Presenting a Structural Model for Improving Productivity in Small and Medium-Sized Automotive After-Sales Service Industries Based on the APQC Framework: A Case Study of Atin Part Afzar Company

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ABSTRACT

The present article is developed out of necessity and in response to the growing diversity in providing after-sales services, particularly for imported vehicles, for Atin Part Afzar Company, which operates under the Mammut Holding. Based on the research process representation outlined in the paper, achieving a contingency model of after-sales service first required focusing on the key concepts of productivity, modeling, the APQC standard, the system of variables influencing modeling, and the relationships and ratios among them. Relevant literature was gathered through reliable domestic and international documents and references, and expert interviews were conducted to contextualize the contingency process. As a result, a system of variables and an initial conceptual model were proposed. The research is developmental-applied in nature and employed an exploratory mixed-methods design. The validity and reliability of the final model were assessed using SmartPLS software through measurement and structural modeling. The study utilized a purposive sample of 20 participants drawn from different departments of the company, along with several distinguished university professors. Subsequently, the study examined the research hypotheses, which focused on the relationships between the dual dimensions of support management and service, the operational dimension, and 14 interrelations among the components and subcomponents derived from the APQC model. Findings from inferential statistics confirmed the proposed contingency model of after-sales service in Atin Part Afzar Company, and the model was further validated as a good fit. Ultimately, in addition to confirming the hypotheses, the internal and external consistency of the variables—and, in other words, the appropriateness of the variables for application in Atin Part Afzar Company—were verified.

Keywords: Structural model; productivity improvement; automotive after-sales service; APQC framework

1. Introduction

After-sales service has become a strategic determinant of long-term customer satisfaction, loyalty, and organizational competitiveness in today's rapidly changing business environment. In the automotive industry, particularly in emerging economies, after-sales services are critical in strengthening trust, sustaining brand equity, and encouraging repeat purchases (Adusei & Tweneboah-Koduah, 2019). The effectiveness of after-sales service is not only a technical matter but also a multidimensional management issue, linking customer experience, corporate governance, marketing communication, and innovation practices to overall firm performance (Khalifeh Soltani & Vakili Manesh, 2020; Pourhosseini et al., 2019; Sahafzadeh & Haghighi, 2023). The literature consistently emphasizes that the ability of organizations to provide effective after-sales services significantly affects brand positioning, customer loyalty, and even long-term financial viability (Mohd et al., 2021).

The conceptual foundation of after-sales service commitment reveals that it is embedded within cultural, contractual, and organizational frameworks that shape both customer and company behaviors (Niazi et al., 2020). This indicates that after-sales service should be recognized as a strategic pillar of competitiveness rather than a peripheral organizational function. For example, in the Iranian gas industry, soft systems methodology has been applied to design world-class after-sales service models that enhance operational resilience and customer trust (Azar et al., 2021). Similarly, structured approaches to service evaluation in the automotive sector highlight how customer expectations can be systematically monitored and benchmarked to ensure improved performance (Nordin, Osman, et al., 2016).

At the intersection of service, governance, and performance, the role of integrated models becomes highly significant. Research has shown that integrated marketing communication strategies positively influence brand image and financial outcomes, thereby reinforcing the effectiveness of after-sales service systems (Pourhosseini et al., 2019). In addition, studies of corporate governance and risk-taking demonstrate that organizational inspection mechanisms and governance frameworks significantly shape the way firms approach after-sales service delivery (Khalifeh Soltani & Vakili Manesh, 2020). In parallel, research on brand empowerment through open innovation indicates that industries such as home appliances benefit from aligning after-sales service with collaborative innovation practices that strengthen brand positioning (Sahafzadeh & Haghighi, 2023).

From an operational perspective, diverse methodological approaches have been employed to evaluate and improve after-sales service. Simulation modeling has been used to increase customer satisfaction and optimize service delivery in the automotive industry (Damayed, 2017). Similarly, lean assessment models and performance measures provide structured approaches for assessing efficiency and customer satisfaction (Nordin, Jacob, et al., 2016). Advanced econometric and clustering models have further enabled firms to integrate profitability planning with after-sales service management in industries such as automotive manufacturing (Ebrahimi Sadrabadi et al., 2018). Furthermore, studies on support personnel allocation demonstrate how human resource strategies can be aligned with customer service needs to ensure responsiveness and efficiency in service delivery (Ebrahimi Zadeh et al., 2019).

Knowledge sharing and innovation culture also play pivotal roles in strengthening after-sales service strategies. Research has established that embedding knowledge-sharing practices in small and medium-sized enterprises (SMEs) helps create sustainable competitive advantages by enabling more innovative and adaptive service delivery (Arsawan et al., 2022). Similarly, studies highlight that networking capabilities and digital innovation enhance knowledge worker productivity and contribute to sustainable organizational performance (Tariq et al., 2024). In this regard, knowledge-based dynamic capabilities, moderated by organizational culture, have been shown to directly influence productivity within professional service firms (Khaksar et al., 2023). These findings emphasize that after-sales service effectiveness depends not only on organizational processes but also on the knowledge and adaptability of human resources.

Leadership and human resource capacity are equally critical for sustaining effective after-sales services. Transformational leadership styles have been found to enhance employee recognition and engagement, thereby improving productivity and indirectly supporting service delivery systems (Kwarteng et al., 2024). Similarly, the sustainability of SMEs is strengthened when human resource capacity is improved, as this enables higher productivity and ensures that service systems remain competitive and resilient (Hernita et al., 2021). Complementary research indicates that organizational resilience is reinforced through transformational leadership that builds adaptive cultures,

directly contributing to improved service system performance (Odeh et al., 2023).

The broader macroeconomic context also provides insights into the role of innovation and productivity in shaping after-sales service. For example, studies on open innovation demonstrate how economic growth and SME productivity can be enhanced through innovative service delivery mechanisms (Surya et al., 2021). In education, research has shown that designing superior service delivery models leads to greater public satisfaction, highlighting the cross-sectoral applicability of innovative service frameworks (Golabchi et al., 2024). Together, these studies highlight the importance of embedding after-sales service frameworks within wider innovation and knowledge ecosystems.

Despite the growing body of evidence, (Dorogbo, 2019) points out that after-sales services remain under-theorized in operations and production research. There is a pressing need for systematic frameworks that combine theoretical, methodological, and practical perspectives to guide managers in designing robust after-sales systems. This gap is particularly evident in emerging markets, where organizations face simultaneous challenges of customer retention, market competition, and limited resources. For example, research on marketing mix factors highlights the importance of after-sales service in shaping perceived customer value and retention in digital retailing contexts (Darvishi, 2022). Similarly, studies on managing information in after-sales units demonstrate that systematic approaches are required to strengthen customer service and operational efficiency (Armaghan, 2016).

A key methodological consideration in advancing after-sales research is the reliability and validity of measurement instruments. Cronbach's alpha continues to serve as a cornerstone for establishing internal consistency and reliability in service research, ensuring that complex constructs such as customer satisfaction, loyalty, and productivity can be empirically validated (Taber, 2018). The rigorous application of validity and reliability measures strengthens the empirical foundation of after-sales service research and provides a basis for comparative studies across industries and geographies.

In the Iranian context, after-sales service represents both a strategic necessity and a competitive challenge. Empirical studies in industries such as automotive and liquid gas have emphasized the importance of designing localized but globally competitive service frameworks (Azar et al., 2021; Ebrahimi Zadeh et al., 2019). Furthermore, research on

comparative law and governance highlights that service-related commitments must be embedded within broader organizational and regulatory structures (Niazi et al., 2020). When these perspectives are combined with knowledge management and innovation frameworks, organizations are better positioned to design adaptive after-sales service models that reflect both global standards and local contingencies.

The present study contributes to this evolving literature by developing and validating a contingency after-sales service model for Atin Part Afzar Company, grounded in the APQC framework.

2. Methods and Materials

In this article, considering the nature of the questions and objectives, the research is developmental-applied in type, while the research method is mixed and of a sequential exploratory nature. In the first stage, qualitative data were collected and then analyzed, and finally, quantitative data were also gathered. In fact, the study first explored and surveyed the main research questions and developed the hypotheses, and subsequently, quantitative data were used to test and confirm the qualitative findings. To identify the system of variables, documentary studies and expert interviews were employed. In contingency modeling, the structural equation modeling approach was used sequentially to identify the validity of the system of variables, to examine the hypotheses, and to determine the fit of the proposed model.

In this article, we propose that to fill the theoretical research gap in the literature on after-sales service in Iran, it is necessary to strengthen the APQC process classification framework in after-sales services, so that a recognized standard of terminology for process definitions may become a consensual framework. To achieve an APQC-PCF-based framework for benchmarking service delivery in business transformation projects, it is essential to expand the concepts of critical realism with a focus on the APQC approach (Chapman, Murray, & Mellor, 1997).

As we know, the APQC approach, due to its nature related to process quality control based on advanced standards from the United States, must perform its analyses using both quantitative and qualitative data simultaneously. In fact, the data are both qualitative and quantitative. For quantitative data, quantitative methods are applied, and for qualitative data analysis, qualitative approaches are employed. The APQC approach essentially consists of two

main levels, which are employed in this study as the main dimensions: the first dimension is managerial-support and the second dimension is operational. The selected components in both dimensions, based on the APQC framework, are as follows.

Operational Dimension Components (APQC framework):

- Vision and Strategy
- Product and Service Development and Management
- Marketing and Sales of Products and Services
- Delivery of Physical Products
- Service Delivery
- Customer Service Management

As can be seen, these components possess dual quantitative and qualitative characteristics. For example, vision is qualitative and descriptive in nature, whereas product and service development and management are about 70% quantitative and 30% qualitative. Marketing and sales of products and services are descriptive in the area of market research, while in measuring criteria such as supply and demand, as well as market elasticity and size, they are quantitative. In the delivery of physical products,

considering the relevant subcomponents such as sales and product distribution, the nature is predominantly quantitative.

Managerial-Support Dimension Components (APQC framework):

- Human Capital Development and Management
- Information Technology (IT) Management
- Financial Resource Management
- Acquisition, Construction, and Asset Management
- Organizational Risk, Compliance, Remediation, and Resilience
- External Relations Management and Development and Management of Business Capabilities

As can be seen, human capital development and management are mainly qualitative, while financial resource management is predominantly quantitative. Therefore, the presence of dual characteristics requires the use of both object-oriented positivist realism and phenomenological interpretivist idealism. Both schools of thought exist within critical realism. In the next step, appropriate components and indicators must be selected for all thirteen components.

Table 1

Components and Indicators in the Literature Based on APQC Standard

Component Title	Number of Components	Number of Indicators	Source
Vision and Strategy	3	17	(Azar et al., 2021); (Armaghan, 2016)
Product and Service Development and Management	4	21	(Pourhosseini et al., 2019); (Ebrahimi Zadeh et al., 2019)
New Product Development	4	21	(Ebrahimi Sadrabadi et al., 2018); (Dorogbo, 2019)
Physical Product Delivery	5	27	(Damayed, 2017); (Adusei & Tweneboah-Koduah, 2019)
Service Delivery to Customers (Team Performance in Service Delivery)	5	26	(Mohd et al., 2021); (Niazi et al., 2020)
Customer Relationship Management (CRM)	9	40	(Darvishi, 2022); (Sahafzadeh & Haghighi, 2023)
Asset Acquisition, Construction, and Management	—	—	(Golabchi et al., 2024)
Human Capital Development and Management	4	14	(Kwarteng et al., 2024); (Hernita et al., 2021)
IT Management	3	11	(Surya et al., 2021); (Tariq et al., 2024)
Financial Resource Management	4	17	(Khaksar et al., 2023); (Odeh et al., 2023)
Organizational Risk	3	14	(Khalifeh Soltani & Vakili Manesh, 2020); (Nordin, Osman, et al., 2016)
External Relations (Organizational Communication)	4	17	(Nordin, Jacob, et al., 2016); (Arsawan et al., 2022)
Reliability and Validity (Measurement Support)	—	—	(Taber, 2018)

As can be observed, based on the components influencing the contingency model of after-sales service according to the APQC standard, the sources mentioned in the above table—using a combined approach—can serve as the initial basis for the conceptual model. Subsequently, their validity and reliability are established within Atin Part Afzar Company.

In this article, due to the composite complexity of conceptual constructs, it was necessary to involve highly specialized experts who were familiar with the characteristics of the industry as well as with System Dynamics (SD), and who held at least a master's degree. Accordingly, 20 specialized experts were identified, and through orientation workshops, they were engaged in the

modeling process. However, the final questionnaire, in accordance with standard rules in Smart PLS, had to meet the requirement of having at least 10 times the number of the largest indicators or relationships. Based on the table, the maximum indicator was 17, and therefore the minimum required sample size was 170. To increase sensitivity in this study, 340 questionnaires were distributed (twice the minimum requirement to ensure double certainty), of which 308 were returned. Participants were purposively selected from different departments, including sales and commerce, systems and methods, administrative and financial deputies, after-sales services, warehouse, and repair shop.

To examine content validity, the questionnaire was given to experts, who were asked to rate each item as (1) "essential," (2) "useful but not essential," or (3) "essential." Then, for each item, the Content Validity Ratio (CVR) was calculated using the formula $CVR = (Ne – N/2) / (N/2)$, where Ne = the number of experts rating the item as "essential" and N = the total number of experts consulted. Thus, the CVR ranges between -1 and +1. The Lawshe table was then used to determine the minimum acceptable CVR for the number of experts involved, in order to extract the threshold value. For the Content Validity Index (CVI), another Likert scale was used across two dimensions: (a) relevance – (1) "not relevant," (2) "somewhat relevant," (3) "quite relevant," or (4) "highly relevant"; and (b) clarity – (1) "unclear," (2) "somewhat clear," (3) "quite clear," or (4) "highly clear." The relevance index at the item level (I-CVI (R)) was calculated as $I\text{-}CVI\ (R) = Nr / N$, where Nr = number of experts assigning a score of (3) or (4) and N = total number of experts. Thus, the CVR ranged from 0 to 1. Similarly, clarity at the item level was calculated as $I\text{-}CVI\ (C) = Nc / N$. At the scale level, the Scale Content Validity Index (S-CVI (R)) was determined by calculating the number of items rated as relevant (scores of 3 or 4) by all judges (or the number of items with CVI equal to 1) divided by the total number of items. A similar approach was used to calculate S-CVI (C) for clarity. In this article, the CVR value was obtained as 0.89, while the minimum threshold for 20 experts according to Lawshe's table is 0.50. For assessing internal consistency or the goodness-of-fit of the questionnaires, they were again provided to 20 experts, who were asked to evaluate the representativeness of the questions for Atin Part Afzar Company. Eighteen of them selected the option "essential." Based on the formula, for 20 experts the CVR should be at least 0.50, while for this study, a CVR of 0.89 was achieved, indicating that the questionnaire had appropriate content validity.

As mentioned earlier, in this study, based on existing literature and expert interviews, the final model was derived consisting of 2 dimensions, 13 components, 54 subcomponents, and 284 indicators. In the first stage, to select the most relevant factors influencing the final model and to eliminate irrelevant factors, a formal content validity approach was applied through expert opinion. Consequently, the selected final model was confirmed, comprising 2 dimensions, 13 components, 54 subcomponents, and 223 indicators. In other words, 63 indicators were removed due to their weak impact on content validity, as judged by specialized experts for Atin Part Afzar Company.

Based on the above, the purpose of model fit is to determine to what extent a model is consistent and aligned with the relevant data. Therefore, this section evaluates the goodness-of-fit of the proposed research model to ensure its compatibility with the data and ultimately to infer answers to the research questions. The examination of the conceptual model's fit was conducted in two stages: first, evaluating the fit of the measurement model, and second, evaluating the fit of the structural model. These two stages are discussed in detail in the following section.

3.   Findings and Results

Based on the study of Lowry and Gaskin (2014), the values for the SMART-PLS software settings were selected for the purpose of fitting the measurement model as follows: *Maximum Iterations = 1000* and *Criterion = 7* (Lowry & Gaskin, 2014, pp. 123–126). The results for factor loadings are presented in Table 8-10 separately for components, subcomponents, and indicators (items). As can be observed, 204 indicators obtained factor loadings above 0.7 and were therefore confirmed, while 19 other indicators were eliminated at this stage. Variables with factor loadings above 0.7 confirm that they have an acceptable ability to explain their related subcomponents as well as the intended components. Accordingly, the final model was confirmed with two dimensions, 13 components, 54 subcomponents, and 204 indicators (items). On this basis, the factor loadings of the remaining and validated subcomponents and indicators were presented in the table. As seen, over 90% of the indicators and all the subcomponents were deemed appropriate for measuring the current state of Atin Part Afzar Company. In other words, with over 90% accuracy and the confirmation of all subcomponents and components, confidence can be established regarding the adequacy and contingency of the model in Atin Part Afzar's after-sales

service company. The table presents the factor loadings of the subcomponents and indicators that met the acceptable threshold.

Considering the fitted model and the large number of components, some components are reviewed as examples. For instance, the standardized regression coefficient for the effect of strategy formulation on vision and strategy is 0.856, and for the effect of implementation and execution on vision and strategy is 0.891, as shown in the table below. The R^2 value for the variables of strategy formulation and implementation and execution is 0.733 and 0.793, respectively. This means that strategy formulation and implementation and execution explain 73.3% and 79.3% of the variance in vision and strategy, respectively. Such interpretations are also generalizable to other variables. As mentioned, due to the composite nature of components and subcomponents, R^2 values must also be examined for stronger confirmation of

the model based on the recommendations of Henseler et al. (2015) and Cho (2013). They argue that variable values typically fall within three ranges: 0.02 indicates weak, 0.13 indicates moderate, and 0.26 indicates strong relationships. Based on the results in Table 9-22, nearly all variables scored above 0.26, indicating that endogenous variables are strongly acceptable. In the table below, subcomponents such as *managerial factor* (0.888) and *cost control* (0.871) had the highest R^2 values, classifying them as subcomponents with strong influence. Atin Part Afzar Company should therefore place more focus on these. Similar conditions were observed for other subcomponents such as *intuition in analysis*, *organizational risk*, *control and evaluation*, and particularly *accountability*. The researcher labeled these and other high R^2 factors as *leverage points*, which in fact represent critical success factors.

Table 2

R^2 Values of Subcomponents in the Final Model

Subcomponent	R^2	Subcomponent	R^2
Training and Skills Development	0.733	Process-Oriented	0.567
Customer Service Delivery	0.563	Operational Process	0.280
Organizational Communication (External Relations Management)	0.539	Organizational Capability	0.850
Team Service Evaluation	0.848	Communication Content	0.789
Information System Strategy	0.868	Managerial	0.596
Flexibility	0.783	Technology-Based CRM	0.536
Marketing and Sales of Products and Services	0.743	Customer Relationship Management (CRM)	0.735
Planning and Budgeting	0.435	Knowledge Management	0.853
Quality Improvement	0.981	Human Capital Management	0.797
Strategy Formulation	0.733	Business Process Management	0.799
Team Formation	0.659	IT Management	0.502
Customer Orientation	0.884	Financial Resource Management	0.655
Technical Ability	0.889	Cost Management	0.793
Human Capital Development and Management	0.494	Accountability	0.726
Business Capability Development and Management	0.404	Communication Pathway	0.737
Product and Service Development and Management	0.617	Participation and Effectiveness	0.703
Real Estate Asset	0.190	Customer Orientation	0.691
Competitor Orientation (Monitoring Competitors)	0.798	Skills Training	0.600
Organizational Risk	0.322	Interdepartmental Coordination	0.713
Communication Style	0.662	Accountability	0.838
Risk-Taking Level	0.802	Implementation and Execution	0.793
Needs Identification	0.815	Vision and Strategy	0.509
Intuition in Analysis	0.827	Communication Channels	0.762
Marketing Factor	0.737	Asset Acquisition, Construction, and Management	0.646
Commercialization Factor	0.806	Cost Control	0.871
Technology Factor	0.600	Control and Evaluation	0.874
Managerial Factor	0.888	Integrated Control	0.789
Financial Performance	0.798	Information System Quality	0.722
Standard-Based Performance	0.796		

The final measurement model is presented in the Figure 1. As can be observed, in addition to confirming the appropriateness of the components, the intensity of the factor

loadings is also illustrated in the model. Typically, the highlighting of observed variables alongside other

acceptance criteria confirms the final validation of the measurement model.

As we know, Smart PLS software is typically used for structural modeling for two purposes: first, to fit the existing relationships among latent variables, and second, after extracting statistics such as rho_A, Cronbach's alpha, R^2, and AVE, to reconfirm both internal and external consistency of the variables and, in other words, the adequacy of the variables for use in Atin Part Afzar Company. Since Smart PLS relies on T-statistics and P-values to determine the significance of relationships, where the threshold for a 5% error rate is 1.96, the same principle was applied in this study. Specifically, if the T-statistic is greater than 1.96, the relationship is considered significant. According to Table 9-36, all T-statistics were greater than 1.96 with P-values less than 0.05, meaning that all relationships in the model were significant and the research hypotheses were confirmed. In other words, all components and dimensions had significant relationships, and structurally, the model possessed the required adequacy to explain and interpret influences within Atin Part Afzar Company.

In reviewing the T-statistics and P-values, first, the relationships between the model's dimensions—namely, managerial-support processes and operational processes—with the main construct, i.e., the contingency after-sales service model in Atin Part Afzar Company, were found to be significant. Likewise, other relationships among each of the components and subcomponents were examined, which, given the high values of T-statistics and P-values, were also significant. Thus, a significant relationship was confirmed between the managerial-support process and the operational process. Moreover, relationships between dimensions and components, and between components and subcomponents, were all validated.

In fact, seven significant relationships were confirmed between the operational process dimension and the following components: (1) customer service delivery, (2) marketing and sales of products and services, (3) quality improvement, (4) product and service development and management, (5) customer relationship management (CRM), (6) business process management, and (7) vision and strategy. Similarly, the managerial-support dimension demonstrated significant relationships with seven components: (1) organizational communication (external relations management), (2) quality improvement, (3) human capital development and management, (4) business capability development and management, (5) organizational risk, (6) IT management, and (7) financial resource management.

Therefore, the contingency after-sales service model of Atin Part Afzar Company, based on APQC, was validated with two dimensions (operational process and managerial-support process) and 14 components, with one additional component added to the APQC standard framework, which is one of the innovations of this research. Furthermore, all other relationships among the components and subcomponents, which were selected contextually for Atin Part Afzar Company based on APQC, were also confirmed. Additionally, significant relationships were found between CRM components and subcomponents such as customer orientation, technology-based CRM, and knowledge management; between business process management and process-oriented, managerial, and human capital subcomponents. In other words, all proposed relationships in the conceptual model were confirmed at the level of dimensions, components, and subcomponents. With regard to the relationships between subcomponents and first-order factors, these were essentially the indicators themselves.

The table below presents the data related to T Statistics (O/STDEV) values greater than 1.96 and P Values less than 0.05, which are therefore confirmed.

Table 3

T Statistics and P Values of the Final Research Model

Research Hypotheses Relationships	T Statistics (O/STDEV)	P Values
There is a significant relationship between customer service delivery and team service evaluation	88.431	0.000
There is a significant relationship between customer service delivery and team formation	29.209	0.000
There is a significant relationship between customer service delivery and needs identification	76.637	0.000
There is a significant relationship between customer service delivery and standard-based performance	48.198	0.000
There is a significant relationship between customer service delivery and accountability	71.481	0.000
There is a significant relationship between organizational communication (external relations management) and communication style	30.740	0.000

There is a significant relationship between organizational communication (external relations management) and communication content	57.945	0.000
There is a significant relationship between organizational communication (external relations management) and communication pathway	47.081	0.000
There is a significant relationship between organizational communication (external relations management) and communication channel	45.164	0.000
There is a significant relationship between marketing and sales of products and services and competitor orientation (competitor monitoring)	69.321	0.000
There is a significant relationship between marketing and sales of products and services and customer orientation	30.116	0.000
There is a significant relationship between marketing and sales of products and services and interdepartmental coordination	37.906	0.000
There is a significant relationship between human capital development and management and training and skills development	46.728	0.000
There is a significant relationship between human capital development and management and accountability	41.421	0.000
There is a significant relationship between human capital development and management and participation and effectiveness	37.748	0.000
There is a significant relationship between human capital development and management and skills training	26.372	0.000
There is a significant relationship between business capability development and management and flexibility	49.748	0.000
There is a significant relationship between business capability development and management and risk-taking level	73.305	0.000
There is a significant relationship between business capability development and management and intuition in analysis	84.517	0.000
There is a significant relationship between product and service development and management and marketing factor	34.187	0.000
There is a significant relationship between product and service development and management and commercialization factor	66.402	0.000
There is a significant relationship between product and service development and management and technology factor	21.389	0.000
There is a significant relationship between product and service development and management and managerial factor	114.680	0.000
There is a significant relationship between the operational process and customer service delivery	18.494	0.000
There is a significant relationship between the operational process and marketing and sales of products and services	50.420	0.000
There is a significant relationship between the operational process and quality improvement	4.453	0.000
There is a significant relationship between the operational process and product and service development and management	23.276	0.000
There is a significant relationship between the operational process and customer relationship management (CRM)	8.613	0.000
There is a significant relationship between the operational process and business process management	69.114	0.000
There is a significant relationship between the operational process and vision and strategy	16.981	0.000
There is a significant relationship between the managerial-support process and organizational communication (external relations management)	12.886	0.000
There is a significant relationship between the managerial-support process and quality improvement	4.346	0.000
There is a significant relationship between the managerial-support process and human capital development and management	15.059	0.000
There is a significant relationship between the managerial-support process and business capability development and management	10.392	0.000
There is a significant relationship between the managerial-support process and organizational risk	9.713	0.000
There is a significant relationship between the managerial-support process and operational process	14.838	0.000
There is a significant relationship between the managerial-support process and IT management	18.829	0.000
There is a significant relationship between the managerial-support process and financial resource management	26.036	0.000
There is a significant relationship between the managerial-support process and asset acquisition, construction, and management	27.304	0.000
There is a significant relationship between CRM and customer orientation	134.990	0.000
There is a significant relationship between CRM and technology-based CRM	17.243	0.000
There is a significant relationship between CRM and knowledge management	109.177	0.000
There is a significant relationship between business process management and process-oriented subcomponent	28.034	0.000
There is a significant relationship between business process management and managerial subcomponent	22.765	0.000
There is a significant relationship between business process management and human capital management	71.522	0.000
There is a significant relationship between IT management and planning and budgeting	14.136	0.000
There is a significant relationship between IT management and cost control	109.183	0.000
There is a significant relationship between IT management and integrated control	58.826	0.000
There is a significant relationship between financial resource management and information system strategy	109.956	0.000
There is a significant relationship between financial resource management and financial performance	55.219	0.000
There is a significant relationship between financial resource management and cost management	63.210	0.000
There is a significant relationship between financial resource management and information system quality	29.757	0.000
There is a significant relationship between vision and strategy and strategy formulation	44.781	0.000
There is a significant relationship between vision and strategy and implementation and execution	48.869	0.000
There is a significant relationship between vision and strategy and control and evaluation	96.125	0.000
There is a significant relationship between asset acquisition, construction, and management and technical ability	110.478	0.000
There is a significant relationship between asset acquisition, construction, and management and real estate asset	7.636	0.000
There is a significant relationship between asset acquisition, construction, and management and organizational capability	77.581	0.000

As can be observed, a total of 58 significant relationships were identified: 54 relationships related to components and subcomponents, and four relationships related to the managerial-support and operational dimensions and the contingency after-sales service model of Atin Part Afzar. In fact, all relationships between latent variables were confirmed, indicating that, from the perspective of experts, the system of variables and the relationships among latent variables (subcomponents, components, and dimensions) were validated in terms of both reliability and validity for the Atin Part Afzar industry.

Table 4

Results of the Four Criteria: Cronbach's Alpha, Rho-A, Composite Reliability (CR), and Convergent Validity (AVE)

Variables	Cronbach's Alpha (α > 0.7)	Rho-A	Composite Reliability (CR > 0.7)	Average Variance Extracted (AVE > 0.5)
Training and Skills Development	0.897	0.897	0.928	0.764
Customer Service Delivery	0.954	0.958	0.959	0.558
Organizational Communication (External Relations Management)	0.937	0.939	0.945	0.502
Team Service Evaluation	0.853	0.854	0.901	0.694
Information System Strategy	0.840	0.841	0.893	0.676
Flexibility	0.895	0.895	0.927	0.761
Marketing and Sales of Products and Services	0.918	0.920	0.930	0.527
Planning and Budgeting	0.869	0.872	0.911	0.718
Quality Improvement	0.971	0.975	0.970	0.676
Strategy Formulation	0.866	0.867	0.919	0.790
Team Formation	0.750	0.809	0.843	0.584
Customer Orientation	0.867	0.868	0.919	0.790
Technical Ability	0.861	0.862	0.915	0.782
Human Capital Development and Management	0.925	0.926	0.935	0.507
Business Capability Development and Management	0.937	0.938	0.946	0.613
Product and Service Development and Management	0.934	0.935	0.943	0.559
Real Estate Asset	0.730	0.760	0.830	0.553
Competitor Orientation (Competitor Monitoring)	0.841	0.842	0.894	0.679
Organizational Risk	0.857	0.866	0.897	0.635
Communication Style	0.869	0.871	0.911	0.719
Risk-Taking Level	0.881	0.883	0.918	0.737
Needs Identification	0.864	0.865	0.908	0.711
Intuition in Analysis	0.880	0.880	0.926	0.807
Marketing Factor	0.845	0.846	0.906	0.763
Commercialization Factor	0.881	0.885	0.918	0.738
Technology Factor	0.782	0.819	0.900	0.819
Managerial Factor	0.801	0.805	0.872	0.631
Financial Performance	0.887	0.887	0.922	0.746
Standard-Based Performance	0.847	0.849	0.907	0.766
Process-Oriented	0.803	0.808	0.884	0.717
Operational Process	0.968	0.976	0.969	0.563
Managerial-Support Process	0.972	0.973	0.973	0.766
Organizational Capability	0.724	0.736	0.844	0.645
Communication Content	0.863	0.863	0.907	0.709
Managerial	0.891	0.891	0.932	0.821
Technology-Based CRM	0.860	0.861	0.935	0.877
Customer Relationship Management (CRM)	0.913	0.916	0.930	0.625
Knowledge Management	0.850	0.850	0.909	0.770
Human Capital Management	0.897	0.898	0.928	0.764
Business Process Management	0.867	0.869	0.898	0.557
IT Management	0.877	0.878	0.905	0.577
Financial Resource Management	0.946	0.947	0.952	0.553
Cost Management	0.857	0.860	0.903	0.700
Accountability	0.834	0.834	0.901	0.752
Communication Pathway	0.799	0.809	0.868	0.623
Participation and Effectiveness	0.813	0.813	0.889	0.728

|				
Customer Orientation	0.854	0.862	0.901	0.696
Skills Training	0.863	0.863	0.907	0.709
Interdepartmental Coordination	0.910	0.911	0.937	0.788
Accountability	0.899	0.899	0.929	0.767
Implementation and Execution	0.890	0.891	0.924	0.752
Vision and Strategy	0.937	0.938	0.946	0.593
Communication Channel	0.882	0.883	0.914	0.680
Asset Acquisition, Construction, and Management	0.875	0.880	0.907	0.621
Cost Control	0.841	0.848	0.894	0.679
Control and Evaluation	0.885	0.889	0.916	0.687
Integrated Control	0.796	0.795	0.881	0.711
Information System Quality	0.829	0.829	0.886	0.661

As shown in the table, all 58 interrelationships among latent variables met the proposed thresholds across all four parameters. In fact, reliability, which is primarily assessed through three parameters—factor loadings, composite reliability (CR), and Cronbach's alpha—was verified. In the above table, Cronbach's alpha values for all latent variables fall within the acceptable range of 0.6 to 0.7 or higher. Therefore, it can be claimed with high confidence that the final proposed model possesses appropriate reliability.

Moreover, validity was confirmed through both discriminant validity (AVE > 0.5) and convergent validity (CR > 0.7). Thus, the proposed model also possesses appropriate validity.

In this article, according to the GOF formula, the values of the model were applied, and the criterion was calculated as follows: the GOF value in the proposed contingency after-sales service model of Atin Part Afzar Company, based on APQC, was obtained as 0.703536. This value is higher than 0.36 and confirms the strong final fit of the proposed model. Moreover, considering the three benchmark values of 0.01, 0.25, and 0.36 as indicators of weak, moderate, and strong fit for this criterion, respectively, the obtained result of approximately 0.70 demonstrates that the model enjoys an acceptable overall fit.

Figure 1

Final Model
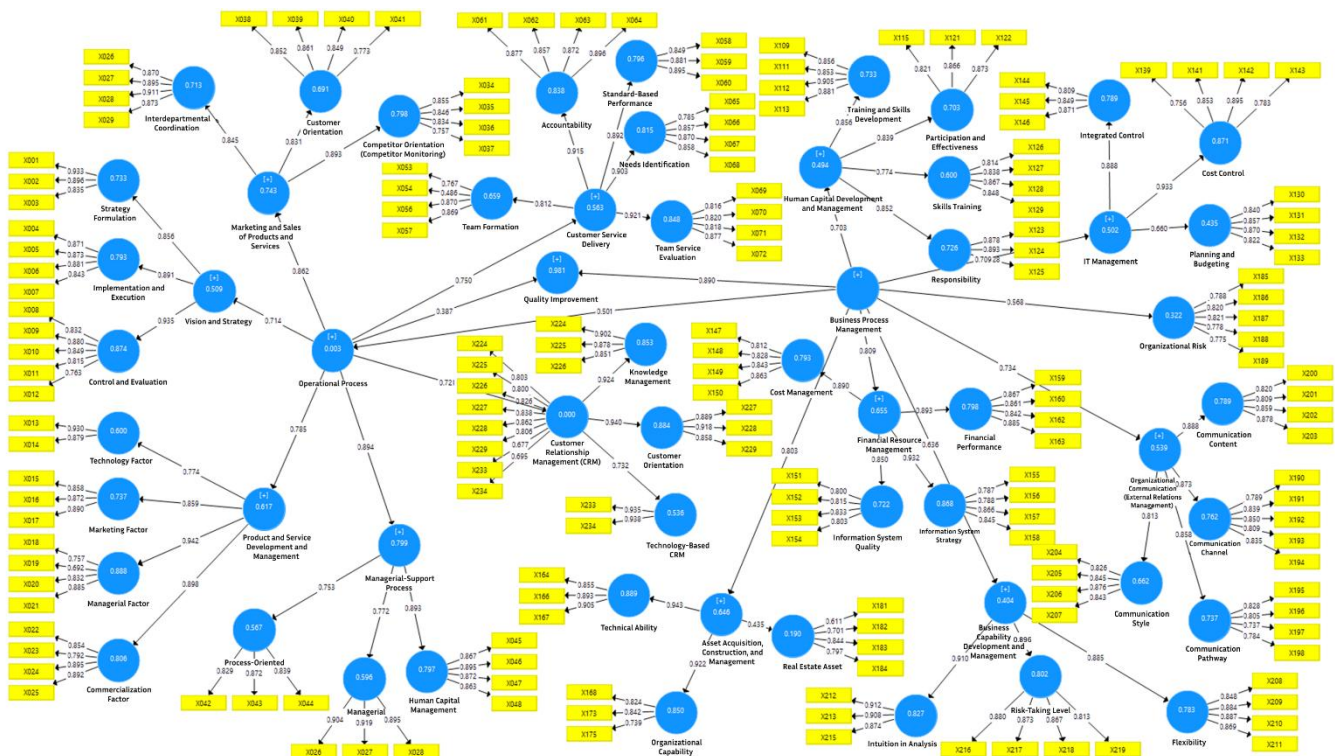
4.   Discussion and Conclusion

The findings of this study confirmed the validity and reliability of the contingency after-sales service model for Atin Part Afzar Company, designed within the APQC framework. By incorporating both managerial-support and operational dimensions, the results indicated that the model offers strong explanatory power and practical relevance in improving productivity and service quality. Statistical outputs revealed significant relationships between subcomponents, components, and dimensions, with most factor loadings above the acceptable threshold and R² values suggesting strong explanatory capabilities. This demonstrates that the conceptual structure of after-sales service in the company is robust, contextually appropriate, and aligned with both organizational strategy and customer expectations. The results also highlight that key subcomponents such as cost control, accountability, flexibility, and knowledge management represent leverage points with substantial influence on organizational performance.

These results are consistent with prior studies emphasizing that after-sales service is not merely an operational necessity but a strategic mechanism that fosters loyalty, satisfaction, and competitive advantage. For example, Mohd (Mohd et al., 2021) confirmed that effective after-sales service strengthens customer loyalty and repurchase intention, which directly supports the conclusion that Atin Part Afzar can utilize its after-sales service framework to enhance long-term customer relationships. Similarly, Adusei (Adusei & Tweneboah-Koduah, 2019) showed that after-sales services significantly contribute to customer satisfaction in emerging economies, aligning with this study's finding that well-structured service delivery systems are vital in markets where imported cars and maintenance services play an increasing role.

The significant role of governance in shaping service outcomes also emerged as a major theme. The results showed that the managerial-support dimension, which encompasses financial resource management, IT, and organizational risk management, is critical in ensuring sustainability and resilience of after-sales services. These findings align with research showing that corporate governance structures and inspection mechanisms shape risk-taking behaviors and market expansion strategies (Khalifeh Soltani & Vakili Manesh, 2020). They also

resonate with the argument that brand empowerment requires integrating service innovation with broader governance frameworks (Sahafzadeh & Haghighi, 2023). This indicates that Atin Part Afzar's contingency model can contribute to reducing vulnerabilities and increasing adaptability through improved oversight and resource alignment.

From an operational standpoint, the results demonstrated that factors such as customer orientation, service delivery, and business process management exhibit high explanatory power for organizational performance. This supports earlier empirical work where simulation modeling and service evaluation were applied to improve customer satisfaction in the automotive sector (Damayed, 2017; Nordin, Osman, et al., 2016). The removal of weaker indicators and the retention of highly loaded variables in this study reaffirm the necessity of refining measurement tools and ensuring construct validity in service management research. This methodological attention echoes recommendations to apply reliability and convergent validity measures such as Cronbach's alpha and AVE, which remain essential for empirical rigor (Taber, 2018).

The study also identified that knowledge and innovation-related components, particularly knowledge management, IT-based CRM, and human capital development, significantly contribute to organizational effectiveness. These findings align with research highlighting that knowledge sharing and innovation culture generate sustainable competitive advantage in SMEs (Arsawan et al., 2022). They also reinforce insights that digital innovation and networking capabilities are central for knowledge worker productivity and sustainable performance (Tariq et al., 2024). In professional service firms, knowledge-based dynamic capabilities moderated by organizational culture have been shown to enhance productivity, which is consistent with the role of cultural alignment identified in this study (Khaksar et al., 2023).

Leadership and human resources emerged as critical determinants in ensuring the success of the after-sales service framework. The results highlighted that employee-focused variables such as training, accountability, and recognition strongly influenced productivity and customer satisfaction outcomes. These findings are consistent with research on transformational leadership, which demonstrated that employee recognition and engagement directly increase productivity and, consequently, service quality (Kwarteng et al., 2024). The outcomes also reflect

the conclusions of Hernita (Hernita et al., 2021), who emphasized the importance of strengthening human resource capacity to increase SME productivity and sustain business operations. By validating these factors in the Iranian automotive after-sales sector, the current study extends the applicability of leadership and HR-focused findings into new contexts.

Another crucial result of this study was the confirmation that strategic alignment between vision, strategy, and operational service delivery drives overall model effectiveness. The strong relationships observed between strategy formulation, implementation, and performance indicators confirm earlier findings in service research. For example, Azar (Azar et al., 2021) demonstrated that world-class after-sales service models rely heavily on aligning operational processes with strategic objectives. Ebrahimi Sadrabadi (Ebrahimi Sadrabadi et al., 2018) also emphasized that integrating econometric modeling with clustering approaches provides firms with tools to ensure profit planning is systematically linked to service management. These studies converge with the current findings, which underscore that strategic planning and operational execution must be harmonized within a contingency model to ensure both internal and external validity.

Marketing-related elements also played a substantial role in shaping after-sales outcomes in this study. The relationships between marketing, customer orientation, and competitive monitoring were particularly strong. These findings reinforce conclusions from Pourhosseini (Pourhosseini et al., 2019), who showed that integrated marketing communication models enhance brand image and financial outcomes, strengthening the service-consumer relationship. Similarly, Darvishi (Darvishi, 2022) found that marketing mix factors, including after-sales service, directly affect customer retention, further validating the importance of marketing integration identified in this research.

Beyond the automotive context, the results resonate with findings from cross-sectoral studies. For instance, Golabchi (Golabchi et al., 2024) demonstrated that superior service delivery models in education improve public satisfaction, underscoring the transferability of structured service frameworks across industries. Surya (Surya et al., 2021) highlighted that SME productivity and economic growth depend heavily on innovation in service delivery, which parallels this study's finding that innovation-driven practices such as IT-based CRM and digital knowledge management strengthen after-sales service performance. Similarly, Odeh (Odeh et al., 2023) illustrated how transformational leadership and adaptive cultures build organizational resilience in the service sector, aligning with this study's identification of leadership and adaptability as leverage points.

The systematic literature also indicates that after-sales services remain under-theorized and fragmented in their conceptual frameworks (Dorogbo, 2019). The results of this study, by validating a contingency-based APQC model, directly respond to these calls by integrating theory with practical application. Furthermore, evidence from information and communication studies confirms that managing after-sales units requires systematic approaches to integrate experience and information, consistent with the present study's findings on the importance of organizational communication (Armaghan, 2016). By reinforcing both the operational and managerial dimensions, this study contributes to bridging theoretical and applied gaps in after-sales service research.

Taken together, the findings confirm that a holistic approach, which integrates governance, leadership, knowledge management, marketing, and operational processes, is necessary for effective after-sales service in complex industries such as automotive. By validating a contingency model tailored to the Iranian context, this study extends existing research while aligning with global evidence. The robustness of the model, indicated by strong statistical outputs and expert validation, highlights its practical relevance and theoretical contribution. It also underscores the importance of adapting global frameworks such as APQC to local industry needs, ensuring both standardization and contextual fit.

This study, while comprehensive, is subject to several limitations. First, the research was conducted within a single company, Atin Part Afzar, which may limit the generalizability of the findings to other firms or industries. Second, although the APQC framework provided a strong foundation, its adaptation to local conditions required subjective judgments, particularly during expert interviews, which could introduce bias. Third, the reliance on self-reported survey data presents potential issues of common method bias, despite efforts to validate responses through statistical measures. Finally, the cross-sectional design restricts the ability to capture changes in after-sales service performance over time, which would require longitudinal analysis.

Future studies should expand the scope of research by applying the contingency APQC model across multiple companies and industries, thereby improving the

generalizability of findings. Longitudinal studies are also needed to capture how after-sales service performance evolves over time and in response to changes in market dynamics. Further research could integrate customer-side perspectives more comprehensively, ensuring that the model captures both organizational and consumer dimensions of after-sales service. Additionally, comparative cross-national studies could explore how cultural and regulatory differences influence the adaptation of standardized frameworks like APQC. Finally, incorporating advanced technologies such as artificial intelligence and predictive analytics into after-sales service models could provide new insights into future service innovations.

For practitioners, the findings highlight the importance of aligning vision, strategy, and operational service delivery to strengthen after-sales systems. Managers should focus on leverage points such as cost control, accountability, and knowledge management to maximize impact. Employee training, recognition, and engagement should be prioritized to enhance productivity and service responsiveness. Firms should also invest in IT-based CRM systems and digital innovation to improve customer orientation and adaptability. Lastly, integrating governance and risk management into after-sales frameworks ensures resilience, enabling organizations to remain competitive in volatile markets.

Authors' Contributions

Authors contributed equally to this article.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethics Considerations

In this research, ethical standards including obtaining informed consent, ensuring privacy and confidentiality were considered.

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