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DECISION-MAKING OF MANUFACTURING SYSTEM FUNCTIONAL OBJECTIVES

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Abstract. *We study the relationship among customer demand, competitive strategy and manufacturing system functional objectives based on manufacturing enterprises in the northeast of China. The results show that customer demands have a significant positive effect on competitive strategy. Enhancing customer demand is beneficial to improve the level of competitive strategy of enterprises; competitive strategy have a remarkable positive influence on manufacturing system functional objectives; customer demand directly affect manufacturing system functional objectives, which is indirectly impacted by customer demand through competitive strategy. In addition, both competitive strategy and manufacturing system functional objectives are notably influenced through satisfactions of customer demand. The conclusion of the research can provide theoretical guidance for enterprises which implement manufacturing system functional objectives.*
Keywords: Customer demand, Competitive strategy, Operational performance, Functional objectives, Decision

1. **Introduction.** Today, with the rapid development of information technology and communication network, the market environment on which enterprises rely has changed dramatically: the trend of economic globalization is increasingly obvious; enterprise competitions are more and more intense; product lifecycle becomes shorter sharply; customer demand on due date and product quality is more rigorous, etc. Manufacturing system functional objective decision is jointly influenced by customer demand and competition strategy. The original traditional manufacturing system functional objectives only pursue the harmony of low cost and high efficiency, which cannot adapt to the current trend that has the features of information era and manufacturing system, such as agile manufacture, Mass Customization, networked manufacture, and intelligent manufacture. Manufacturing system is the core subsystem of enterprise, and it is the basis that enterprises provide satisfactory products to the users as well as the foundation of winning in market competition. Manufacturing system functional objective decision is the base and premise of the design of manufacturing system, meanwhile the carrier of manufacturing system functional objective determines the function of manufacturing system.

Manufacturing system is an input/output system in which manufacturing resources are converted into products or semi-finished products, and the system consists of manufacturing process and the related hardware, software and workers. The system involves the whole or part process of product lifecycle which contains market analysis, product design, process plan, manufacturing process, assembly, transport, product sales, after-sales service, and recycling, etc. Different from cell production technology, the research objectives of manufacturing system are not only traditional technological behaviors, but consist of

economy, society, humanity and other integrated factors as well. Therefore, manufacturing system should be placed in economic, social, humane environment, considered as a complex social large system. The basic functional objectives of manufacturing system research are time, quality, cost, service and environment (TQCSE). Manufacturing system functional objectives are mutual restriction; even some objectives are contradictory, like high quality and low cost, high efficiency and satisfactory service. Knowing the mechanism of dual pressures of customer demand and market competition affect manufacturing system functional objective decision, is the key problem of manufacturing system to respond to market demand, to carry out strategic intent of enterprises, to obtain sustainable competitive ability and to resist highly uncertain manufacturing environment.

Many transnational corporations, such as IBM, Toyota, General and Electric, the competitive advantages are to enhance the ability that manufacturing system functional objective decision responds to customer demand and competitive environment, to identify market demand, to integrate their own resources and to determine the competitive strategy, which is directed to reduce unnecessary waste, and the ultimate objectives are to enhance market share and to reduce operation cost. So, as a big manufacturing country of China, what is the key problem of manufacturing system? What is the relevance of customer demand and competitive environment to functional objectives? Although a lot of scholars believe that both customer demand and competitive environment have an influence on manufacturing system functional objectives, it lacks some empirical research. By means of empirical research, we validate the relevance of customer demand and competitive environment to functional objectives, which is to provide theoretical basis for manufacturing system of enterprises to make scientific decisions.

2. Theoretical Basis and Research Hypothesis.

2.1. Concept definition.

2.1.1. *Customer demand.* Many scholars define customer demand from different angles. For example, A. A. Levis and L. G. Papageorgiou (2005) [1] consider customer demand is the agreement of competitive strategy, benefit sharing and risk sharing between buyers and sellers. C.-F. Tsai and M.-Y. Chen (2010) [2] believe customer demand is that for the same objective different customers invest related resources which are mainly time and money to make efforts to reach product objective quality and quantity set by themselves. A. Haensel (2011) [3] claims customer demand is a relationship between customer and enterprise which is based on the trust towards each other, the total risk, benefit-sharing awareness, achieving competitive advantage and creating greater performance. H. G. H. Tiemessen et al. (2013) [4] maintain that it is an agreement between sellers and buyers, by which enterprises could achieve objectives of mutual benefit,the total risk, sharing profit.

In summary, we define customer demand as the one which is formed between consumers and enterprises, which are benefit-sharing, risk-sharing, long-term, stable and cooperative. Establishing forecasts and management of customer demand can attain the objectives of reducing cost, diversifing risk, gaining critical resources and improving competitive position.

While, what aspects shall we proceed to measure customer demand? On the basis of the opinions of E. Babakus et al. (2009) [5], customer satisfaction and customer loyalty are two factors of measuring customer demand. Thereinto, customer satisfaction is honest and mutual understanding belief between customers and enterprises. This belief can reduce communicating cost and mutual suspicion, and avoid taking opportunistic practice which may hurt each other. Customer loyalty is that both sides in order to achieve common

goals are willing to sacrifice short-term benefit by contributing critical resources, to show that they think highly of bilateral relations and desire for preservation.

2.1.2. *Competitive strategy.* Competitive strategy is considered as the base of realizing enterprise market share (E. Claver-Cortés et al. 2012 [6]; M. Acquaah and M. Yasai-Ardekani, 2008 [7]). Most scholars argue that the upstream and downstream of supply chain can alleviate Bull hip Effect by competitive strategy (Information Sharing), to improve supply chain performance (M. J. R. Ortega, 2010 [8]; Y. Zhang et al. 2010 [9]). What aspects of information should supply chain partnership share? S. Salunke, J. Weerawardena and J. R. McColl-Kennedy (2011) [10] point that in supply chain organizational complete competitive strategy should contain: partners are willing to share sales forecasting information and technical information; both sides understand product sales' degree, etc. Deeming competitive strategy of supply chain can be divided into four aspects: order processing information, operation information, strategic information and competitive information.

According to the existing literature, we divide competitive strategy content of supply chain into three aspects: operation information, financial information and strategic information. Operation information is mainly about order processing information, stock amount, production scheduling, production capacity planning and order forecasting, etc. Financial information is mainly about sales data sharing, production cost and profit so on. Strategic information mainly provides the information of increasing the rate of reaction and reducing the uncertainty of demand for enterprises.

2.1.3. *Manufacturing system functional objectives.* Cost, customer service, flexibility, due date and innovations are always applied by manufacturers to evaluate performance or operational objectives. I. Um et al. (2009) [11] apply six indexes which are stock, time, order fulfillment, quality, customer focus and customer service to evaluate performance of supply chain. O. A. Joseph and R. Sridharan (2011) [12] use four kinds of competitive advantages which are cost, quality, due date and flexibility to analyze manufacturer performance. M. H. M. A. Jahromi and R. Tavakkoli-Moghaddam (2012) [13]; H. Nouri and T. S. Hong (2013) [14] adopt cost, quality, flexibility and innovations to discuss automobile manufacturer performance. Based on the above researches, we apply four variables which are cost, service level, time and innovations to measure manufacturing system functional objectives. Cost performance applies two items to evaluate: low production cost and the decrease of overall cost; customer service applies three items to evaluate: order satisfaction rate, distribution punctuality and out of stock rate; time applies two items to evaluate: the production lead time shortened and time to market of new products shortened; innovations apply two items to evaluate: new product quality and existing products' function increasing.

2.2. **The relationship among customer demand, competitive strategy and manufacturing system functional objectives.**

2.2.1. *Customer demand and competitive strategy.* The closer the relationship between customer and enterprise is, the easier they share information with each other, even more willing to change its internal information system reinvestment to reduce the problem of the drop of informatization level, to improve the capacity of manufacturing system. V. Kalogeraki et al. (2008) [15] argue, future leaders regard customer value, commercial appeal, individuation and variety as competitive centre whose key influencing factors are individuation and variety of customer demand. A. Agus and Z. Hassan(2011) [16] point, in terms of the action of competitive strategy, when there is no customer demand, manufacturing system functional objectives are the key factors for the success of manufacturing

system which balance planning skills and executive ability of competitive strategy. When enterprise strategy and manufacturing system are integrated in the interactive process, there will be close contact between each other, which can promote prospective and customer demand satisfied actions. N. Bolloju et al. (2012) [17] consider, customer demand is the basis of competitive strategy, and cultivating responsible relations is propitious for enterprises to timely adjust strategy. O. Kaya (2013) [18] say, reliant relationship in organizations will influence the ability of information flow, and the accuracy of determining customer demand will help enterprises to make competitive strategy and resist market risk. Thus, we adopt the first hypothesis.

H1: customer demand has a significant positive impact on the performance of competitive strategy.

2.2.2. *The relationship between competitive strategy and manufacturing system functional objectives.* M. Heijltjes and A. van Witteloostuijn (2003) [19] consider, adding the preference of competitive strategy can reduce Bull Whip Effect of manufacturing system caused by insufficient competitive strategy. G. S. Dangayach and S. G. Deshmukh (2006) [20] hold, competitive strategy obviously affects manufacturing system functional objectives, that is, the higher degree of competitive strategy can give an index to higher performance of manufacturing system. M. J. R. Ortega (2010) [21] argue, competitive strategy obviously affects executive capacity of manufacturing system, that is to say, the higher degree of competitive strategy requires manufacturing system having better adaptability and schematization. M. L. Santos-Vijande et al. (2012) [22] say, competitive strategy provides the guidelines of power and direction of sustainable development for enterprises. Manufacturing system is an important medium for the implementation of competitive strategy, which needs timely adjustment in accordance with competitive strategy. So, we put forward the second hypothesis.

H2: competition strategy has a significant positive effect on manufacturing system functional objectives.

2.2.3. *The relationship between customer demand and manufacturing system functional objectives.* The customer demand strongly affects the performance of the manufacturing system (J. Hadden et al. (2007) [23]). When the intensity of customer demand is more and more dependent on manufacturing system functional objectives, manufacturing system will show significant changes by transforming its functions [24,25]. Because, when relations that customer demand depends on manufacturing system functional objectives change, different functional objectives of the system will be adjusted anew, in order to response to market opportunities which make the system have the ability to respond to customer demand and make both sides more efficiently match resource to achieve the same objectives. So building relationship between customer demand and manufacturing system functional objectives will improve the dependent degree between customers and enterprises, and then improve operating performance of manufacturing system. Therefore, we use the third hypothesis.

H3: customer demand has a significant positive impact on manufacturing system functional objectives.

3. **Research Plan.**

3.1. **Conceptual framework of the research.** We establish conceptual framework of the research based on previous research results, related theories and panel discussion, as Figure 1 says. In this chart, customer demand not only directly affects manufacturing system functional objectives, which are also indirectly affected by competitive strategy.

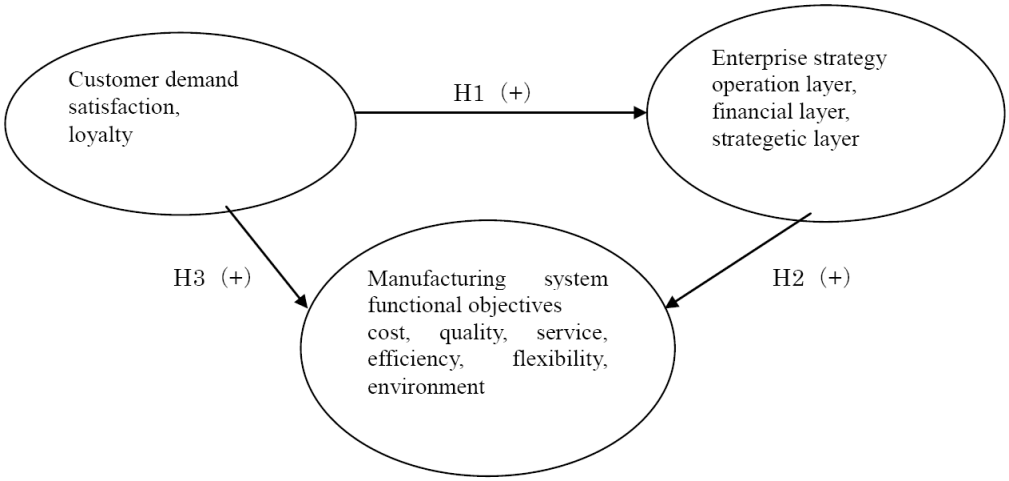


FIGURE 1. The hypothesis path

3.2. **Definition and measure of the variables.** To ensure validity and reliability of measuring tool, we use the scales which have been used by the existing literature and are amended on the basis of research objectives as far as possible.

The scales of customer demand mainly come from the research of [26-30], among which there are 13 items including 2 factors which are customer satisfaction and customer loyalty in all. The scales of competitive strategy of supply chain mainly come from the research of [31-36], among which there are 12 items including 3 factors which are operation layer, financial layer and strategic layer. The scales of manufacturing system functional objectives mainly come from the research of [37-45], among which there are 21 items including 6 factors which are cost, quality, service, efficiency, flexibility and environment.

3.3. **Research sample.** This research mainly studies the relationship among customer demand, competitive strategy and manufacturing system functional objectives. Manufacturing industry is the one which has the characteristics of obvious manufacturing system. So manufacturing industry is the research model, and the research objects are basically the enterprises of automobile industry, chemical industry, computer and related equipment industry, appliances industry, mechanical industry, telecommunication industry and textile industry in the manufacturing industry. The field of investigation is the northeast of China.

On the basis of enterprise yellow pages of the northeast of China, this paper randomly chooses the sample enterprises intended to investigate, then gets in touch with the executives by phone. After ensuring they accept investigation, the action begins. Meanwhile EMBA students, senior manager training class and MBA students of Harbin Institute of Technology, Jilin University and Northeastern University are chosen, which gathers a lot of business executives, and ask them to fill out this questionnaire when they are free. All of the students come from the northeast of China, which have comparative cultural backgrounds to understand this questionnaire.

500 copies of questionnaires are sent. 253 copies of questionnaires are taken back, among which there are 5 copies of invalid questionnaires whose answers are not complete and 248 copies of valid questionnaires. Manufacturing industry is the research object, so 36 copies of non-manufacturing enterprises questionnaire are deducted. 212 copies of questionnaires are actually used. The investigation time is from March 1st, 2012 to July 30th, 2012.

3.4. **Factor analysis.** Aiming at customer demand and manufacturing system functional objectives, this paper uses factor analysis to extract main factors. Customer dimension consists of 15 items (A1∼A15), using to measure the customer demand. After retrieving data, factors are analyzed by SPSS16.0. We start with principal components analysis, and takes 4 factors whose eigenvalue is 1 plus, and rotates their shafts by maximum variation. After the first factors analysis, the paper finds interpretation degree of 6 items which are A4, A7, A10, A12, A14, A15 which are worse, so they are deleted. Then analyze the remaining 8 items whose qualities are higher, the results are shown in Table 1. Known by Table 1, the value of KMO is 0.770, which is greater than Kaiser (1974) that the least value of KMO is 0.5, which shows that there are a lot of common factors in the variables, it is adapted to adopt factor analysis; Bartlett's test of sphericity (P-value):0, which reaches significant level, meaning correlation matrix of the population has common factors, it is adapted to adopt factor analysis, and 2 factors extracted can explain the whole variant 71.094%.

Table 1. Factor analysis of customer demand

item	customer satisfaction	customer loyalty
A6	0.876	
A1	0.801	
A2	0.773	
A5	0.705	
A3	0.684	
A13		0.814
A9		0.735
A11		0.700
A8		0.681
explained variation %	43.787%	27.307%
Total variation %	43.787%	71.094%
Kaiser Meyer Olkim (KMO) Measure of Sampling Adequacy:0.709		
Bartlett's test of sphericity (P-value):0		

Performing principal component analysis to analyze 12 items of competitive strategy, Kaiser Meyer Olkim (KMO) Measure of Sampling Adequacy:0.821, which is greater than Kaiser (1974) that the least value of KMO is 0.5, which shows that there are a lot of common factors in the variables, it is adapted to adopt factor analysis. And Bartlett's test of sphericity (P-value):0, which reaches significant level, meaning correlation matrix of the population has common factors, it is adapted to adopt factor analysis, and 3 factors extracted can explain the whole variant 70.141%. The results are shown in Table 2.

Performing principal component analysis to analyze 21 items of manufacturing system functional objectives, Kaiser Meyer Olkim (KMO) Measure of Sampling Adequacy:0.790, which is greater than Kaiser (1974) that the least value of KMO is 0.5, Bartlett's test of sphericity (P-value):0, which reaches significant level, 4 factors extracted can explain the whole variant 87.773%. The results are shown in Table 3.

3.5. **Reliability test.** Reliability analysis of the questionnaires is to further confirm the reliability. We adopt Cronbach's reliability analysis which is widely used in the literature. Generally, the one less than 0.3 is incredible, from 0.3 to 0.4 is barely credible, from 0.4 to 0.5 is a little credible, from 0.5 to 0.7 is credible, from 0.7 to 0.9 is highly credible, greater than 0.9 is fully credible. As shown in Table 4, Cron2bach's values of various factors and variables are credible, which shows the scale has good reliability.

TABLE 2. Factor analysis of competitive strategy

item	operation information	strategic information	financial information
B5	0.851		
B6	0.793		
B2	0.762		
B8	0.691		
B1	0.587		
B11		0.813	
B12		0.751	
B9		0.688	
B3		0.676	
B10			0.870
B4			0.805
B7			0.647
explained variation %	29.183%	22.104%	18.854%
Total variation %	29.183%	49.871%	70.141%
Kaiser Meyer Olkim (KMO) Measure of Sampling Adequacy:0.821			
Bartlett's test of sphericity (P-value):0			

TABLE 3. Factor analysis of manufacturing system functional objectives

item	cost	quality	efficiency	service	flexibility	environment
C16	0.845					
C5	0.798					
C6	0.777					
C9		0.884				
C13		0.839				
C1			0.762			
C2			0.751			
C3			0.623			
C16				0.804		
C8				0.613		
C21					0.811	
C10					0.781	
C14					0.701	
C4					0.645	
C7						0.830
C18						0.794
explained variation %	20.126%	17.704%	14.509%	13.816%	11.776%	9.842%
Total variation %	25.773%	37.830%	52.339%	66.155%	77.931%	87.773%
Kaiser Meyer Olkim (KMO):0.790						
Bartlett's test of sphericity (P-value):0						

TABLE 4. Reliability test

value	factor	Cronbach's		variable	factor	Cronbach's	
manufacturing system functional objectives	cost	0.8178	0.8460	information sharing	operation information	0.8542	0.8239
	quality	0.8007					
	efficiency	0.7059			financial information	0.7866	
	service	0.7147					
	flexibility	0.6914			strategic information	0.8803	
	environment	0.7033					
customer demand	satisfaction degree	0.8413	0.8219				
	loyalty degree	0.7835					

4. Research Results.

4.1. The influencing relationship of the major factors of variables.

4.1.1. *The relationship between customer demand and competitive strategy.* Regarding 2 factors of customer demand as the independent variable, regarding 3 factors of competitive strategy as the dependent variable, we separately adopt regression analysis. The results are shown in Table 5. The satisfaction of sharing performance like operation information, financial information and strategic information has significant positive impacts, which means enhancing customer satisfaction can improve the level of competitive strategy. In addition, loyalty degree has significant positive impacts on competitive strategic performance and financial information.

TABLE 5. The influence of customer demand of supply chain on manufacturing system functional objectives

independent variable	dependent variable		
	operation information	strategic information	financial information
satisfaction degree	0.288**	0.271**	0.361***
	(2.406)	(2.164)	(2.691)
loyalty degree	0.079	0.243*	0.231*
	(0.594)	(2.021)	(1.995)
the value of F	4.237**	6.859***	8.667***
R^2	0.112	0.171	0.210

(Note: The data in the table is the standardized coefficient, the values in parentheses is t coefficient, "*" means p<0.1, "**" means p<0.05, "***" means p<0.01)

4.1.2. *The influence of customer demand on manufacturing system functional objectives.* Regarding 2 factors of customer demand as the independent variable, regarding 6 factors of manufacturing system functional objectives as the dependent variable, we separately adopt regression analysis. The results are shown in Table 6. The satisfaction has significant positive impacts on cost, quality, efficiency, service, flexibility and environment, which means ameliorating customer satisfaction, is beneficial to improve the performance of manufacturing system functional objectives. Besides, loyalty degree has significant positive impacts on service and flexibility.

TABLE 6. The influence of customer demand on manufacturing system functional objectives

independent variable	dependent variable					
	cost	quality	efficiency	service	flexibility	environment
satisfaction degree	0.412*** (3.506)	0.516*** (4.736)	0.361*** (2.781)	0.438*** (3.807)	0.342*** (2.711)	0.398*** (3.794)
loyalty degree	0.071 (0.564)	0.126 (1.041)	0.273 (2.670)	0.219 (2.415)	0.290 (2.904)	0.245 (2.595)
the value of F	8.242***	16.472***	10.997***	16.903***	12.302***	14.165***
R^2	0.257	0.365	0.267	0.361	0.247	0.321

(Note: The data in the table is the standardized coefficient, the values in parentheses is t coefficient, "*" means p<0.1, "**" means p<0.05, "***" means p<0.01)

4.1.3. *The influence of competitive strategy on manufacturing system functional objectives.* Regarding 3 factors of competitive strategy as the independent variable, regarding 6 factors of manufacturing system functional objectives as the dependent variable, we separately adopt regression analysis. The results are shown in Table 7. The higher level of competitive strategy is more beneficial to improve the performance of manufacturing system functional objectives. Operation information is conducive to reducing operating cost and improving quality, efficiency, flexible manufacturing capability. Financial information is conducive to improving enterprise performance and the level of customer service. Strategic information is conducive to reduce cost, improve the level of customer service and pay attention to the environmental protection.

TABLE 7. The influence of competitive strategy on manufacturing system functional objectives

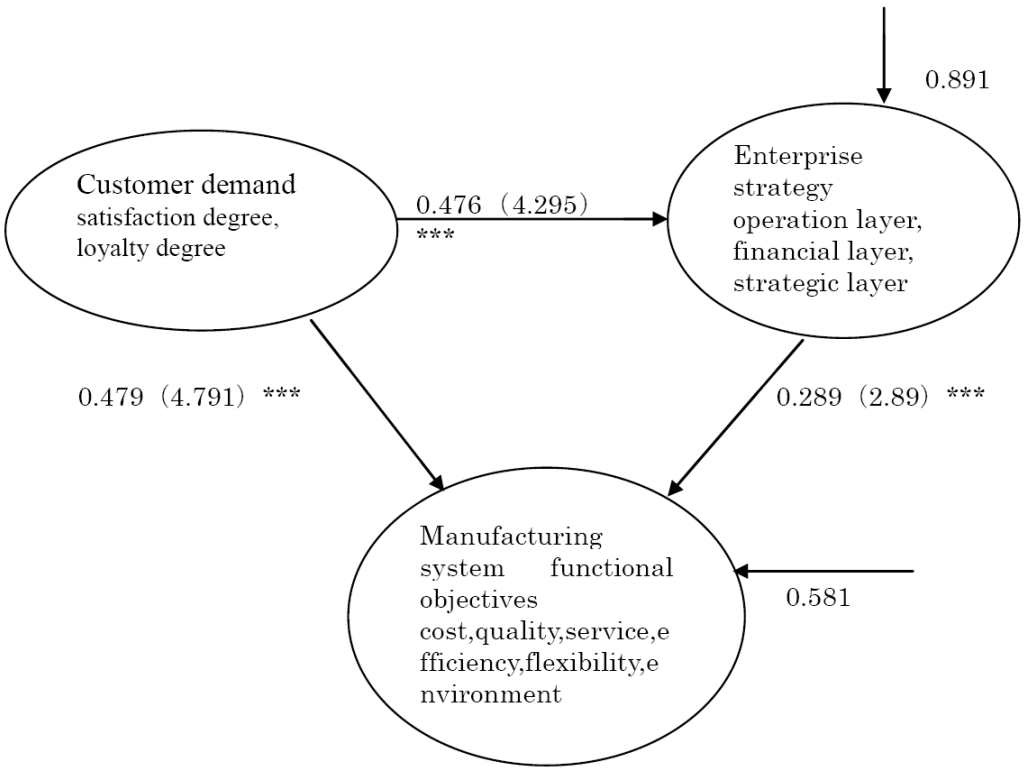
independent variable	dependent variable					
	cost	quality	efficiency	service	flexibility	environment
operation information	0.407*** (4.106)	0.392*** (3.764)	0.385*** (3.505)	–0.179 (–1.267)	0.329*** (2.811)	0.245(2.595) (2.595)
financial information	0.010 (0.156)	0.349 (2.502)	0.308*** (3.557)	0.373*** (2.277)	0.288 (2.716)	0.276 (2.035)
strategic information	0.279** (2.004)	–0.032 (–0.212)	0.088 (0.565)	0.542*** (2.991)	0.280 (2.732)	0.415*** (3.768)
the value of F	15.653	4.89	5.64	9.438	6.781	5.20
R^2	0.431	0.206	0.199	0.307	0.167	0.198

(Note: The data in the table is the standardized coefficient, the values in parentheses is t coefficient, "*" means p<0.1, "**" means p<0.05, "***" means p<0.01)

4.2. **Path analysis of customer demand, competitive strategy on manufacturing system functional objectives.** We analyze the relationship of various factors of three variables among customer demand, competitive strategy on manufacturing system functional objectives above, but do not analyze the interactions between variables. Due to Figure 1, customer demand may not only have a direct impact on the manufacturing system functional objectives, but also indirectly affect the manufacturing system though influencing competitive strategy. So path analysis is needed. In the path analysis, two multiple regression are conducted. Firstly, manufacturing system functional objectives are regarded as the dependent variables; customer demand and competitive strategy are

regarded as the independent variables. Secondly, competitive strategy is regarded as the dependent variable; customer demand is regarded as the dependent variable.

The results are shown in Figure 2. There are 3 outstanding paths of manufacturing system functional objectives. The first one is customer demand which directly affects manufacturing system functional objectives, the path coefficient is 0.492; the second one is competitive strategy which directly affects manufacturing system functional objectives, the path coefficient is 0.294; the third one is customer demand which indirectly affects manufacturing system functional objectives through competitive strategy, the indirect effect is 0.136. The overall influence of customer demand on manufacturing system functional objectives is 0.631, competitive strategy's is 0.294.



(Note: The data in the table is the standardized coefficient, the values in parentheses is t coefficient, "*" means p<0.1, "**" means p<0.05, "***" means p<0.01)

FIGURE 2. The path analysis of customer demand, competitive strategy on manufacturing system functional objectives

TABLE 8. The results of path analysis

dependent variable	independent variable	direct results	indirect results	total results
competitive strategy $R^2 = 0.214$	customer demand	0.476	–	0.476
manufacturing system functional objectives $R^2 = 0.467$	customer demand and competitive strategy	0.479 0.289	0.141 –	0.620 0.289

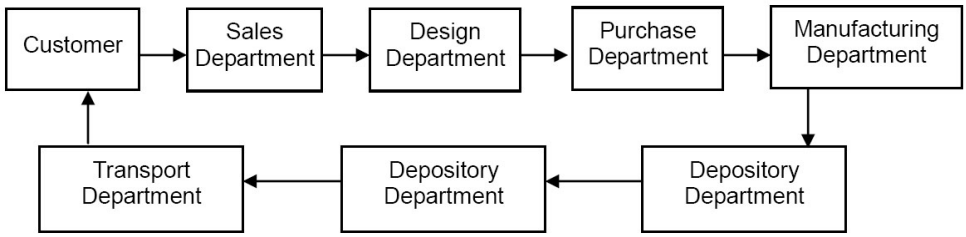


FIGURE 3. Original manufacturing system of SMT

5. **Example.** Shenyang Machine Tool Group was originally regarded as an enterprise with manufacturing system goals relying on its low cost and high efficiency before 2007, and made good profits in the early days, such as Figure 3. However, with the changing of customer demands, the original manufacturing system cannot meet the demands of enterprise development. Therefore, we must adjust the orientation of the original low cost competitive strategy. After a large number of market research, Shenyang Machine Tool finds that service competition based on time and flexible competition based on many varieties are the real demands of the enterprise from market demands, such as Figure 4. Shenyang Machine Tool Group has taken the lead in the industry to change "low cost" strategy, which formed in the past, and has obtained the following results. 1) Removing the value chain of low-end products. In October 2010, Shenyang Machine Tool Group launched a low-end product of socialized transfers, namely OEM projects. So far, OEM project has achieved the expected goals. You could not see the shadow of the low-end products in the park, instead, it frees up space and ability for the development of high-end CNC products. 2) Improving the flexible of manufacturing system and taking the road of mass customized production. Shenyang Machine Tool Group begins to enter the core manufacturing areas, such as numerical control systems, electronic devices, and key components. It will change part of water production mode into unitary production mode, and greatly enhance the flexible production line of products. Last year, customized production of CNC machine tools was 35,000 sets and had increased 10,000 sets than before. 3) Establishing management system of customer relationship, understanding dynamic of customer demands timely, improving service and market response ability. This enterprise realizes the transformation from traditional product manufacturer to modern industrial service provider. Sale staffs in the group have reached 2,000 people, and created a large client mode, set up a customer service center system, at the same time; they implement a 24-hour personal service for customers. 4) The first 4S shop of Shenyang Machine Tool Group has become the fastest growing and most advanced machine tool sales platform. It sets up its own 4S shop. In 2009, the four 4S shops of Shenyang Machine Tool Group achieved the sale of 810 million yuan, accounting for 11.4% of total sales; In 2010, 4S shop of Shenyang Machine Tool Group developed to seven and achieved sales of 2.52 billion yuan, accounting for 23.6 % of the total sales; Last year, it accounted for more than 30%, and the sales of the biggest 4S shop was more than 500 million yuan. In 2011, the sales of Shenyang Machine Tool broke 18 billion yuan, and became the first machine tool manufacturing industry in the world.

6. Conclusions and Discussion.

6.1. **The main results.** The purpose of this research is to explore the relationship among customer demand, competitive strategy and manufacturing system functional objectives. We construct the conceptual framework through reviewing literature and interviewing

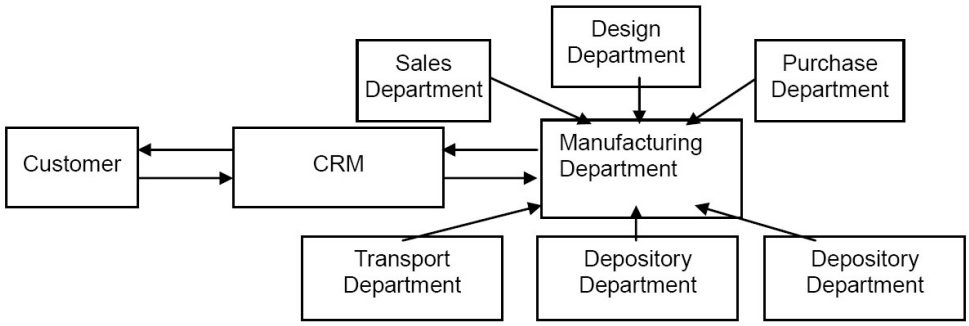


FIGURE 4. New manufacturing system of SMT

cases, and choose manufacturing enterprises of the northeast of China as research objects. The results show customer demand and competitive strategy really have significant effects on manufacturing system functional objectives: (1) Customer demand has a significant positive effect on the performance of competitive strategy; (2) Customer demand has a momentous positive effect on manufacturing system functional objectives; (3) Competitive strategy has an important positive effect on manufacturing system functional objectives; (4) Customer demand not only directly affects manufacturing system functional objectives, but also are indirectly affected by competitive strategy.

6.2. **Innovations.** The results further confirm the argument scholars discussing which is customer demand and competitive strategy have significant positive effects on manufacturing system functional objectives. So, satisfying customer demand and lifting the level of competitive strategy will be beneficial to improve manufacturing system functional objectives.

(1) The analysis scale designed by this study synthesizes previous scholars' research results on customer demands, competitive strategy and manufacturing system functional goals. This study proves the relationship between each other, which provides reference tools and methods for manufacturing enterprises to understand the market, adjust the competitive strategy, design and modify manufacturing system functional goals. (2) The measurement of customer satisfaction and customer loyalty is always an important concern in business activities. This study chooses the cost, quality, service, efficiency, flexibility, environment and other factors as manufacturing system functional goals, and measures their impact on customer satisfaction and customer loyalty degree. It also provides planning ideas for the enterprise on how to conduct a choice between competitive advantage orientation and intensity under the condition of limited resources. (3) An analysis of customer needs and competitive strategic relationship regards job information, policy information, and financial information as strategic bases, which provides important information level support for enterprise to meet customer demands.

Moreover, satisfaction degree and loyalty degree of customer demand have important positive effects on operation information, strategic information and financial information of the performance of competitive strategy. And satisfaction degree and loyalty degree of customer demand have momentous positive effects on cost, quality, service, efficiency, flexibility and environment of manufacturing system functional objectives. It says that when conducting competitive strategy, manufacturing enterprises of the northeast of China should pay attention to the bearing capacity of manufacturing system functional objectives. More importantly, the overall influence of customer demand on manufacturing system functional objectives is higher than that of competitive strategy. That is to say, when conducting competitive strategy, manufacturing enterprises of the northeast of

China, should pay more attention to satisfy customer demand. Because the influences of customer demand on enterprise operation is comprehensive and far-reaching.

6.3. **Deficiency and future research.** Although we come to some extremely important constructive conclusions on competitive strategy decision and manufacturing system functional objective decision of manufacturing enterprises, there are still some deficiencies: (1) When testing the relationship among customer demand, competitive strategy and manufacturing system functional objectives, we do not consider the impact of different industries, which can be further studied aiming at the characteristics of the industry; (2) The samples are mainly from the northeast of China, so the range of the research can be further expanded in the future.

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