0.154	0.086	0.133***	0.132***	-0.046	-0.037	-0.297***	-0.389***	-0.265	-0.359
	(0.031)	(0.033)	(0.143)	(0.154)	(0.036)	(0.036)	(0.221)	(0.221)	(0.102)	(0.086)	(0.247)	(0.245)

Journal of Modern Management
Shinawatra University
Vol. 2 No. 3 July – September 2024

CR	0.001	0.001	-0.007	-0.008	0.000	0.000	-0.014	-0.017	0.000	0.001	-0.024***	-0.020***
	(0.002)	(0.002)	(0.010)	(0.010)	(0.002)	(0.002)	(0.015)	(0.015)	(0.003)	(0.002)	(0.007)	(0.007)
Age	-0.003***	-0.003***	-0.011***	-0.012**	-0.001*	-0.001*	-0.001	-0.002	0.005**	-0.001	-0.012**	-0.019***
	(0.001)	(0.001)	(0.003)	(0.003)	(0.001)	(0.001)	(0.005)	(0.005)	(0.002)	(0.002)	(0.005)	(0.006)
INC	0.001**	0.001**	0.000	0.000	0.001**	0.001**	0.005**	0.005**	0.001	-0.001	0.002	0.001
	(0.000)	(0.000)	(0.002)	(0.002)	(0.000)	(0.000)	(0.002)	(0.002)	(0.001)	(0.001)	(0.003)	(0.003)
si	0.076**		0.137**		0.013		0.218		0.429***		0.755**	
	(0.031)		(0.145)		(0.032)		(0.196)		(0.121)		(0.291)	
Rd		0.031		0.388		0.015		1.632		1.062***		1.020***
		(0.082)		(0.381)		(0.196)		(1.211)		(0.100)		(0.283)
_cons	-0.087	-0.110	0.173	0.038	0.133	0.120	1.053	1.260	0.475	-0.410	1.126	0.076
	(0.134)	(0.139)	(0.628)	(0.646)	(0.144)	(0.141)	(0.889)	(0.870)	(0.394)	(0.331)	(0.950)	(0.938)
N	407.000	407.000	407.000	407.000	526.000	526.000	526.000	526.000	238.000	238.000	238.000	238.000
r2	0.562	0.555	0.049	0.050	0.407	0.407	0.025	0.026	0.278	0.490	0.223	0.243
ar2												

* p < 0.1, ** p < 0.05, *** p < 0.01

Conclusion

The sales intensity of a company listed in the pharmaceutical industry can positively affect the profitability and growth of the company. For a company, the higher the sales intensity, the higher the profitability of the company. This is because high sales intensity leads to more sales opportunities and market share, which in turn increases the profitability of the company and also promotes the overall growth of the company. The R&D investment intensity of listed companies in the pharmaceutical industry can positively affect their profitability and growth capacity. In the pharmaceutical industry, continuous innovation and development of new products are key factors in maintaining competitiveness. By increasing investment in R&D, companies are able to promote the development of more innovative products, which in turn enhances their growth capacity. The impact of sales intensity and R&D investment intensity on profitability and growth varies depending on the type of medicine and pharmaceutical industry. In essence, different industry types may require different sales and R&D strategies to adapt to their specific market environment and competitive pressures.

In conclusion, listed companies in the pharmaceutical industry should maintain high sales intensity and R&D investment intensity, but they need to consider the differences in industry types when implementing them. This helps companies to better respond to market changes and improve profitability and development. These research results provide useful references for strategy formulation and operation management of pharmaceutical enterprises.

Journal of Modern Management
Shinawatra University
Vol. 2 No. 3 July – September 2024

References

Henry Grabowski and John Vernon. (1990,July).*A New Look at the Returns and Risks to Pharmaceutical R&D*. Management Science, Vol. 36, No. 7, pp. 804-821

Ping-Hung Hsieh, C.S. Mishra & D.H.Gobeli .(2003,May).*The return on R&D versus capital expenditures in pharmaceutical and chemical industries*. IEEE Transactions on Engineering Management, Volume:50, Issue: 2

Kotler, P, & Kevin, L. K. (2006).*Marketing management*.New Jersey: Pears on Education.

Amit, et al.(2004). *Advertising Spending And Market Capitalization*. America: University of California, Los Angeles, Anderson School of Management.

Chen J,Waters G.(2017).*Firm efficiency,advertising and profitability:Theory and evidence*.The Quarterly Review of Economics and Finance,63:240-248.

Joshi A,Hanssens D M.(2018).*The direct and indirect effects of advertising spending on firmvalue*.Long-Term Impact of Marketing:Compendium:521-556.

Zhou, Luo Lin. (2018).*Marketing input, financial leverage and firm performance*. Finance and accounting newsletter, 766(02):27-29.

MIAO Jixiang, MENG Qingjun, WU Jianping*Research on the interaction mechanism between innovation speed and enterprise value in the complex environment of Chinese medicine enterprises*. Journal of Economic Research,25:14-18.

Pan Haiying, Fan Xiaoyan, Zong Zhaocang.(2016). *Advertising investment and corporate performance - an empirical analysis based on listed FMCG companies*. Investment Research, 35(01):31-36.2

ZHONG Yangmei,GAO Mengbo. (2018).*Empirical analysis of the impact of R&D expenditure on operating profit in pharmaceutical industry*.Journal of Jiangsu Second Normal College,34(04):59-64[15]

YAN Bin.(2020).*The impact of marketing expenditure intensity on corporate performance an empirical study based on listed companies in the pharmaceutical industry*. Shanghai University of Finance and Economics, Shanghai.

Bosworth D,Rogers M.(2001).Market value, R&D and intellectual property: an empirical analysis of large Australian firms J . Economic Record,77(239): 323-337.

Wang Xiaoting. (2015).*An empirical study on the correlation between R&D inputs and corporate performance in high-tech industries I Empirical evidence from small and medium-sized listed companies*. Finance and Accounting Communication, 692(36):32-34+41.

Zhang Yuan,Li Zexi,Hu Bing.(2019). *R&D Investment, Advertising Expenditure and Financial Performance--A Case Study of Biomedical Industry*. Financial Supervision,14:90-97.30

Journal of Modern Management
Shinawatra University
Vol. 2 No. 3 July – September 2024

Yang Kanglin,Xu Shiying. (2021).*A study on the relationship between government subsidies, R&D expenditures and corporate performance - a case of pharmaceutical industry enterprises*. Science and Technology,05:16-20.

Tian Yuexin,Feng Qinghua. (2014).*An empirical study on the impact of listed companies' R&D expenditures on enterprise value I from biomedical industry data*. Accounting Newsletter,15:49-51.

Lin B.Lee Y Hung S.(2006).*R&D Intensity and Commercialization Orientation Effects on Financial Performance*.Journal of Business Research,59(6): 679-685

Wang, Lianglong. (2013)*Do Selling and Administrative Expenses Have an Impact on Firms' Future Performance? An empirical data from Shanghai and Shenzhen A-shares from 2007 to 2010*. Finance and Accounting Communication, 27: 96-98.

Sun Feng . Wang Youzhi. YU Jingliang. (2014).*R&D input-output efficiency and countermeasures in China's pharmaceutical manufacturing industry an empirical study based on pharmaceutical manufacturing Panal Date*. Science and Technology Progress and Countermeasures, 11 (vol31,22) :46-50