

Model of effective cost management in the time of corona crisis: a PLS-SEM approach

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ABSTRACT

Companies all over the world are affected by the Corona crisis. It is especially important for companies to keep the key business parameters under control in difficult economic times. This paper allocates the factors that influence cost management effectiveness during the corona crisis. The proposed influence model was evaluated in an empirical study involving Austrian companies and validated with Partial Least Squares - Structural Equation Modelling (PLS-SEM) approach. The results show, that allocated factors have a positive effect on the effectiveness of cost management and explain about half of the variance of the corresponding variable, giving moderate explanatory power to the proposed model. The results demonstrate to what extent the use of cost management tools can be a helpful instrument for crisis management.

CCS CONCEPTS

• **Social and professional topics** → Professional topics; Computing and business; Economic impact; • **Applied computing** → Law, social and behavioral sciences; Economics; • **General and reference** → Cross-computing tools and techniques; Empirical studies.

KEYWORDS

cost management, influencing factors, explanatory model, PLS-SEM

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1 INTRODUCTION

During the time of the Corona crisis, companies from all sectors are affected to differing degrees, some even threatened in their existence, such as the tourism industry. In order to reduce the spread of the coronavirus, extensive political and economic measures were taken.



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With the aim to learn the influence of these measures, an impact model with relevant factors was developed. To check the model a survey instrument was developed, asking participants to evaluate the influence of the allocated factors. This study uses Partial Least Squares - Structural Equation Modelling (PLS-SEM) to validate and evaluate the developed model [1-3]. PLS-SEM approach was originally designed for social and behavioural sciences, but since has gained considerable popularity in business management research [3-5].

The paper is organized as follows. Chapter 2 discusses the methodology of the study. It explains the choice of PLS-SEM and debates the selection of factors and the model design. Chapter 3 evaluates the proposed model. Conclusions and the list of references finalize the paper.

2 METHODOLOGY

2.1 Literature analyses

This part of the study answers the research question “what are the most significant factors, which influence the effectiveness of cost management during the corona crisis?”

Crises as peaks of a dangerous development are nothing new for the economy in general and companies in particular [6] but have a stronger effect on the export-oriented Austrian economy. In Austria, the cumulative loss of gross domestic product (GDP) due to the COVID 19 crisis from March 2020 to February 2022 amounts to 40.2 billion euros compared to 2019 [7].

As business management instruments for strategic crisis prevention, Wöhe et al. [8, p. 87] cite inventories to avoid production and delivery bottlenecks, liquidity to avoid payment bottlenecks and equity to avoid forced liquidations. More operationally oriented, Gleich et al. [9, p. 74] suggest cost management with its extensive “arsenal of instruments and methods ... for crisis prevention and management” due to the impact of crises on turnover. Going beyond the planning, documentation and control tasks [8, p. 631] of past-oriented, classic cost accounting, cost management can be used to actively shape the cost level, structure and development with the cross-functional involvement of employees at different hierarchical levels [10, p. 79-100]. Continuous cost management that is geared to profitability goals in all corporate decisions and activities makes it possible to identify, avoid and subsequently reduce inefficiencies [11, p. 28].

The following areas of application of cost management, including the associated instruments and methods, can be derived from [11, p. 38]:

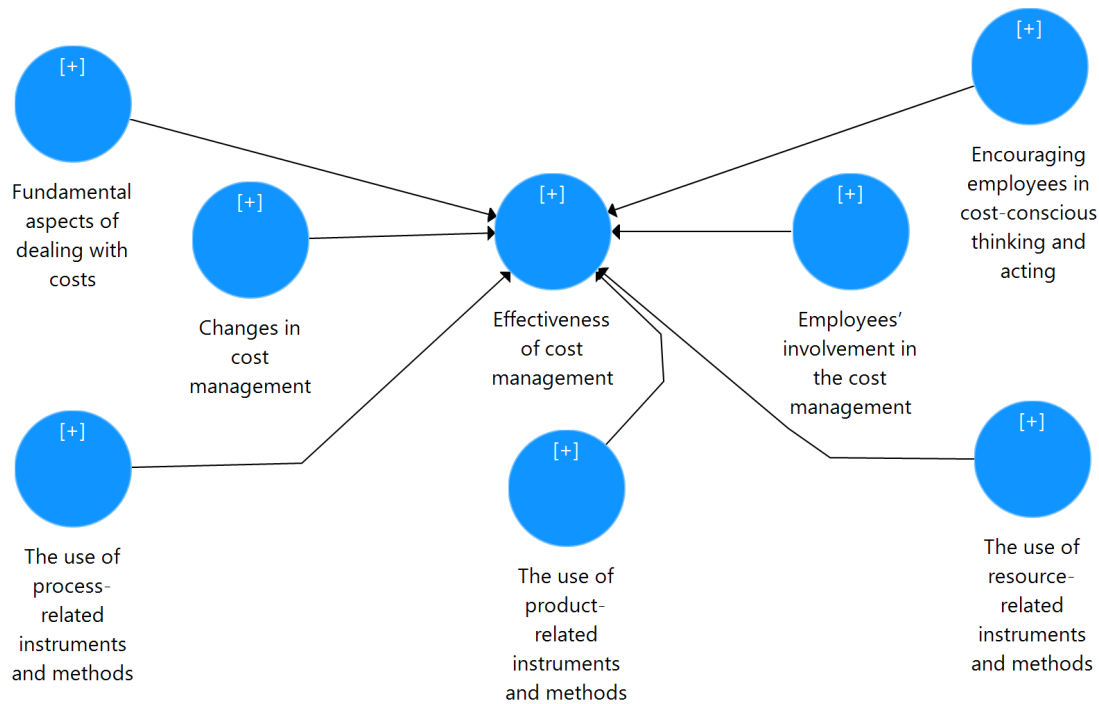


Figure 1: Research model

- Resource level (material, personnel or IT cost management, the total cost of ownership, zero-base budgeting);
- Product level (target costing, multi-level contribution margin accounting or value analysis);
- Process level (activity-based costing, kaizen costing or robotic process automation).

2.2 Model design

Analysis of the literature and various businesses allowed us to allocate seven factors, which influence the effectiveness of cost management during the corona crisis:

1. Taking into account the fundamental aspects of dealing with costs.
2. Changes in cost management.
3. The use of process-related instruments and methods.
4. The use of product-related instruments and methods.
5. The use of resource-related instruments and methods.
6. Employees' involvement in cost management.
7. Encouraging employees in cost-conscious thinking and acting.

Figure 1 shows the proposed research model. Each factor (a latent variable) is represented with a blue sphere. Arrows (paths) between variables correspond to the research hypotheses. They essentially describe whether the allocated factors have a significant positive effect on cost management during the corona crisis.

The hypotheses under investigation are listed below.

- H1. The fundamental aspects of dealing with costs have a positive effect on cost management effectiveness.

- H2. Changes in cost management have a positive effect on cost management effectiveness.
- H3. The use of process-related instruments and methods has a positive effect on cost management effectiveness.
- H4. The use of product-related instruments and methods has a positive effect on cost management effectiveness.
- H5. The use of resource-related instruments and methods has a positive effect on cost management effectiveness.
- H6. Employees' involvement has a positive effect on cost management effectiveness.
- H7. Encouraging cost-conscious thinking and acting have a positive effect on cost management effectiveness.

2.3 Choice of PLS-SEM

Partial Least Squares - Structural Equation Modelling (PLS-SEM) [1-3] was chosen to test the proposed research model. PLS-SEM is a multivariate statistical method allowing to analyse of the relationships of multiple variables simultaneously. SEM allows researchers to consider unobservable (latent) variables which are measured indirectly using indicator variables. These latent variables can be, for example, abstract concepts like "encouraging employees cost-conscious thinking" which cannot be assessed directly. Instead, a set of indicators are measured, which in turn are used to estimate the unobservable variables. Appendix A contains a list of indicators, formulated as survey questions.

Relations (paths) between latent variables are hypothesised, resulting in the structural model. PLS-SEM approximates the path model relationships, to maximize the coefficient of determination R^2 of each endogenous construct. According to Hair et al. [1], it is

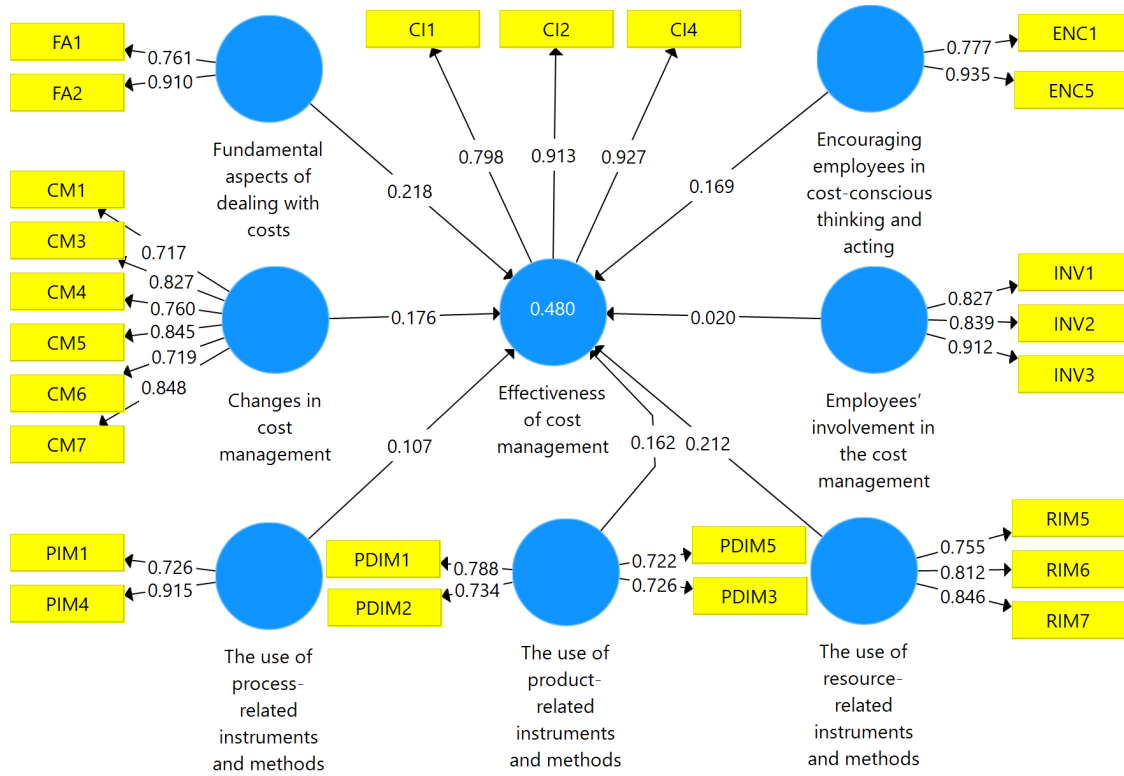


Figure 2: Result of PLS-SEM algorithm

a reason why PLS-SEM is a viable method for theory development, i.e. prediction of constructs.

PLS-SEM has a higher chance of discovering significant effects in comparison to factor-based SEM. PLS-SEM is applicable when the underlying theory is not thoroughly developed compared to its alternatives [12]. Important is that PLS-SEM makes no distributional assumptions and is a non-parametric method. PLS-SEM also handles small sample sizes and still reaches high levels of statistical power without identification issues.

2.4 Empirical study

The data collection took place from April 04 to May 6, 2021. A total of 72 Austrian companies, mainly executives and experts from the finance and controlling area, took part in the study. Data gathering was conducted by the means of an empirical study (online survey). A five-point Likert scale, with the categories of strongly disagree (1), disagree (2), neutral (3), agree (4), and strongly agree (5) was used to evaluate the items. Figure 2 shows the latent variables (constructs) and corresponding indicators. Appendix A contains matching the items formulations of questions.

The proposed model goes through several rounds of validation. In the final model, only those items were selected, which have a particularly strong effect on the allocated factors.

3 EVALUATION OF THE PROPOSED MODEL

Smart PLS tool of version 3.3.2 was used to perform the computations. Figure 2 represents the results of the application of the PLS-SEM algorithm.

3.1 Measurement model evaluation

The first step of PLS-SEM analysis is assessing the measurement model, which includes the examination of the convergent validity, the internal consistency reliability, and composite reliability.

Indicator reliability describes the relationship between the latent variables and their measures. As a part of the convergent validity test, the items loading must be above the value of 0.7 to indicate a reliable measure for a specific construct. Figure 3 shows that all outer loadings in the study exceed the threshold value, so convergent validity is established.

Composite reliability (CR) takes into consideration the varying factor loadings of the items. Acceptable values of CR are generally considered 0.7 and above.

The average variance extracted (AVE) is an indicator of convergent validity that measures the amount of variance that is captured by a construct vs the amount of variance due to measurement error. Generally, AVE of at least 0.5 or higher is demanded, otherwise, a variance of the error is more than the variance explained, which is considered unacceptable. Following Figure 4, the convergent validity criterion is established.

	Changes in cost ...	Effectiveness of cost ...	Employees' involvement...	Encouraging employees...	Fundamental aspects ...	The use of process...	The use of product...	The use of resource...
CI1		0.798						
CI2		0.913						
CI4		0.927						
CM1	0.717							
CM3	0.827							
CM4	0.760							
CM5	0.845							
CM6	0.719							
CM7	0.848							
ENC1				0.777				
ENC5				0.935				
FA1					0.761			
FA2					0.910			
INV1			0.827					
INV2			0.839					
INV3			0.912					
PDIM1							0.788	
PDIM2							0.734	
PDIM3							0.726	
PDIM5							0.722	
PIM1						0.726		
PIM4						0.915		
RIM5								0.755
RIM6								0.812
RIM7								0.846

Figure 3: Outer loadings

	Composite Reliability	Average Variance Extracted (AVE)
Changes in cost management	0.907	0.621
Effectiveness of cost management	0.912	0.777
Employees' involvement in the cost management	0.895	0.740
Encouraging employees in cost-conscious thinking and acting	0.849	0.739
Fundamental aspects of dealing with costs	0.825	0.704
The use of process-related instruments and methods	0.809	0.683
The use of product-related instruments and methods	0.831	0.552
The use of resource-related instruments and methods	0.847	0.648

Figure 4: Constructs reliability and validity

3.2 Structural Model Evaluation

• Path Model Coefficients

Path model coefficients portray the hypothesized relationships between the allocated factors (latent variables).

The values lie between +1 and -1, where plus indicates a positive relationship and minus a negative relationship. The closer the values are to 1, the stronger the relationship.

In the proposed model, “Fundamental aspects of dealing with costs” and “Use the resource-related instruments and methods” have the strongest effect on cost management effectiveness (0.218 and 0.212 correspondingly), followed by “Changes in cost management” (0.176), “Encouraging employees in cost-conscious thinking and

acting” (0.169) and “The use of product-related instruments and methods” (0.162).

• Coefficient of Determination

The coefficient of determination R^2 is a measure to establish the variance explained for every endogenous construct. In other words, it is a measure of the model's explanatory power [10;11]. R^2 values lie between 0 and 1, where higher numbers indicate higher explanatory power. In general, values of 0.75, 0.50 and 0.25 for endogenous constructs fall under the categories of substantial, moderate and weak power respectively [12].

The proposed model has one endogenous latent variable – “Cost management effectiveness”, with R^2 being 0.480. Thus, the allocated factors explain 48% of the variance of “Cost management

effectiveness”, giving moderate explanatory power to the proposed model.

4 CONCLUSION

In times of the Corona crisis, methods and tools of cost management are important factors to improve the cost situation in business companies. The paper develops a model that explains the influence of such factors on the effectiveness of cost management of the companies. The proposed model was evaluated in an empirical study, which involved 72 Austrian companies. The allocated factors explain 48% of the variance of the “Cost management effectiveness” variable, giving moderate explanatory power to the proposed model. PLS-SEM shows that “Fundamental aspects of dealing with costs” and “Use the resource-related instruments and methods” have the strongest effect on the effectiveness of cost management.

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A SURVEY

A.1 Cost management effectiveness (CI)

CI1. We have managed to continuously reduce our costs in relation to our sales

CI2. We have continuously increased our cost-effectiveness

CI4. In terms of our cost-effectiveness, we have managed to continuously improve

A.2 Fundamental aspects of dealing with costs (FA)

FA1. We control costs in precisely defined periodic cycles

FA2. Our management reacts immediately to a deterioration in the cost situation

A.3 Changes in the cost management (CM)

CM1. The corona crisis triggered the overall optimization of our cost management

CM3. Due to the Corona crisis, we have improved the reporting system and the necessary key figures as part of the cost management

CM4. Due to the Corona crisis, we have introduced new methods and instruments for cost management

CM5. The previous methods and instruments were further developed based on the experience of the Corona crisis

CM6. Our top management and our executives have been acting much more cost-consciously since the Corona crisis

CM7. Our employees have become much more cost-conscious since the Corona crisis

A.4 Encouraging cost-conscious thinking and acting (ENC)

ENC1. The values and norms in our company encourage cost-conscious thinking and acting

ENC5. We communicate very strongly within the company (e.g. principles, guidelines, newsletters, circulars) on cost-relevant issues

A.5 Use the resource-related instruments and methods (RIM)

RIM5. Cost benchmarking with a focus on resources

RIM6. Life cycle costing for resources

RIM7. The total cost of ownership

A.6 Use the process-related instruments and methods (PIM)

PIM1. Activity-Based Costing

PIM4. Kaizen Costing

A.7 Use the product-related instruments and methods (PDIM)

PDIM1. (Product) Life Cycle Costing

PDIM2. Target Costing

PDIM3. Cost Benchmarking with a product focus

PDIM5. Value analysis

A.8 Employees' involvement (INV)

INV1. The employees are informed about the necessity of the measures

INV2. Employees understand the need for action

INV3. The employees actively participate in the design of the processes