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The effect of quality management on the service quality and business success of logistics service providers

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Abstract

Purpose – The purpose of the paper is to analyse empirically the causal relationships between quality management, service quality and business success in German logistics companies.

Design/methodology/approach – The paper develops a measurement instrument of logistics service quality by combining conceptual approaches from service marketing with quality indicators from operations management. This measure is verified through factor analysis on a sample of 229 German logistics providers. Relationships between logistics service quality, quality management and business success are investigated in a structural equation model.

Findings – The results support measuring logistics service quality by the three dimensions: service potential, process and outcome. The effect of quality management on these constructs is confirmed. Likewise, the positive effect of service quality on business success is confirmed, with the notable exception of outcome quality.

Research limitations/implications – This research only involves German logistics service providers. Further studies in other countries are needed to generalise the results.

Practical implications – Logistics service providers should devote more attention to quality management than they currently do. To enhance quality, they should focus their efforts on service potential and the service process. The paper offers them a way to measure these quality dimensions.

Originality/value – Research into logistics services has so far been mostly descriptive. The present study is the first to validate empirically a measure of logistics service quality and relate it to other phenomena. The relationship between quality management, service quality and business success found by structural modelling helps to understand the role of quality in logistics services.

Keywords Distribution management, Quality management, Customer services quality

Paper type Research paper

1. Introduction

In the past decades, the scope of logistics services has broadened from the provision of isolated services such as transport and warehousing to the management and handling of the flow of goods for entire companies. The market for logistics services is segmented according to the physical services rendered and the extent to which the service offering contains elements of logistics management. Providers handling basic logistics services are often referred to as second-party logistics service providers (2PL). Carriers and freight forwarders as well as warehouse space providers, among others, fall into this category. In many cases, they act as subcontractors to third-party logistics providers (3PL) which are the equivalent of the systems suppliers used in

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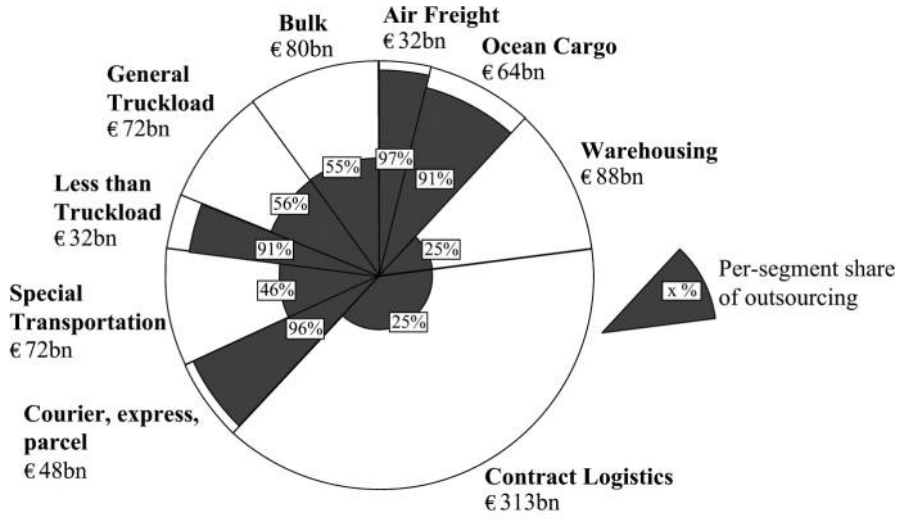
manufacturing, providing entire bundles of coordinated logistics services (Selviaridis and Spring, 2007). If companies outsource parts or all of their logistics activities to these 3PLs, the resulting arrangement is called contract logistics. With the trend towards supply chain management, another class called fourth-party logistics service providers (4PL) emerged in the late 1990s. In line with a broader view of logistics, these providers manage material and information flows in entire supply chains of diverse companies as a neutral agent (Klaus, 2007).

A problem that especially providers of basic logistics services face is strong cost-based competition. In several studies, notably those by van Laarhoven and Sharman (1994), van Laarhoven *et al.* (2000), Wilding and Juriado (2004), Razzaque and Sheng (1998) as well as Selviaridis and Spring (2007), costs are stably identified as the main reason for outsourcing logistics services. Through specialisation and economies of scale, logistics service providers are able to offer their services more cheaply than companies would be able to perform them in-house. Today, however, prices have fallen to such low levels that further cost reductions are not a viable proposition to increase competitiveness, especially for companies based in countries with high labour costs. To overcome this problem, it seems advisable for logistics companies to extend their services to segments with more favourable market conditions. A detailed analysis of the European logistics market by Klaus and Kille (2007) shows that contract logistics, the segment with the highest level of customer-provider integration, still has a large potential for further outsourcing. Of the total €803bn of estimated European logistics costs, 48 per cent are outsourced to logistics service providers, with simple segments such as transportation almost fully handled by them. In contrast, the market overview in Figure 1 shows that only 25 per cent of the activities associated with contract logistics are currently outsourced. However, Cahill (2007) shows that customers are unlikely to engage in the long-term relationships typically associated with contract logistics if a company does not deliver good service quality.



Source: Klaus and Kille (2007)

Figure 1.
European logistics costs and logistics outsourcing by market segment

It seems likely that increasing their service quality would enable providers to expand their portfolio by higher-revenue services, which require a high quality level. For manufacturing companies, the link between quality and success has been confirmed in a number of studies (Buzzell and Gale, 1987; Desatnik, 1989; Sousa and Voss, 2002; Nair, 2006). In the case of logistics services, however, what exactly constitutes quality is not yet systematically understood. Although there have been a number of conceptual papers, empirically validated constructs to measure it are not available. To fill this gap, the present paper develops a measurement model based on existing approaches from operations management and service marketing and validates it based on a survey of 229 German logistics service providers. These constructs are subsequently used to determine the effect of quality management on logistics service quality and the contribution of logistics service quality to business success. The main research questions of this paper are therefore:

- How can logistics service quality be measured?
- Does quality management positively affect logistics service quality?
- Does logistics service quality positively affect the business success of service providers?

2. Measuring service quality

Whereas product quality has long been a topic in operations and business management, the topic of service quality became more visible with the development towards a service economy and the "servitization of business" (Oliva and Kallenberg, 2005). This section identifies ways to measure service quality from the literature. As a complex phenomenon, it cannot be measured directly and has to be conceptualised as one or more latent constructs operationalised by measurable indicators. In order to arrive at a useful conceptualisation for logistics service quality, existing approaches to service quality measurement which are used in other industries are analysed.

2.1 Service quality scales and constructs

Concerning the way service quality perceptions are formed, the most common approach was devised by Parasuraman *et al.* (1985, 1994, 1991) and is often referred to as the PZB model. It suggests that a set of five gaps influences a consumer's perception of service quality, the most important being the gap between the service customers expect and the service they perceive.

The operationalisation of quality criteria in the PZB model is strongly focused on a consumer marketing scenario. The five basic categories in the refined quality scale (Parasuraman *et al.*, 1991) are tangibles, reliability, responsiveness, assurance and empathy. In a comparison of several other papers on measuring service quality, Franceschini *et al.* (1998) find that most adopt this classification. This is certainly very useful in a consumer marketing context. Logistics services, however, are mostly sold to companies. To test the applicability of the PZB model, Franceschini and Rafele (2000) develop a list of criteria, match them with criteria used by a large provider of parcel services and then link to the categories in the PZB model. They find that logistics practitioners did not use any items belonging to the PZB model's empathy construct and scarcely used items of the assurance construct in their performance evaluation. It is likely that the logistics environment is not quite as susceptible to measures of

empathy as the more consumer-oriented industries for which the PZB model was developed.

Another conceptualization of service quality was devised by Grönroos (1984, 2007). He uses a categorization into "technical" service quality (referring to objective, measurable criteria, the "what") and "functional" service quality (referring to customer perceptions, the "how"). However, this approach promotes a purely quantitative view of service outcomes and a purely qualitative view of the service process. This is a clear limitation of Grönroos's approach.

One of the first structured ways of thinking about service quality, devised by Donabedian (1980), avoids this limitation. It breaks down services into the aspects of structure (later referred to as "potential"; Gogoll, 1996), process and outcome: "potential" describes the qualification, resources and organizational conditions of a provider; the "process" dimension describes activities and interactions during the service provision; and "outcome" comprises tangible results of the service encounter and attitudes generated.

Donabedian's is a compelling and very flexible categorisation. Although it was developed for the evaluation of the quality of health care, it is quite independent of any industry context and offers great flexibility in indicator selection. Therefore, it was chosen as the basis for construct development in the present paper.

2.2 Quality scales for logistics

In order to measure potential, process and outcome quality of logistics services, they have to be operationalised through directly measurable indicators. These can be found in the logistics literature. There have been several studies analysing the indicators used for evaluating logistics quality in practice, as well as conceptual approaches to categorising them. These were used as the basis for construct development.

Stock and Lambert (1992) identify important logistics service quality criteria for manufacturing companies and verify them through surveys. Franceschini and Rafele's (2000) list of indicators is compiled from a number of papers published between 1992 and 1996. Both contain mainly quantitative indicators such as order lead time and on-time delivery.

Hannon (2003) analyses the measurement scale manufacturer Michelin uses for its 3PLs. Interestingly, the set of criteria Hannon (2003) reports from the case of Michelin is almost completely disjunct from the indicator set of the consumer-oriented PZB model. No assurance or empathy criteria are used in Michelin's assessment of its providers. On the contrary, a separate criterion measures cost savings, further emphasising the quantitative view taken by practitioners.

Newer results from Davis *et al.* (2008), who find that it is possible for providers to build a brand by "consistently delivering high quality performance" (p. 225), suggest including "soft factors" into the concept of logistics service quality. One such attempt has been made by Engelke (1997). In it, two possible ways of categorising logistics service quality are implemented. Donabedian's categorisation into potential, process and outcome and the PZB model's five categories are applied to a large set of logistics-specific criteria.

Building on Engelke's work, the indicators found in all the above-mentioned studies are used to operationalise the three service quality constructs in the following sections.

2.3Items of the "service potential" construct

Service potential describes the ability of a provider to realise a service through its (human and material) resources. It takes into account the fact that these resources can also be of value to a customer while they are not being used to actively provide the service. A good example of this would be the provision of a certain capacity of warehouse space. Even though it might not be in use at all times, the promise that this capacity will be available when needed provides value to a customer by enabling them to do business without having to continuously ensure storage capacity.

Engelke (1997) sees this category as consisting of three kinds of potential:

(1) employees;

(2) assets; and

(3) organisation.

Concerning employees, a company's service potential is manifested by their qualification, their reliability and caring as well as their competence, knowledge and trustworthiness. A further employee-related indicator of service potential is the availability of individual contact persons within the provider's organisation (Prager, 2003).

The service potential of the assets and technology of a company is most obviously expressed through their general condition. Equipment as well as the cleanliness and maintenance status of this equipment strongly influences of a company's ability to perform high-quality services (Gogoll, 1996). In expert interviews during the preliminary stage of this study, the ability to interface with a customer's ERP software also emerged as an important facilitator for logistics service.

An organisational aspect of service potential is the short-term flexibility offered by the service provider. To be operationally flexible, a company requires built-in procedures that permit a high degree of variation in sequencing, scheduling, etc. (Harris *et al.*, 1998). The same applies to the flexibility a company can offer its customers in terms of fulfilment modalities. Another lasting consequence of a high service potential is the development of a positive image in the market. However, the role of the image in forming quality perceptions is unclear. It can be a consequence as well as a precursor of the perception of quality (Robledo, 2001). Furthermore, an organisation that is good at delivering high quality is also likely to achieve a higher adherence to safety regulations because the same operational diligence that is required to prevent quality failures will also act to prevent accidents.

2.4 Items of the "service process" construct

The "process" dimension assesses how the service is being provided. It refers mainly to intangible aspects, and in this dimension, the simultaneity of production and consumption, which is often considered a distinguishing property of services, most directly applies.

High-quality service processes have a number of important consequences for the customer's quality perception. Firstly, although these processes take place mostly inside the provider firm, logistics services involve customers' personnel and assets and thus make them aware of the reliability of the order completion process. This process starts with the first communication of customer and provider about a certain service event and stops when the service has been rendered fully (Franceschini and Rafele, 2000).

Furthermore, efficient processes lead to a shortening of overall reaction times, thus enabling a company to deal with irregularly occurring events more quickly (Rohleder and Silver, 1997). Customer queries, operational problems and customer complaints are such events. If customer queries are not answered quickly, problems are not dealt with in a timely manner and complaints take too long to lead to a resolution, there is a self-enhancing effect because customers will start another query or complain about the time it takes to resolve their problems. Complaints handling is described in the marketing literature as a way to bind customers and build trust (Tax *et al.*, 1998). A recent example is the white goods manufacturer Bosch Siemens Hausgeräte, who won the 2006 German logistics prize for its concept of handling defects in a way that increases customer loyalty (Bosch Siemens Hausgeräte, 2006).

The effective and error-free receipt, processing and forwarding of information is another positive consequence of high-quality processes (Engelke, 1997). Although a sophisticated IT infrastructure is a further precondition for this, errors in this area can only be consistently avoided by providing a clear information handling workflow. The propensity of LSPs to supply advance notice of delays in the transport of goods is another process item. Delays are unavoidable in the logistics business due to short lead times and the presence of external factors such as road congestion. Good service processes take into account the possibility of internally or externally caused delays and provide employees with clear instructions and means for notifying internal and external stakeholders (Rohleder and Silver, 1997).

The final criterion is the friendliness and courteousness of employees. Eskildsen and Dahlgaard (2000) find that process management is positively associated with employee satisfaction in their study of causal relationships between elements of the EFQM model for quality management.

2.5 Items of the "service outcome" construct

The "outcome" category is surely the most common to be analysed where logistics service quality is concerned. The understanding of logistics professionals seems to be that their customers are principally interested in results. This is understandable given observations like Hannon's (2003) in the case of Michelin, where cost reductions are of paramount importance and outcome criteria are seen to be prerequisites for doing business at all. Not surprisingly, outcome-related criteria were included in all previous studies of logistics quality (see Table I). The most apparent manifestations of outcome quality in logistics are related to lead time. Short lead times enable customers to handle their own operations more flexibly and maintain lower safety stocks. In several investigations, shortened lead times emerge as an important effect companies expect from outsourcing their logistics (Razzaque and Sheng, 1998; Wilding and Juriado, 2004). The consistency of lead times is just as crucial – companies will only be able to profit from short lead times if the associated variation is sufficiently low (Hannon, 2003; Stock and Lambert, 1992). In a similar way, the correctness of shipments plays an important role for customers. Just-in-time production or other highly demanding scenarios leave little room for return shipments. At the least, errors in goods or quantities lead to expensive emergency orders and express shipping. Another poor outcome with severe consequences would be the delivery of goods to the wrong place (Engelke, 1997). Finally, damage to goods during their time in the facilities and transport means of the logistics service provider cannot always be avoided. External

Indicator	Stock and Lambert (1992)	Franceschini and Rafele (2000)	Hannon (2003)	Dimension (Engelke, 1997)	Evaluation in preliminary study
Short-term flexibility	×	×	×	Potential	2.9
Reliability and caring of employees		×		Potential	3.5
Positive image				Potential	
Individual fulfilment and order modalities				Potential	2.5
Competence, knowledge, trustworthiness of employees				Potential	3.5
Availabilty of individual contact persons				Potential	
Employee qualification				Potential	3.2
Condition of assets				Potential	2.7
Compliance with security regulations				Potential	
Interface to customers' ERP software					2.3
Reliability in order completion process		×	×	Process	3.6
Quick processing of complaints	×			Process	3.3
Quick reaction to customer queries				Process	
Quick reaction in case of problems				Process	3.4
Friendliness and courteousness of employees	×			Process	3.4
Error-free receipt, processing and forwarding of information	×			Process	2.8
Advance notice of delays	×			Process	3.7
Short lead times	×	×	×	Outcome	3.0
Adherence to promised lead time	×	×	×	Outcome	3.7
Delivery correctness (goods and quantities)	×	×	×	Outcome	3.3
Delivery correctness (place)	×	×	×	Outcome	3.7
Condition of goods	×	×	×	Outcome	3.3

Table I.
Quality criteria and classification

influences like vandalism and theft during transit can be avoided, but never entirely eliminated. The same applies to fires and catastrophic weather influences on warehouses to a smaller extent.

Table I summarises the indicators and shows the studies they were included in. Additionally, it contains the results of an exploratory survey conducted among 23 purchasing managers in Germany (Kersten and Koch, 2008) that provided further evidence for the indicators to be included. The participants were asked to evaluate indicator relevance on a Likert scale (0 = very unimportant; 4 = very important). Respondents rated the relevance of most items to be high or very high. Additionally, they were asked to state their satisfaction with logistics service providers regarding these indicators. This turned out to be significantly lower for nearly all items.

3. Design and methodology of empirical study

Having developed a way to measure logistics service quality in the previous section, quality management and business success still need to be operationalised in order to be able to answer the research questions. Fortunately, the measurement of both these phenomena is a common issue that has already been covered in various publications. For the purposes of this study, quality management was measured through the

implementation of quality management practices. Following meta-studies by Nair (2006) as well as Sila and Ebrahimpour (2002), which provide reviews of the most relevant quality management practices, eight practices were chosen:

(1) customer focus;
(2) employee development;
(3) leadership commitment;
(4) employee involvement;
(5) continuous improvement;
(6) quality data and measurement;
(7) process management; and
(8) supplier quality management.

These were measured through constructs available in the literature, as was business success. The applicability of these constructs to the German logistics services industry was tested in confirmatory factor analyses.

The resulting path model is shown in Figure 2. Because of the conceptualisation of logistics service quality in three dimensions, the research question about the relationship between quality management and logistics service quality leads to three research hypotheses:

H1. Potential quality is positively related to quality management.

H2. Process quality is positively related to quality management.

H3. Outcome quality is positively related to quality management.

Likewise, the third research question, regarding the relationship between service quality and business success, gives rise to the following three hypotheses:

H4. Business success is positively related to potential quality.

H5. Business success is positively related to process quality.

H6. Business success is positively related to outcome quality.

To validate the newly developed constructs empirically and test the structural hypotheses, a survey was conducted. Ten experts from the logistics industry agreed to pretest the survey instrument. In response to their comments on the constructs and the wording of the questions, the survey was adapted. It was then sent to 1,565 German

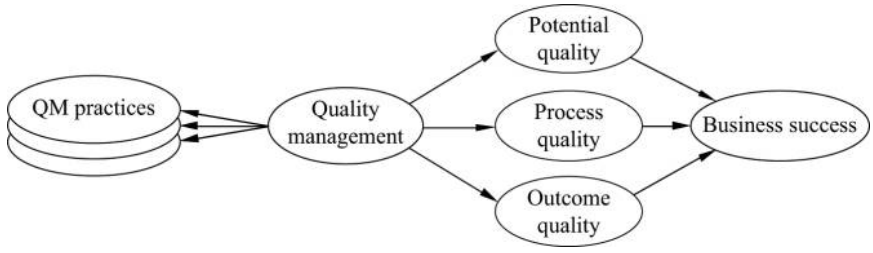


Figure 2.
Path model

logistics service providers. Addresses were identified through a publicly available database of German businesses and a business networking website (XING). Quality managers, plant managers and general managers were chosen as the addressees as it is assumed that they have good insights into the company's quality practices and output. The survey instrument was distributed as a paper-based version and via email. Two hundred and twenty-nine usable responses were received. This corresponds to a response rate of 14.6 per cent. Respondents were asked to rate the quality level of their business unit with respect to the indicators mentioned in the previous section and the implementation of quality management items on a seven-point Likert scale (1 = very low; 7 = very high). Basic company data was collected additionally.

These firms represent a cross-section of the industry in terms of size and the logistics tasks they perform. Company sizes were between five and 100,000 employees with 39 per cent in the 100-1,000 employees range. The tenure of respondents in their company was between one and 55 years, with 35 per cent between five and ten years. Non-response bias was tested by comparing early and late respondents (Armstrong and Overton, 1977). No significant difference of mean or variance between the groups was detected. Missing data (3.1 per cent) were found to be missing completely at random (MCAR) and imputed using the expectation-maximisation algorithm (Dempster *et al.*, 1977). In order to determine the applicable estimation methods for fitting the structural equation model, the data were analysed for multivariate normality using the Shapiro and Wilk (1965) and Kolmogorov-Smirnov tests (Lilliefors, 1967). Both tests rejected normality, thus the common maximum likelihood estimator cannot be used in this study. As an alternative, the unweighted least squares (ULS) estimator was used because it has been shown to lead to highly similar results (Ogasawara, 2003) and is available in the software used (AMOS).

4. Validation of the measurement model

In order to determine whether the developed measurement instrument of logistics service quality is dependable and can be used in further research, an assessment of the reliability and statistical validity of the constructs was performed. This was also necessary to make the scale useful as an instrument for practitioners to assess and benchmark logistics service quality (Flynn *et al.*, 1994).

Following Ahire and Devaraj (2001) and because the constructs under investigation have not been tested before, an exploratory factor analysis was first conducted using principal components factor analysis. The Kaiser-Meyer-Olkin measure of sampling adequacy was 0.859, well above the adequate level of 0.8 (Hair, 2006). Through analysis of a scree plot, the number of constructs in the scale (three) was confirmed (Cattell, 1966). Also, each of the indicators loaded onto the expected construct. However, a number of indicators had to be eliminated because they failed to exhibit a high loading on a single construct. The analysis was continued with a reduced scale of five items in the "service potential" construct and four each in the "process" and "outcome" constructs (see Table II).

In order to ensure unidimensionality, a confirmatory factor analysis was conducted on each of the factors through structural equation modelling. A minimum was reached, and the resulting models yielded a goodness-of-fit index (GFI) higher than 0.95. The SRMR for all constructs was less than the 0.08 that Hu and Bentler (1999) consider adequate.

Table II.
Constructs after principal components analysis

Service potential	Service processes	Service outcome
Reliability and caring of employees	Reliability in order completion process	Condition of goods
Individual fulfilment and order modalities	Quick reaction to customer queries	Delivery correctness (place)
Condition of assets	Advance notice of delays	Short lead times
Compliance with security regulations	Quick reaction in case of problems	Delivery correctness (goods and quantities)
Interface to customer's ERP software		

Scale reliability, which refers to the degree of dependability, consistency or stability of a construct (Ahire and Devaraj, 2001), was tested using Cronbach's α. An α value of at least 0.7 is proposed as the cut-off for maturing constructs (Nunnally and Bernstein, 1994). All three constructs fulfil this criterion.

Convergent validity is the extent to which varying approaches to construct measurement yield the same results (Campbell and Fiske, 1959). The normed fit index (NFI) proposed by Bentler and Bonett (1980) was used to test this. Values above 0.8 are acceptable, and values above 0.9 demonstrate strong convergent validity. The NFI values of the logistics service constructs all exceed 0.9.

Discriminant validity was tested to preclude definitional overlap between constructs by an approach suggested by Bagozzi *et al.*(1991). It verifies whether the value of Cronbach's α for each of the constructs is adequately larger than its average inter-scale correlation. Since all the constructs pass this test, their discriminant validity is ensured.

Detailed results of all tests performed can be found in Table III. To summarise, the validity of the constructs was confirmed in all analyses that were performed. Thus the first aim of this study – to develop and test empirically an instrument that measures service quality in logistics services – was fulfilled.

Having validated the logistics service quality constructs, the applicability of the other constructs (quality management practices and business success) to the German logistics service industry needs to be confirmed. As these are mature constructs, only confirmatory factor analysis was performed. The constructs, their origin in literature and the CFA results are shown in Table IV. The analyses confirm the validity of all the constructs that are used.

Table III.
Scale unidimensionality, reliability, convergent and discriminant validity indices

	Unidimensionality		Reliability	Convergent validity	Discriminant validity
	GFI	SRMR	α (Cronbach)	NFI	AVISC
Potential	0.997	0.036	0.71	0.9859	0.48
Process	0.979	0.029	0.86	0.974	0.46
Outcome	0.992	0.024	0.75	0.980	0.37

	Source	Unidimensionality GFI	Unidimensionality SRMR	Reliability α	Convergent validity NFI	Discriminant validity AVISC
Customer focus	D/J[a]	0.994	0.044	0.84	0.989	0.20
Employee development	D/J[a]	0.998	0.025	0.88	0.998	0.23
Leadership commitment	C[a]	0.995	0.050	0.91	0.992	0.50
Employee involvement	A[a]	0.993	0.067	0.83	0.986	0.23
Continuous improvement	C[a]	0.995	0.054	0.82	0.989	0.36
Quality data and measurement	A[a]	0.995	0.052	0.87	0.991	0.47
Process orientation	C[a]	0.996	0.040	0.86	0.993	0.40
Supplier quality management	C[a]	0.997	0.037	0.89	0.995	0.26
Business success	D/J[a]	0.992	0.051	0.81	0.983	0.18

Notes: [a]A = Ahire *et al.* (1996); C = Conca *et al.* (2004); D/J = Douglas and Judge (2001)

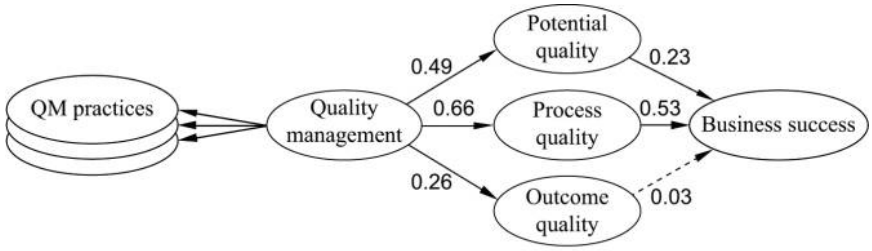
Table IV.
Confirmatory factor analysis of quality management and business success constructs

5. Results of the structural equation model

The path model shown in Figure 2 was fitted to the data. The fit of the resulting model was good for all fit measures except the SRMR value of 0.084, which slightly exceeded the defined cut-off value of 0.08. However, an SRMR of <0.10 is generally deemed acceptable (Schermelleh-Engel *et al.*, 2003). Since the GFI (0.946) and NFI (0.935) are above their cut-off value of 0.90, the model is found to fit the data well. Figure 3 shows the path coefficients of the fitted model. Based on these coefficients, it is now possible to confirm or disconfirm the research hypotheses.

The first hypothesis to be tested is *H1*, which predicts that quality management has a positive effect on service potential. The path between the two constructs has a coefficient of 0.49, which suggests a strong positive relationship. Because of the ULS estimation of the model, it is not possible to state a significance level for this relationship. However, due to the good overall fit of the model, the existence of this relationship is credible. *H1* is therefore accepted.

Hypothesis *H2*, stating that process quality is positively affected by quality management, receives a coefficient of 0.66. This is the highest in the model and points to an especially strong relationship, confirming this hypothesis as well. The third research hypothesis, *H3*, connects QM and outcome quality. The coefficient here is lower than those of *H1* and *H2*, but it is safely larger than zero. Thus the model also confirms *H3*.



Note: GFI: 0.946; NFI: 0.935; SRMR: 0.084; df: 1,696

Figure 3.
Coefficients of the fitted model

H4-H6 concern the relationships between logistics service quality and business success. *H4*, which assumes that an increase in service potential is associated with higher business success, and *H5*, which assumes the same for process quality, are confirmed by values of 0.23 and 0.53, respectively. *H6*, however, has to be rejected because the path coefficient between outcome quality and business success is close to zero (0.03). Overall, the model explains 42.4 per cent of variation in business success.

6. Discussion of findings

In answer to the first research question, this study empirically validates a measurement model for logistics service quality. It is interesting that the very simple service quality dimensions "potential", "process" and "outcome" which were hypothesised by Donabedian (1980) are so flexible that they apply to a completely different service industry. Donabedian's work had its roots in health care, and there are few obvious similarities of this field to logistics services. This also lends additional credibility to the adoption of this concept in service theory (Corsten and Gössinger, 2007; Gogoll, 1996).

Furthermore, the finding that aspects of service quality that have not previously been considered as indicators of logistics service quality were found to be part of these constructs advances the study of logistics services.

In agreement with prior research, the present study finds a positive influence of quality management on business success. This finding is of great relevance to logistics service providers who currently struggle in a race for competitiveness, which they commonly assume to be dominated by prices. It shows that those providers that emphasize service quality are more likely to be successful than competitors with an exclusive concern for costs.

Beyond this summary finding, the developed model shows that the effect of quality management on business success is facilitated by service quality. What is especially interesting about this is that the roles of the three dimensions used to conceptualise service quality in the present study differ strongly. Whereas process quality is strongly affected by quality management and itself exhibits a strong influence on success, the association of potential quality to these constructs is weaker, and outcome quality turns out to have a negligible success impact.

The probable reason for this difference is in the level of quality and customer satisfaction that providers have already achieved today. In our preliminary study, logistics service customers were asked to state their satisfaction with providers with regard to a list of quality indicators. The outcome indicators showed the highest level of satisfaction. This could be explained by the Kano model (Kano *et al.*, 1984), which explains the decreasing effects of quality changes on customer satisfaction by the existence of "basic characteristics". These have a level of saturation above which increases have virtually no effect. The results concerning outcome quality suggest that it is such a basic characteristic of logistics service quality. This enables logistics service providers to focus on increasing the process and potential aspects of their service, while maintaining the current level of outcome quality.

7. Conclusion

This paper investigated the relationship between quality management, service quality and success for the German logistics service industry. Through combining the findings

of the service marketing and operations management fields, a new approach to measuring logistics service quality was developed. This approach measures the potential, process and outcome quality. These were conceptualised as latent variables, and a measurement model for them was statistically validated on a sample of 229 German logistics service providers. A structural equation model was used to test the effect of quality management on these quality dimensions and the effect of the dimensions themselves on business success. For all dimensions except the outcome quality, positive relationships were found. The resulting model was able to explain 42.4 per cent of variation in business success.

These results are important firstly because they confirm earlier results concerning the effect of quality management on business success and verify their applicability in Germany. This is also a step towards accepting the generalisation of such results beyond the regions in which they have been explicitly confirmed. Secondly, these results confirm the effect of quality management in the logistics service industry. The fact that this industry sells services makes this especially interesting as most previous studies were concerned with manufacturing. This is probably due to the difficulties that still exist when measuring service quality. The measurement model used in this study is industry-specific, but the basic conceptualisation it uses – Donabedian's three dimensions of potential, process and outcome – has proven to be easily adaptable, and its use should be encouraged.

Most importantly, this study emphasises the importance of quality in logistics services and enables logistics practitioners to focus their quality efforts in a way that is likely to affect business success positively. In an industry that is currently dominated by intensive price competition, focused quality initiatives could be the solution for companies unwilling or unable to cut costs even further.

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