

PLS and Success Factor Studies in Marketing

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Summary

While in consumer research the “Cronbach’s α - LISREL”-paradigm has emerged for a better separation of measurement errors and structural relationships, it is shown here that studies which involve an evaluation of the effectiveness of marketing or organizational strategies based on structural relationships require the application of PLS. This is because we no longer distinguish between constructs and their reflecting measures but rather between abstract marketing policies (constructs) and their forming detailed marketing instruments (indicators). It is shown with the help of examples from literature that many studies of this type applying LISREL have been misspecified and had better made use of the PLS approach. I also demonstrate the appropriate use of PLS in a study of success factors for e-businesses. I conclude with recommendations on the appropriate design of success factor studies including the use of higher-order constructs and the validation of such studies.

Keywords: Success factor analysis, formative versus reflective indicators, structural equation modeling.

1 Introduction

Based on research primarily in the area of salesperson behavior Churchill [7] has advocated in an influential article a better measurement approach for empirical studies in marketing. He stresses that complex constructs like role conflict or role ambiguity cannot be measured with a single item because each measure has its idiosyncratic error and will not give a reliable measure. Rather, it is better to work with multiple measures. This allows the researcher to separate the relationships between various constructs from its measurement errors. According to classical test theory as developed in psychology, Churchill promoted the evaluation of the internal consistency of the items with the help of Cronbach's α [8]. Furthermore, relationships between constructs can be modeled by structural equation approaches that can be estimated with the help of variance-covariance-based approaches like LISREL. This has become the standard for many years in marketing.

While in the beginning many studies that have used this approach were in the field of consumer behavior research, later studies used the same approach for studies of organizational effectiveness. Typical examples are studies on market orientation by e.g. Homburg and Pflesser [18], Matsuno, Mentzer, and Özsoy [21], and Zhou, Yim, and Tse (2005). While the approach by Churchill is mostly applicable to psychological constructs this no longer holds for organizational constructs. The reason is that the measurement approach advocated by [7] works with the assumption that constructs may be operationalized through indicators that reflect the construct. However, if one is interested in the area of organizational and marketing effectiveness in the factors that drive success, then, the constructs have to be operationalized as different aspects and are thus forming the construct. Unfortunately, many articles have not paid attention to this important distinction and have estimated their models under the assumption of reflective indicators [19, 12]. This misspecification has not only consequences with respect to the estimation of parameters but also to the selection of the right indicators and to the derivation of implications of the results.

I, therefore, describe in section 2 typical misspecifications in structural equation approaches applied in empirical marketing studies. In section 3 I derive consequences of these misspecifications which ask for a paradigm shift from the so called "Cronbach's α - LISREL" approach for mostly psychological constructs to the derivation of success factor constructs based on content validity grounds and to estimate the structural equations with the help of Partial Least Squares (PLS). Section 4 describes a prototypical application with recommendations how to report results. Based on these experiences I formulate in section 5 some recommendations for the design of success factor studies in marketing and give in section 6 a conclusion.

2 Misspecification of Marketing Studies

According to Jarvis, Mackenzie, and Podsakoff [19], 28% of all structural equation modeling articles in marketing top-A-Journals, especially in *Journal of Marketing*, use misspecified models. This refers to the fact that studies assume reflective indicators while they are in fact different facets and hence must be formative. The same is true for articles in the leading German journals. Fassott [12] reports that ca. 33% of those articles use misspecified models.

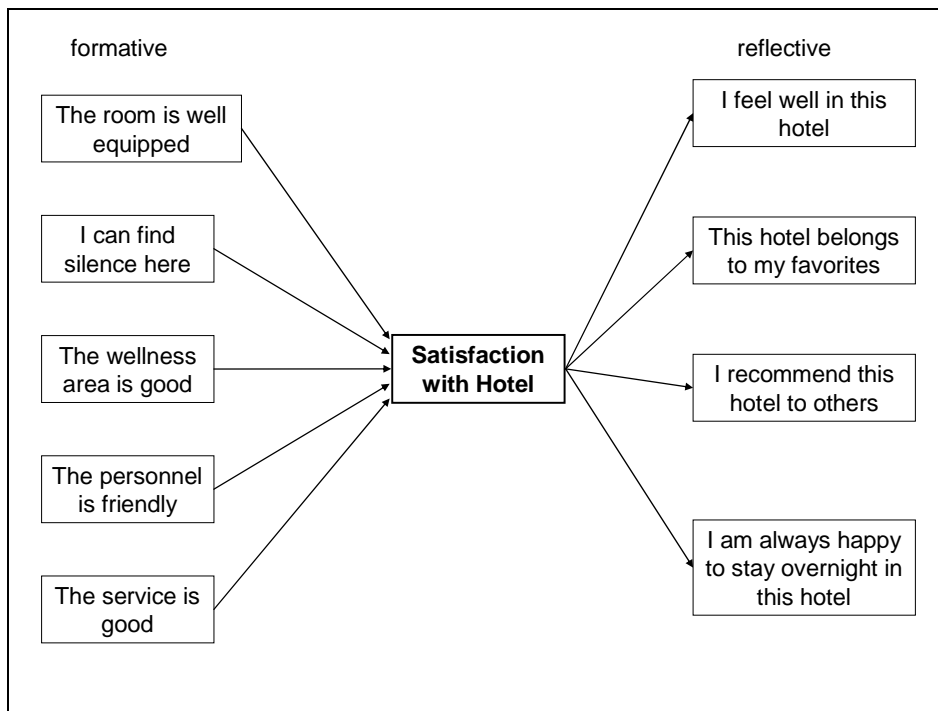
The authors of these articles follow a common scheme that can be deduced for example from the articles by Steenkamp and van Trijp [26], Baumgartner and Homburg [4], and Steenkamp and Baumgartner [25]. In Germany an article by Homburg and Giering [17] was very influential and was later misused as kind of recipe for empirical work. The basic premise is that success of marketing is due to complex influences like market orientation and so on. These influences cannot be measured error-free. Rather, it is advisable to measure the construct with the help of indicators. According to classical test theory one should use indicators or items that are reliable and should discriminate between different constructs. Therefore, it is tested whether the constructs and its operationalizations are supported by Cronbach's α [8] and other reliability measures and confirmatory factor analysis. If the constructs do not comply with the tests they are purified in a sense that indicators that do not correlate sufficiently high with the other indicators of a construct are deleted. Based on these modified operationalizations of constructs the statistical analysis is carried out with the help of LISREL which tries to fit the variance-covariance matrix as best as possible. The advantage is that LISREL is readily available and provides many test statistics to assess the overall model fit. In the very end, the overall fit was used for supporting or rejecting theories. This approach represented the ruling paradigm for many years so that Homburg and Baumgartner [16, p. 1093] conclude that one cannot get papers accepted that do not follow these rules.

Only later on, it was pointed out by Diamantopoulos and Winklhofer [10] and Rossiter [23] that this approach may be misleading if the researcher wants to investigate the drivers of success. In this case the constructs have to be operationalized by formative rather than reflective indicators. The misspecification of structural equation models by implicitly assuming reflective indicators, although they are actually formative, can mostly be observed when the articles deal with organizational constructs like market orientation, customer orientation, and service orientation of companies, salesforces or employees.

In the following I want to give a good distinction between reflective and formative indicators. Figure 1 shows that a construct can be, in principal, operationalized in both ways [2]. The right side of Figure 1 shows reflective indicators. In this case

the causal direction is that a construct is reflected by indicators and therefore the causal relationship goes from the construct to the indicators. This might be appropriate when a researcher wants to test theories with respect to satisfaction. However, in managerially oriented business studies we want to find out what are most important drivers of satisfaction that ultimately lead to the retention of a customer. In this case we need as many facets of satisfaction as required for a success factor study. In this case the causal relationship is going from the indicators to the constructs.

Figure 1: Satisfaction as a formative and reflective Construct



Source: Albers and Hildebrandt [2]

In case of formative indicators the classical test theory does no longer apply. The items are no longer replaceable and very often do not correlate enough. As a consequence researchers that struggled with the requirement of 0.7 for Cronbach's α , but found that their constructs did not meet this requirement, relaxed this requirement

with the excuse that weaker requirements should be applied for new constructs [22, p. 382]. However, formative constructs need not be correlated and therefore could not be tested with test theory at all. If researchers either tried to delete unreliable items (false purification) or assumed the wrong direction of the relationship, this can lead to misspecified models [19].

This misspecification is still present in many articles in top-A-journals. I want to demonstrate this with the help of some examples that are typical for this area. However it is not my purpose to single out certain authors but rather to discuss the way of misspecification of the particular methodology applied in these articles:

In a study by Homburg and Pflesser [18], it is investigated whether market orientation is based on an organizational culture that has shared basic values influencing norms and these in turn influencing artifacts and behaviors and these in turn again finally impacting market and financial performance. They operationalized their constructs with the help of 23 aspects that are itself first-order constructs which are operationalized in turn by 78 indicators or items. They applied the usual techniques of Cronbach's α and confirmatory factor analysis (CFA) to purify the scales of the 23 first-order constructs. As they considered their model to be too complex the authors tested simplified alternative measurement models and selected the one with the best CAIC (consistent Akaike information criterion). Based on a 5-factor model with only one dimension of shared values (out of 8 aspects), one dimension for norms (out of 8 aspects), one dimension for market-oriented behaviors (20 original items were reduced to 12 items), and 2 dimensions of artifacts (out of 6), they finally tested their hypothesized structure. Although this implies a reflective philosophy of construct operationalization, Homburg and Pflesser [18] report different dimensions (aspects) of their constructs which is only possible if one assumes that the first-order factors form the second-order constructs. If one deletes different aspects then the overall meaning of the constructs has changed and the results are no longer holding for this construct in general but only for this particular operationalization. While this procedure allows the application of statistical criteria for construct validation and the final application of LISREL with reflective indicators this would have strongly altered the originally postulated model. If we really have different aspects then they are not interchangeable and therefore could not be deleted. Deletion of items is only possible if all items stem from a universe of alternative but interchangeable measures that reflect the whole construct but not special facets or aspects [23].

The study by Matsuno, Mentzer, and Özsoy [21] investigates whether market orientation and entrepreneurial proclivity have an influence on business performance. The authors develop a structural equation model (SEM) in which entrepreneurial proclivity influences market orientation via constructs describing organizational structure (formalization, centralization, and departmentalization) while market orientation finally impacts business performance. All the constructs have

been operationalized with the help of item batteries that have been purified according to Cronbach's α and CFA. The model itself has been estimated by LISREL assuming reflective relationships between constructs and indicators.

A closer look at the operationalization of the construct market orientation shows that nearly all indicators represent different (formative) aspects of market orientation but are not total reflections of the construct. Indeed, on the basis of a factor analysis Matsuno, Mentzer, and Özsomer [21] find three sets of indicators to be sufficiently correlated. They, therefore, argue that this implies that market orientation is a second-order factor with the sets of correlated indicators as first-order factors. These first-order factors are termed intelligence generation, intelligence dissemination, and responsiveness and are in turn representations of a total of 22 indicators. In order to be able to run LISREL the authors determined the values of the three first-order factors by calculating the unweighted mean of the respective indicators. This means that the model is based on market-orientation with its first-order factors as indicators. As these first-order factors represent different aspects (otherwise they could not come out as different factors in a confirmatory factor analysis) it would have been mandatory to handle them as formative indicators. Unfortunately, they were erroneously considered to be reflecting indicators of market orientation. In the same way, entrepreneurial proclivity was operationalized by the unweighted means of the indicators of the three first-order factors innovativeness, risk taking, and proactiveness. The authors derive as managerial implication that both constructs positively affect business performance. However, because of the reflective nature of their indicators they could not give an indication what drives business performance the most. Therefore, the value of this investigation is limited.

Zhou, Yim, and Tse [29] analyze whether market orientation impedes breakthrough innovations. They work with constructs like market orientation, technology orientation and entrepreneurial orientation for strategic orientation and demand uncertainty, market turbulence, and competitive intensity for market force and analyze with the help of variance-covariance based structural equation modeling whether these factors exert an influence on either technology-based or market-based innovations and finally on performance. These factors are constructs and therefore operationalized through a total of 54 indicators. Although many of these indicators represent different aspects the authors have validated them with the help of confirmatory factor analysis leading to the dropping of a number of indicators. As some of their constructs are second-order factors they replaced the first-order factors by the summated scores of their indicators. In the final model they treated all constructs as reflected by indicators. Of course, this is not possible given the nature of the indicators representing aspects or drivers but not reflections. It is surprising to see that despite all the articles already published such as the ones by Diamantopoulos and Winklhofer [10], Rossiter [23], and Jarvis, Mackenzie, and

Podsakoff [19], authors and reviewers of top-A-journals apparently do not know about this problem of misspecification.

The review by Jarvis, Mackenzie, and Podsakoff [19] also makes it clear that many researchers like to make a compromise by considering different aspects or drivers with the help of several first-order factors forming one second-order factor while staying in the tradition of classical test theory by operationalizing the first-order factors with the help of multiple reflecting measures. Very often this is the outcome of a process of an exploratory factor analysis and a purification following a confirmatory factor analysis. Because of the difficulties to handle second-order factors in LISREL as well as other SEM approaches authors frequently calculate unweighted means as measures for the first-order factors and continue to work with those by mostly using regression analysis.

3 Consequences of Misspecification

The discussion of several applications in top-A-journals in marketing makes clear that the models suffer from a manifold of misspecifications:

- a) Items have been deleted despite of the relevance to the construct.
- b) Many constructs are not measured in a general way but only represent the meaning of its sample of indicators.
- c) The estimation of misspecified models leads to biased estimates.
- d) In the case of unweighted linear combinations for being able to run linear regressions, the relationships are underestimated because stronger relationships can be found with a weighting of the indicators.
- e) With the assumption of reflective indicators it is only possible to derive results for the constructs but not for the differential effect of the indicators. This is especially a problem in success factor studies where it is not so much of concern to learn that market orientation has a positive impact on market results (this is a highly plausible conclusion) but which drivers (indicators) are mostly responsible for the success.

Ad a) The recommendation by Churchill [7] to use better measures in marketing by using multiple items is only holding for constructs that are measured by reflective indicators. As each indicator has its idiosyncratic error it will not give a reliable measure. Rather, it is better to work with multiple items. However, this also implies that all multiple measures must come from a universe of equally suitable items and are drawn randomly from it. Therefore, it can be checked with the help of classical test theory whether the selected items show internal consistency, e.g. by calculating Cronbach's α and testing for one-dimensionality. While this procedure makes very often sense in the field of consumer behavior research this is generally no longer true for studies of organizational effectiveness. Here, we are

interested, for example, in finding out which drivers of the organizational structure and culture that lead to market orientation have an impact on success. Only this information provides recommendations on concrete actions that improve business while the information that market orientation has a positive impact on success does not tell us what to do. Therefore, researchers have strived for operationalizing their constructs with as many aspects as extractable from expert interviews. Now, if one applies the so called “Cronbach’s α – LISREL” paradigm (which may also include other reliability measures) researchers have found that these indicators are no longer internally consistent or sufficiently intercorrelated. They have, therefore, deleted all items that showed a low reliability. Frequently, authors report a percentage of deleted items of up to 50%.

Ad b) It can be seen from our two examples that authors have either deleted items during the purification process that do not show reliability (see a) or have selected only some aspects. However, if these items do not represent interchangeable items drawn randomly, then any selection of indicators alters the meaning of a construct. Therefore, findings can only refer to the special operationalization of this construct in this study and do not allow for any kind of generalization. In the essence, under reflective assumptions one selects the set of maximally intercorrelated items while in a formative approach one tries to avoid intercorrelated items. This means that the operationalization can differ as much as the sets of items for both approaches are distinct. Diamantopoulos and Siguaw [11] re-analyzed an already published study by Cadogan, Diamantopoulos, and Pahud de Mortanges [5] in which reflective indicators have been erroneously assumed and therefore some of them have been deleted that do not provide internal consistency. In contrast, Diamantopoulos and Siguaw [11] have only assumed formative relationships of the indicators with its construct export coordination. This allows for the inclusion of many facets but resulted in multicollinearity. Therefore, the authors eliminated some intercorrelated indicators. Now, it is no surprise that only 2 indicators out of a pool of 30 indicators are the same according to both methods. This implies that the meaning of the construct, even if they have the same name, is drastically altered. In addition they find that the relationship to 14 different export success measures can better be explained with the help of the remaining 5 uncorrelated formative indicators than with the correlated 16 reflective indicators.

Ad c) If one attempts to estimate a model with the help of variance-covariance based approaches like LISREL [20] or AMOS [3] that is based on reflecting indicators that are actually formative, then one obtains biased estimators [19]. The purification process may result in model structures that give totally different results compared to true models with formative indicators estimated with the help of PLS [28]. The results of a simulation study show that the coefficients explaining the influence of the various constructs (inner model) are positively biased. With respect to the level of the coefficients there is a significantly negative relationship with respect to the level of intercorrelation of the indicators of the constructs. However, this result only holds for maximum-likelihood estimations of variance-

covariance models [19]. When comparing LISREL with PLS, Albers and Hildebrandt [2] found that the coefficients are surprisingly robust if the models are specified correctly while formative models estimated by PLS and alternatively by LISREL under the assumption of reflective indicators lead to completely different conclusions.

Ad d) Very often the approach of using multiple-items for measurement leads to complex models with large numbers of indicators. As estimation procedures require a sufficient number of degrees of freedom (5 observations per parameter is an often used rule) authors have to work with a smaller number of indicators. Rather than specifying a full model and estimating it with the help of LISREL these authors only evaluate the measurement model with the help of confirmatory factor analysis and then work with indices that comprise the items as unweighted means. This allows them to apply simple OLS regression to estimate relationships. As the weights are equal this means that the explanatory power of the construct is less than in the weighted case and the structural relationships may be underestimated. We have also seen in the study by Matsuno, Mentzer, and Özsoy [21] that these authors handle formative aspects by defining second-order constructs that have different aspects or facets as first-order constructs which in turn are measured by reflective multiple items. If one collapses one level of this second order construct relationship by forming indices of unweighted means of indicators and works with the indices as indicators reflecting the construct, then the indicators are not sufficiently intercorrelated and therefore we arrive at a bad model fit.

Ad e) By assuming reflective indicators it is implied that the indicators are interchangeable representations of the construct. Therefore, these studies only argue with the effects of the constructs. In the case of studies on the influence of market orientation one has no knowledge how to achieve this market orientation. If the indicators are formative and modeled as such then one can determine the influence of the indicators on the construct. However, in the case of the use of reflective indicators any such interpretation is not possible. However, it might be argued that one can use reflective indicators if we are only interested in the influence of a holistic strategy with highly intercorrelated strategy elements. If we understand the strategy in a way that all indicators have to be altered in case the construct is altered then the direction of causality is not crucial. However, the explanation power of the model is limited because we can only investigate the influence of a complete strategy and not of its components and we cannot be sure whether the strategy has been operationalized completely. Moreover, in case of such strategies there is no need for a separation of the measurement model and the structural model because the operationalization of a strategy cannot involve a measurement error according to classical test theory. Rather, it can only be incomplete which would determine the meaning of the strategy. Insofar, indicators can serve as reflective effects of a construct as well as formative aspects of a construct depending on the purpose of the study.

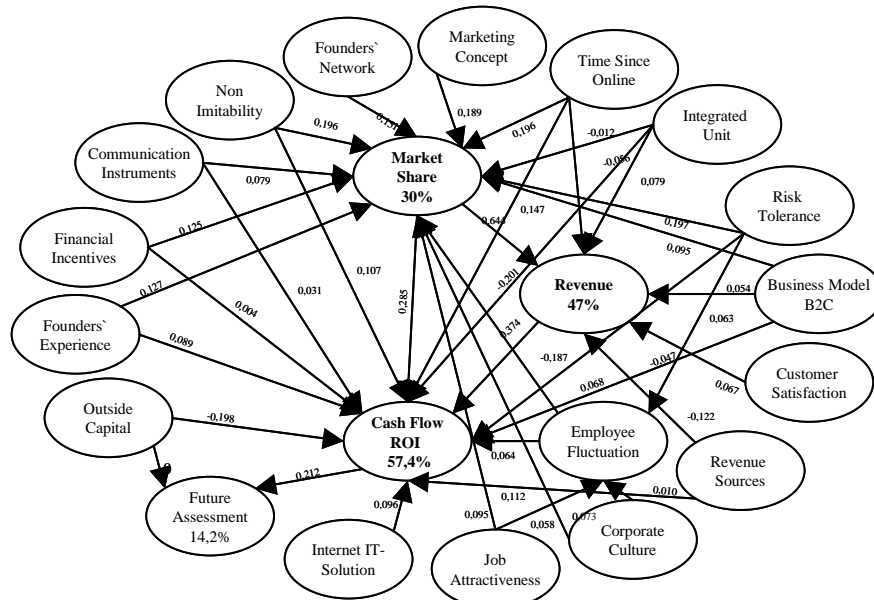
Hence, contrary to the intention of Jarvis, MacKenzie, and Podsakoff [19, p. 203] to provide decision rules that allow for an unequivocal determination of either a reflective or formative character of indicators, it is argued in the preceding paragraph that it is not possible to assess whether an approach of construct operationalization is correct or not. Rather, the approach (working with holistic strategies or components determining a strategy) limits the kind of results obtainable and may lead to an inappropriate model. In case of reflective indicators the model might be correct but allows only an analysis whether the change of all indicators at the same time will lead to more success or not. Whether single indicators have more importance cannot be the goal of such a study. In the same way one cannot evaluate the validity of constructs with formative indicators. Rather, the chosen indicators determine the meaning of the construct and thereby the explanatory power of the model [2].

4 Success Factor Models in Marketing

Success factor studies should concentrate on the impact of success drivers. Insofar hypothesis testing is not the primary goal but rather identifying the differential impact of the various factors. As success in marketing is driven by many factors one first faces the problem of selecting the relevant factors. According to Rossiter [23] this should be done on the basis of expert interviews and a thorough literature review. If some of these factors are belonging to the same domain they are subsumed under more abstract constructs that allow for a more aggregate discussion. I only consider here studies that have such structural relationships. In a second step, multicollinearity has to be removed. In success factor studies, intercorrelated factors do not imply indicators reflecting a construct but are rather the result of applying certain holistic strategies in practice. As multicollinearity of indicators within a construct inflates the standard error it is advisable either to remove correlated indicators or to aggregate them within a single index.

In this way, Albers [1] investigated which marketing strategies, business models, characteristics of founders, financial incentives, job characteristics, organizational culture, and kind of IT-solution have the highest positive impact on business performance as measured by market share, revenue and profitability. In this study, the author elicited measures that represent different stages of the success chain: satisfaction with the achieved level of market share and with its development over the last 12 months and the same for revenue. Of course, both are only a prerequisite of profitability which is operationalized by cash-flow and ROI considerations in order to capture absolute as well as relative effects. In addition, it was asked for the company's judgment of achieved customer satisfaction and employee fluctuation rate. The assumed causal relationships are visualized in Figure 2.

Fig. 2 Structure and Estimation Results of Structural Equation Model



Based on expert interviews and a literature study, 42 indicators have been aggregated to 10 constructs. In the majority, the indicators have been measured on 7-point Likert scales. In addition, the model takes some dummy-variables into account. Details of the measurement model are given in Albers [1]. On this basis the following relationships are assumed: Market share is the heart of all activities and therefore influenced by the marketing concept, the communication strategy, and the non-imitability. In addition, the founders' network and experience, job attractiveness, financial incentives, and corporate culture influence the effort of the employees to fight for market share. All these variables in the very end explain 30% of market share. Market share determines revenue which is also directly influenced by the revenue sources and some other variables that also influence market share. The variance of revenue can, thus, be explained by 47%. Revenue, then, determines profitability. Profitability is also directly influenced by marketing variables if they determine the margins that can be realized and by variables that have cost consequences like the IT-solution and the financial incentives. Based on this model the explained variance with respect to profitability is 57.4%. Profitability finally explains the variance of the future assessment of the operations given by continuing the operations and/or increasing investments by 14.2%.

If we want to investigate data from a broad cross-section of companies it is advisable to include covariates as additional explanatory variables in order to absorb heterogeneity of the sample. Since large differences between B2C and B2B operations are observed a respective dummy-variable is included. Companies have already reached their break-even when they started earlier so the time since being online was included. In addition, it was taken into account whether the operation was financed by outside capital which may impose different expectations on profitability. Finally, a dummy-variable was included which distinguishes between start-ups and integrated units to capture residual variance that can not be explained by the constructs. The relationships described so far represent a structural equation model that is given in Figure 2.

In order to test empirically the relative importance of the various success factors, Albers [1] has distributed a questionnaire via email (in a few cases also by fax and surface mail) to 590 companies. Addresses of the companies were obtained with the help of an online-search for phrases like e-commerce, start-up, online-shop etc. Moreover, it was systematically searched in web-newspapers and shopping indices. The questionnaire was addressed to members of the board, chief executive officers as well as managers of the e-business operations. A total of 191 companies responded which resulted in a response rate of 32%. Unfortunately, 21 out of 191 companies refused to fill in the necessary information on business success. In addition, we excluded another 23 companies because they showed more than 4 missing values in the success factors. In the other cases missing values have been replaced by mean values of the respective variables. As a result, we can base our analysis on 147 complete questionnaires. The sample of responses does not claim to be representative but appears to be typical.

Based on 147 complete questionnaires, Albers estimated a PLS model despite the unfavorable ratio of observations to parameters of less than 4. This is because PLS partially estimates parameters per construct so that the degree of freedoms $147 - 10 - 1 = 136$ was still satisfactory.

The study did not reveal any surprising relationships with respect to the sign of the regression coefficients. Rather, the derivation of the impact of the various indicators was the goal of this investigation. This means that, first of all, the effects of the various indicators via all paths on the endogenous variable ROI had to be calculated. By adding up all single effects one obtains the total effect. Table 1 presents the results of the impact of the various success factors on success in terms of standardized regression coefficients. Even better would be to sort the variables in a matrix with different classes of overall parameter values as well t-values for the total effect. However, this requires a Monte-Carlo simulation to determine the distribution of the parameter value over several paths. This has still to be implemented by current software.

Table 1 Total Effects of Single Indicators for ROI (Albers 2002)

Classes	Positive Total Effects		Negative Total Effects	
> 0,15	Time Since Online	0,2456	Venture Capital Funded	-0,1980
	Brand Advantage	0,1872		
	Prior Experience in Same Industry	0,1634		
0,05 - 0,15	Individually developed IT-solution	0,1040		
	Employee Fluctuation	0,0998		
	Network for Data on market and competition	0,0983		
	Secure Jobs	0,0690		
	Wide assortment	0,0678		
	Selling to target group	0,0615		
	Prior Consulting Experience	0,0604		
0,03 - 0,05	Career opportunities	0,0571	Margins on Sold Products	-0,0562
	Time Advantage	0,0512	Prior Entrepreneur Experience	-0,0439
	Commercially available IT-solution	0,0501	Public Relations	-0,0413
	Stock options and shares	0,0480	Prior Experience in IT-technology	-0,0405
	Online Advertising Communication	0,0457	Network for Access to suppliers and customers	-0,0342
	TV Communication	0,0449	IT-solution tested upfront by customers	-0,0310
	Open source Software or Freeware	0,0434		
	Above average salary	0,0389		
	Attractive price	0,0382		
	IT-solution Influenced by lead-user	0,0329		
< 0,03	Customer Satisfaction	0,0251	Network for Acceptance and References	-0,0288
	Business Model (B2C)	0,0232	Revenue from Online-Advertising	-0,0276
	Commissions	0,0192	Print Communication	-0,0255
	Revenue Fixed fees	0,0120	Technology and Know-how Network	-0,0236
	Hierarchical decision making	0,0096	Created new brand	-0,0214
	Autonomous unit	0,0070	Prior Experience in Finance and Accounting	-0,0150
	Risk Tolerance	0,0029	Interesting Tasks	-0,0115
	One-to-One Marketing	0,0003	Selling brands	-0,0109
			Radio Communication	-0,0107
			Prior Experience in Marketing and Sales	-0,0088
			Continuous education	-0,0078
			Supply of own ideas	-0,0068
			Complaint management	-0,0057

In a similar way Thies and Albers [27] investigated the success of drivers of cooperation strategies between content providers and ecommerce companies.

5 Recommendations on the use of PLS for success factor studies in marketing

On the basis of my critic as well as the description of typical applications of success factor studies (with constructs and indicators) in marketing we can give the following recommendations:

- a) Indicators of success factor studies should be actionable and therefore need to be formative.
- b) Indicators can only be evaluated on grounds of content validity.
- c) The application of SEM estimated by PLS is superior to working with indices and running simple regressions or applying LISREL to indices.
- d) There is no need for second-order constructs.
- e) Rather than reporting significant coefficients, the impact of indicators should be reported (standardized b versus t-values).
- f) Because of structural equations the total impact of exogenous indicators on endogenous indicators should be evaluated by counting all paths.
- g) We need finite mixture programs for the PLS framework for capturing unobserved heterogeneity.

Ad a) With respect to success factor studies we are not so much interested in supporting hypotheses of the type that a construct such as market orientation has a positive impact on business performance. Such a relationship is highly plausible. Valuable information for the business community is only generated if we know the level of impact that the various drivers of market orientation have. The indicators should be actionable which implies that they must be forming a construct and not reflecting.

Ad b) A set of formative indicators should cover all aspects or facets of a construct. Such indicators can therefore not be drawn randomly from a universe of interchangeable indicators. This implies that we cannot apply statistical criteria for the validation of the measurement of a construct. Rather, we can only test content validity by appropriate reasoning [23]. Although some authors [9, 13] have argued that this is unsatisfactory and should be accompanied by appropriate statistical tests Rossiter [23] argues against it. Even the tetrad-test is only a test whether indicators are truly reflective but not a test on the contrary [14].

Ad c) In order to handle formative indices we frequently found in the literature that authors aggregate indicators to indices in order to be able to run LISREL or

simple OLS regressions. This implies that the indices have been aggregated by computing the unweighted mean of all indicators forming a construct. Unfortunately, this has the consequence that one cannot determine the different impact of different indicators as drivers. In addition, equal weights will underestimate the relationship between the construct and a final endogenous construct. Aside of this, current programs like LISREL or AMOS also enable the user to include formative indicators but one can estimate much more parameters with PLS because the degree of freedoms in PLS is determined on the basis of the maximum number of indicators or relationships per construct.

Ad d) In the literature we find the approach of second-order constructs. Its use has become popular because it allows for the operationalization on the basis of aspects or facets (first-order factors forming the second-order factor) and at the same time allows to work with multiple items that reflect a first-order factor and to evaluate its measurement according to the “Cronbach’s α – CFA” paradigm. Unfortunately, a second-order factor can only be handled in SEMs if it is itself reflected by some indicators. One proposal is to use the unweighted sum of all indicators as a reflecting indicator [19]. This practice is questionable because it means that the construct will be explained by just one indicator and thereby not allowing for different weights of the different aspects. It is therefore better, to restrain from using the highly abstract second-order construct and work with all the first-order factors as constructs. This will give richer information on the impact of the various constructs. Even in this case it would be better to work with indicators forming first-order factors because this gives actionable results.

Ad e) The purpose of studies with reflective or formative indicators is different. In the first case, the test of theories has been the dominant research goal of studies. We have seen that a test whether market orientation has a positive impact on business performance provides limited insights because the relationship is highly plausible and the result of a significance test heavily depends on the number of investigated cases or other non-controlled effects. Therefore, we get richer information if we determine the level of impact that different drivers have on business performance. Insofar we advocate that not significance testing is the main purpose of success factor studies but the determination of the parameter levels. To better visualize the different impacts it is proposed to present a table with indicators classified according to different intervals of importance (total effects) and standard errors.

Ad f) In the application it has been proposed to determine not only the direct effect but also the total effect of an indicator on the endogenous construct via all indirect paths. However, the standard errors of the total effect are not given so far by programs like PLS-graph [6]. Rather, one has to determine via simulation what the standard error of the sum of paths with different standard errors per connection in the graph is.

Ad g) In marketing it is observed that regression results are heavily distorted because of heterogeneity across cases. When investigating success and its drivers one has to concede that decision units combine drivers in different ways which makes it impossible to determine just one uniform relationship. Rather, it will be found that at least segments of units (cases) behave in a similar way. It is therefore advisable, to simultaneously determine segments of cases and regression equations per segment. This is done with the help of finite mixture regressions. Unfortunately, there is no program available for PLS that can perform this kind of estimation. So far, only a program FIMIX has been developed that can determine the regression equations once the weights of the various indicators have been determined beforehand [15].

6 Conclusion

Success factor studies in marketing have traditionally been analyzed with the help of an approach that determines not only the structural relationships but also the measurement error of complex constructs. Researchers implied reflective indicators that could be validated and estimated according to the traditional “Cronbach’s α – LISREL” paradigm. Unfortunately, reflective indicators in a structural equation model do not allow for actionable results. Rather, success factors should consider all facets of a construct and be treated as formative indicators. If researchers have worked with facets as indicators but treated them as reflective misspecifications are the result. The item purification process may lead to the deletion of important aspects and the estimation might result in substantial biases.

This article proposes a new paradigm for success factor studies in marketing. In such studies, the significance of highly plausible relationships is no longer of interest. Rather, the differential impact of the various variables in the entire model is of interest. PLS is the most suitable model for such applications allowing for quantifying the total effects of success factors.

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