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Correlations among Product Development, Product Innovation, and Green Marketing in Healthcare Industry

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Abstract

Along with increasing national income and popular health awareness as well as annually rising problems in serious ageing population and diseases of civilization, people are enhancing the idea of using healthcare products. Along with the rapid changes in technology, green issues become one of the major strategies for enterprises. The development of green products to create product attributes with green and successfully include green concept into the core thinking of business decisions and marketing campaign becomes the irresistible green challenge and is the green business opportunity for enterprises. Aiming at employees and supervisors in healthcare industry in Fujian Province, 500 copies of questionnaire are distributed, with random sampling, and 394 valid copies are retrieved, with the retrieval rate 79%. The research results show significant and positive effects of 1.product development on product innovation, 2.product innovation on green marketing, and 3.product development on green marketing. According to the results to propose suggestions, it is expected to provide reference for green product development and green innovation in healthcare industry as well as experts and scholars' research on green product development and green innovation.

Keywords: healthcare industry; product development; product innovation; green marketing.

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Introduction

Due to the rapid progress of medical technology in past years, global quality of living environment is positively improved to promote humans' good quality of life as well as extend humans' life expectancy. Ageing population structure formed in developing or developed countries gradually increases the chronic disease patients to result in a hidden worry about healthcare and social welfare to the nations (Cao & Wu, 2020). Along with increasing national income and popular health awareness as well as annually rising problems in serious ageing population and diseases of civilization, people are also increasing the idea of using healthcare products. Moreover, green issues become one of the most concerned issues due to the rapid changes in environment and ecology (Sun & Guo, 2021). Advanced countries like the US and European Union successively promoting various green regulations and green standards to strictly test imported products forms the green barrier to international trade. Especially, along with rapid changes in technology, green issues become one of the major strategies discussed by enterprises. The development of green products to create product attributes with green and the successful inclusion of green concept into the core thinking of business decisions and marketing campaign become the irresistible green challenge and the green business opportunity for enterprises.

Undeniably, countries, enterprises, and even individuals nowadays have to adopt actions to reduce the destruction of modern industries to living environment. Some firms pay attention to modern green issues and become green oriented companies (Wang & Song, 2020). When a modern green oriented company tends to have the products conform to international trend and green demand, the produced products have to be green products; and, an enterprise intending to produce green products has to introduce green procurement and green manufacturing technology (Gao, 2020). Furthermore, green innovation should be introduced to manufacturing process in order to have green products present more competitive advantage so as to produce green product conforming to green demand and being competitively advantageous. Environmental protection, energy saving and carbon reduction issues are positively promoted at the moment that industries make changes in the acquisition of product raw materials, manufacturing process, and package & marketing to cope with the market change. It is expected to promote the performance through green product development and green innovation. In this case, healthcare industry, in face of the public expectation of healthcare products, being able to introduce green issues and green practice into enterprises as well as develop green products matching public expectation could enhance product innovation to facilitate consumers' purchase intention. The empirical research is therefore developed in this study, expecting to provide reference for green product development and the practice of green innovation in healthcare industry as well as experts and scholars' research on green product development and green innovation.

Literature review

Wang & Chen (2020) proposed product development as a strategic process that an enterprise had to make strategies, set goals, distribute resources to various product development projects, as well as develop and innovate various new products and new manufacturing processes to achieve the goal. Su & Zeng (2021), taking high tech industry in Taiwan as the research object, revealed that a company's new product development would affect the new product innovation, and new product development strategies were the basis of founding new product development to influence an enterprise's innovation of new product development. Accordingly, product development strategies and processes would affect the presentation of product innovation. Aggarwal (2020) stated that new product development was not simply important for corporate survival, but was also the driving force to maintain competitive advantage. In the new product development process, an enterprise could not only rapidly promote new products, but also had to really satisfy customer needs and cope with competitors' threats. As a result, it was important to correctly analyze consumer market information to assist an enterprise in drafting new product development strategies mostly suitable for the enterprise. Hou & Lee (2020) regarded a new product development strategy as the basis to found new product development that it would affect the innovation of an enterprise developing new products. In addition to grasping valuable information in the new product development process, a product strategy was the basis to found product development (Su & Lee, 2021). The following hypothesis is therefore proposed in this study.

H1: Product development presents significantly positive effects on product innovation.

Pang *et al.* (2021) considered that the "novelty" of product innovation could be defined by two dimensions. 1. Novelty to company: Although other companies might have started production or sales, a company might not have the experience in manufacturing or selling such types of products. 2. Novelty to market: It referred to product innovation for the first time in the market. Jian & Kuang (2020) indicated that the innovation of a new product could be analyzed from different dimensions of newness, and the higher innovation of a product stood for the higher uncertainty and risk to increase the invested resources and change the product development style. Kong & Zhang (2020) proposed that one of successful green marketing strategies was to consider the minimum impacts of the product production process and the product on the environment as well as the balance among quality, convenience, and purchasable price required by customers. Chen *et al.* (2020), from the viewpoint of green marketing, stated that a promoter could appeal the competition from the development of green oriented product design, development of green product, promotion of green education to consumers, and

green positioning to protect the worsening ecological environment. Apparently, an enterprise intending to implement green marketing and satisfy customers had to structure the innovation of product function and appearance design matching and satisfying customers' green demand. It is therefore inferred in this study that an enterprise's innovation performance on green products would influence the effectiveness of green marketing. Mao *et al.* (2021) revealed in the empirical research that product innovation showed positive effects on customer satisfaction. Consequently, the following hypothesis is proposed in this study.

H2: Product innovation shows remarkably positive effects on green marketing.

Liu & Chen (2021) mentioned that consumers and firms gradually stressed on green marketing due to rising green awareness; green appealed products in the market were increasing that it was not enough to have single green characteristic be the product appeal; and, an enterprise could continuously attract consumers merely by constantly expanding the product functions or innovating functions. Accordingly, it was understood that an enterprise could more easily attract users' attention through product innovation in the product development; such a favorable condition could more largely affect the performance on green marketing (Wu *et al.*, 2021). Fan *et al.* (2020) regarded new product development as a series of well-organized and closely-related important activities. For this reason, when facing rapidly changing competitive environment, technology, finance, human resources, and management should be taken into account for the development of new product, i.e. adopting systematic integration to plan new product development. Lee & Tang (2020) considered that the development of a new product initiated from ideas which were then derived to satisfy the needs of potential customers and enterprise related parties as well as various marketing plans (Su *et al.*, 2021). Apparently, an enterprise, intending to satisfy green demand in the market, has to present the capability to develop and promote green products. Accordingly, the following hypothesis is proposed in this study.

H3: Product development reveals notably positive effects on green marketing.

Methodology

Operational definition

Product development. The product development scale in this study is referred to the measurement of Jiang & Cao (2021) with following dimensions: (1) Technique: An enterprise's product technology compared with it of the same industry; (2) Support: An enterprise's willingness to invest resources for product development.

Product innovation

The product innovation scale in this study is referred to the dimensions and scale proposed by Li & Zhang (2021): (1) *Radical innovation*: Having major breakthrough on core concept or technology; (2) *Incremental innovation*: Expanding existing product design functions.

Green marketing

Based on the measurement of Zhang *et al.* (2021), the green marketing scale is developed in this study: (1) *Product*: When contacting green products, consumers' expected value could be started from energy saving, cost reduction, pollution prevention, sustainable development, waste recycle & reuse, green product design, and green image management of a company to increase the added value of green products; (2) *Promotion*: Understanding the type of green product advertisement being mostly accepted by consumers.

Method and model

The fit test in AMOS model could generally be measured from overall model fit (i.e. extrinsic quality of model) and intrinsic quality of model. In terms of overall model fit, the most frequently used fit indicators contain (1)"χ2 ratio" (Chi-Square ratio), standing for the difference between real theoretical model and expected value, which is better smaller than 3, (2)goodness of fit index (GFI) and adjusted goodness of fit index (AGFI), which are better close to 1, (3)root mean square residual (RMR), reflecting the square root of "fit residual variance/ covariance mean", which is better smaller than 0.05, and (4)incremental fit index (IFI), showing good model fit when it is higher than 0.9.

Common indicators in AMOS to evaluate intrinsic quality of model include (1)SMC (square multiple correlation) of individual manifest variable, as R2 of manifest variables and latent variables, which should be higher than 0.5, (2) composite reliability (ρ) of latent variable, as the Cronbach's α of observed indicators in latent variables, which should be higher than 0.6, and (3)average variance extracted of latent variable, calculated by the R2 sum of manifest variables in a latent variable being divided by the number of manifest variables to show the percentage of latent variable being measured by the manifest variables, which is better higher than 0.5.

Research sample and object

Aiming at employees and supervisors in healthcare industry in Fujian Province, 500 copies of questionnaire, with random sampling, are distributed and collected from January to March, 2024. Total 394 valid copies are retrieved, with the

retrieval rate 79%. The collected questionnaire data are analyzed with the statistical software.

Reliability and validity test

Validity refers to a measuring scale being able to actually measure the degree of something measured by a researcher. Common validity covers "content validity", tending to qualitative verification, "criterion validity", using known extrinsic criterion and the correlation coefficient in the test for the evaluation, and "construct validity", used for evaluating a measurement with theoretical consistency with other observed variables. The questionnaire content in this study is based on past theories and referred to the actual situations of research objects to design the tool being able to actually express the essence and complete representativeness that the questionnaire conforms to the content validity. Besides, the final communality estimation of factor analysis results is used for testing the construct validity of measured items, and the acquired validity appears in 0.8~0.9, showing good validity test result of this questionnaire.

Results and Discussion

Model fit test

With "maximum likelihood" estimation, the analysis result achieves convergence. Overall speaking, the indicators for overall model fit pass the test, Table 1, fully reflecting good extrinsic quality of model.

Table 1. Model analysis result

	Evaluation indicator	Judgment standard	Result
overall fit	*p* -value	*p* -value > 0.05	0.000
	χ_2/d.f.	< 3	1.926
	GFI	> 0.9	0.957
	AGFI	> 0.9	0.908
	CFI	> 0.9	0.934
	RMR	< 0.05, <0.025 excellent	0.011
	RMSEA	0.05~0.08 good < 0.05 excellent	0.028
	NFI	> 0.9	0.956
	IFI	> 0.9	0.942

Path relationship test

Regarding the test of quality of internal model, SMC of manifest variables is higher than 0.5 (Table 2), revealing good indicators in latent variables. Moreover, latent variables of product development, product innovation, and green marketing appear the composite reliability higher than 0.6, and the average variance extracted is higher than 0.5 (Table 3), conforming to the requirement for intrinsic quality of model.

Table 2. SMC of variable to dimension

product development		product innovation		green marketing	
technique	support	radical innovation	incremental innovation	product	promotion
0.80	0.83	0.76	0.81	0.85	0.87

Table 3. Composite reliability and average variance extracted of variable

item	product development	product innovation	green marketing
composite reliability	0.814	0.783	0.86
average variance extracted	0.80	0.76	0.84

From the model analysis result, Table 4, product development and product innovation (0.846) present positive and remarkable correlations, product innovation and green marketing (0.871) show positive and notable correlations, and product development and green marketing (0.863) also reveal positive and significant correlations that H1, H2, and H3 are supported. The hypothesis results are displayed in Table 5.

Table 4. Linear structural model analysis result

Evaluation item	Parameter/evaluation standard	Result	t
internal fit	product development→product innovation	0.842	27.36**
	product innovation→green marketing	0.827	23.75**
	product development→green marketing	0.853	32.44**

Table 5. Hypothesis verification

Research hypothesis	Correlation	Empirical result	P	Result
H1	+	0.842	0.00	supported
H2	+	0.827	0.00	supported
H3	+	0.853	0.00	supported

Conclusion

The research results reveal remarkably positive effects of product development on product innovation that healthcare industry grasping the mainstream technology, leading technology, and superior technology to the same industry, and even acquiring patented unique technology as well as regarding green product as the key performance index for product development, having senior supervisors' support and encouragement, being willing to invest more in human resources and budget, and positively acquiring global green tag or patent granted could benefit the performance on types and novelty of product innovation. It is discovered in this study that product innovation presents remarkably positive effects on green marketing. For healthcare industry, promoting green products is the innovation of producing new products, adopting new manufacturing or new sales, and even opening new markets or new customers. Besides, adding green new concept, using new materials, combining popular design elements or functions, and reinforcing product novelty could benefit healthcare industry providing green products matching customer demands to have customers identify and affirm the satisfaction with firms providing green marketing. It is also found out in this study that product development reveals notably positive effects on green marketing. That is, healthcare industry being able to grasp green product mainstream, leading or unique technologies, being willing to invest in more resources, and having senior supervisors supporting the R&D of green products would have customers identify and affirm the satisfaction with firms providing green marketing.

Suggestions

According to the research results, essential suggestions, aiming at product development, product innovation, and green marketing, for healthcare industry are proposed in this study.

– The major obstacle to develop green products is buyers' trust, and the key in receiving buyers' trust lies in the entire process of suppliers' product production, sales, abandon, recycle and reuse reassuring buyers conforming to green standards. Practically, buyers could hardly confirm whether sellers conform to green standards at each stage that they could merely purchase from trustworthy suppliers. In this case, it is suggested that the government and healthcare industry related institutions should lead and

integrate healthcare industry into business alliance, and even expand to cross-industry alliance, to provide the green supply chain with complete upstream material, abandon, recycle, and reuse conforming to international green standards and develop the national image of green kingdom so as to have the country become the first choice in healthcare product purchase. It would largely assist healthcare industry in developing green products and grasping green business opportunity.

– Product development in healthcare industry should combine with global customer market orientation and present ecological green and social commitment to satisfy customer demands. Moreover, it is suitable for healthcare industry adopting affordable R&D in international market, i.e. building competitive advantage of the industry with excellent quality and reasonable prices. In fact, acquiring global green tags is regarded as the best certificate to sell green products in international markets and acquire buyers' trust. It is suggested that healthcare industry should reinforce the acquisition of global green tag or be granted patents on green products as well as include green thinking into corporate core strategies.
– The government could list counseling the development of green healthcare products in the special fund application for domestic healthcare industry, entrust the execution to suitable institutions, promote domestically advantageous green healthcare products, and provide substantial subsidy funds to encourage healthcare industry developing and producing green products. Meanwhile, combining green with charity would build deeper and broader green value, such as offering disadvantaged groups, like low-income households, with job opportunity of recycling green products, and create unique green culture and value. Under the international trend of rising green awareness and corporate responsibility, it would provide international buyers with more meaningful green choices and give extra points for the green in healthcare industry.

References

Aggarwal, V. A. (2020). Resource Congestion in Alliance Networks: How a Firm's Partners' Partners Influence the Benefits of Collaboration. *Strategic Management Journal*, *41*(4), 627-655; DOI: 10.1002/smj.3109.

Cao, X. Y. & Wu, X. Z. (2020). The Collaborative Strategy for Carbon Reduction Technology Innovation on Dual-channel Supply Chain under the Carbon Tax Policy. *Journal of Central China Normal University*, *54*(5), 898-909.

Chen, W., Wang, X., Qu, H., Wei, X. & Lin, C. (2020). The Influencing Factors of Sharing Behavior of the Industry-University-Research Collaboration. *Management Review*, *32*(11), 92-101.

Fan, F., Lian, H., & Wang, S. (2020). Can Regional Collaborative Innovation Improve Innovation Efficiency? An Empirical Study of Chinese Cities. *Growth and Change*, *51*(1), 440-463; DOI: 10.1111/grow.12346.

Gao, M. (2020). Mechanism of External Knowledge Sources on Enterprise Service Innovation Ability in Cooperative Innovation. *Journal of ZEJIANG SHUREN University*, *20*(1), 64-74.

Hou, X. L. & Lee, J. N. (2020). Research on Construction and Evaluation of Performance Management System of Manufacturing Enterprises based on Big Data. *Journal of University of Science and Technology Liaoning*, *43*(6), 463-472.

Jian, Z. Q. & Kuang, Z. (2020). Collaborative Innovation Network, Compositional Capability and New Service Development Performance. *Chinese Journal of Management*, *17*(10), 1498-1505.

Jiang, Y. & Cao, Y. (2021). Innovation Efficiency Evaluation of Industry-University-Research Cooperation in Chinese Pharmaceutical Manufacturing: Based on Three-stage DEA Model. *Science and Technology Management Research*, *21*(2), 54-60.

Kong, X. & Zhang, D. (2020). Research on Knowledge Diffusion Modeling and Simulation for Heterogeneity Enterprises in Cluster Innovation Network. *Operations Research and Management Science*, *29*(10), 173-182; DOI: 10.12005/orms.2020.0269.

Lee, Y. & Tang, L. (2020). Bidirectional Technology Spillover of "Clusters with Cores" and Cluster Innovation Performance: Regulation of Independence. *Nankai Business Review*, *23*(2), 39-50.

Li, B., & Zhang, J. (2021). A Cooperative Partner Selection Study of Military-Civilian Scientific and Technological Collaborative Innovation Based on Interval-Valued Intuitionistic Fuzzy Set. *Symmetry*, *13*(4), 553; DOI: 10.3390/sym13040553.

Liu, H. & Chen, J. (2021). Research on the Relationship between Niche Suitability of Innovation System and Economic High-quality Development. *Science & Technology Progress and Policy*, *21*(3), 1-9; DOI: 10.6049/kjjbydc.2020110566.

Mao, Y., Cao, J. & Fang, Y. (2021). Research on Collaborative Network Structure of Technological Innovation in New R&D Institutions. *Science and Technology Management Research*, *21*(3), 76-82.

Pang, M. C., Zhang, C. & Jiao, W. W. (2021). Venture Capital, Institutional Context and the Industrial Upgrading. *Science & Technology Progress and Policy*, *21*(3), 1-10.

Su, C. & Zeng, G. (2021). Review on Study of Regional New Path Development from the Perspective of Evolutionary Economic Geography. *Economic Geography*, *41*(2), 23-34.

Su, C., Zeng, G., Lee. Y. & Xu, Y. (2021). Influence of Trans-regional Cooperation Innovation on Regional Diversification in the Yangtze River Delta. *Resources and Environment in the Yangtze Basin*, *21*(3), 1-16.

Su, Y. & Lee, Z. (2021). Research on the Influence of Main Body Cooperation Intensity on Innovation Performance in Regional Innovation System. *Journal of Industrial Engineering*, *35*(3), 64-76.

Sun, K. & Guo, W. (2021). Research on the Stability of High-tech Enterprise Innovation Alliance from the Perspective of Coopetition. *Chinese Journal of Management Science*, *29*(3), 219-229; DOI: 10.16381/j.cnki.issn1003-207x.2018.1674.

Wang, J. & Song, Y. (2020). Research on the Impact of Relationship Management Capability on Enterprise Innovation Performance Based on the Perspective of Network Structure Characteristics. *Journal of UESTC*, *22*(6), 76-85.

Wang, L. & Chen, Z. J. (2020). How Does Value Co-Creation Affect the Improvisational Capabilities of Innovation Enterprise: A Case Study Based on Resource Dependence Theory. *Management World*, *36*(11), 96-132.

Wu, S. Q., Yin, H. & Cai, T. T. (2021). Embedded Innovation Network, Cross Border Cooperation, and Innovation Capability of Advanced Manufacturing Enterprises: An Empirical Study on Advanced Manufacturing Clusters in Yangtze River Delta. *East China Economic Management*, *35*(4), 34-41.

Zhang, Y., Wang, W., Wu, D., Cheng, S., Shi, Y. & Ma, X. (2021). Analysis on the path of agricultural scientific research institutes to promote the industrialization of intellectual property. *Hubei Agricultural Science*, *60*(3), 190-192.