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Towards a reference model for online research maps

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SUCCESS FACTOR VALIDATION FOR GLOBAL ERP PROGRAMMES

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The success of current global enterprise resource planning (ERP) programmes depends on a wider range of factors than encountered in previous ERP efforts. Therefore, a better understanding of how these factors contribute to the effectiveness of ERP will aid programme development. To this end, the validity of twelve success factors with two to seven associated management actions derived by prior research was verified by a survey evaluated with structural equation modelling (SEM) based on the partial least squares (PLS) algorithm. This study was able to verify all twelve success factors and more than 80% of the associated management actions. The results form a predictive model of success probability of global ERP programmes.

Keywords: CSF, ERP, global, SEM, PLS, predictive model, success factors.

1 INTRODUCTION

The number of companies operating globally is constantly increasing. This expansion applies to large corporations as well as small and medium-size enterprises. In order for these companies to operate globally, they require a global view of processes and their implementation in global enterprise resource planning (ERP) systems. These ERP systems allow to integrate an organization's information sources and to harmonize its processes across multiple sites and countries. Most ERP systems are based on software packages from companies like SAP or Oracle. ERP implementations are generally cost intensive and have a duration of many months or years.

But, not all global ERP programmes are successfully implemented. Some implementation projects fail in terms of classical project tracking, e.g. slippage of roll-out dates, budget overruns or missed scope objectives, while others fail more severely in their business impact, e.g. intended business benefits are not achieved including process standardization, process automation and asset carrying cost reduction. A report on ERP implementations in companies with more than $500 million in revenues indicated an average schedule overrun of 230%, an average budget overrun of 178% and an average slide of functional improvements of 59% (Buckhout *et al.*, 1999, p. 61).

To reduce the number of failed ERP programs, their general success factors have been investigated but reports of these are not sufficiently comprehensive for global programmes as multi-national operations generate aspects that need to be addressed for success. To generate a better understanding of how these success factors contribute to the efficiency and effectiveness of ERP and to aid programme development the validity of twelve success factors with two to seven associated management actions derived by prior research was verified by a survey evaluated with structural equation modelling (SEM) based on the partial least squares (PLS) algorithm.

This study was able to verify all twelve success factors and more than 80% of the associated management actions. The results form a predictive model of success probability of global ERP programmes. Use of this model may aid companies in developing effective global ERP programmes.

2 BACKGROUND

Many companies of various sizes must decide the extent and means by which to support worldwide activities through globally-harmonized processes and systems. An example of a typical global ERP implementation based on a case study is extensively described in the literature by Sankar & Rau (2006). A detailed review of whether to implement an ERP system, categorization of the types of benefits to be expected and the guidelines in selection of ERP consultants, software and hardware vendors can be found in Davenport (2000).

One way to face this decision is to use a technical approach based on templates; this approach was defined about a decade ago. Huber *et al.* (2000) defined a template as "concepts or models for the standardization of processes, functions, and data that could be implemented in a physical (ERP) system (Huber *et al.*, 2000, p. 4)" and further defines a concept for standardization of company-wide ERP systems.

Necessary requirements to implement global ERP systems are investigated in Davidenkoff & Werner (2008). In particular the legal requirements, customs and user requests, but as well challenges in languages, address versions and time zones are reviewed (Davidenkoff & Werner, 2008, p. 37ff).

In general, Critical Success Factors (CSF) for implementing ERP programmes have been broadly analysed in the literature. Early investigation of CSF as Holland & Light (2003) were based on general case studies. Later Nah *et al.* (2001), Somers & Nelson (2001) and Al-Mashari *et al.* (2003)

investigated CSF for the different phases of ERP programmes. While recent studies investigated CSF for specific settings as e.g. industry and size (Soja & Put, 2007), no comprehensive investigation of CSF for global ERP programmes was identified from literature.

Aspects of change management are always part of ERP implementations and have been investigated repeatedly. For example, Hossain *et al.* (2002) propagates the use of the "myth of integration", i.e. the vision of an integrated enterprise as the driver for change (Hossain *et al.*, 2002, p. 17ff). While the CSF list in the literature is extensive, it generally does not consider multi-national aspects of ERP implementation. However, a few papers have been dedicated to this subject. Huang & Palvia (2001) introduce a research framework to compare ERP deployment in developed and developing countries (Huang & Palvia, 2001). Multi-national ERP implementation practices were shown to be affected by national differences, identified as culture and language, government/corporate politics, management style, government regulations, time zone and labour skills (Sheu *et al.*, 2003). The relationship between ERP implementation and a firm's competitive strategy has also been investigated and national culture and government/corporate policies, in particular, were found to have a significant impact on ERP deployment (Yen & Sheu, 2004).

3 HYPOTHESIS

A series of expert interviews conducted in prior research and an extensive review of CSF literature has led to a definition of success of global ERP programmes and a number of common and site specific success factors (Seidel, 2009). In total 13 interviews were conduced with CIOs and project managers of multi-national ERP programmes defined as covering more than one language area. Content validity was ensured by using a theory based interview guide and inclusion of CSF only if cited without contradiction by multiple interviewees. These success factors and associated management actions and their impact on success as defined below are the hypothesis to be verified in this research.

3.1 Definitions of Success

Success of a global ERP programme is two-fold. On one hand the impact of the resulting Information System on the organisation is of interest. On the other hand the execution of the global ERP programme is of interest as a measure of efficiency. The former is named 'Programme Objectives', the latter 'Project Objectives' in this research.

The programme objectives are either clearly quantifiable 'Savings' in terms of IT costs, process costs or directly associated reductions to specific business expenditures such as stock-carrying costs. On the other hand, a number of indirectly quantifiable long-term business benefits are possible benefits such as risk reduction, auditability, adherence to standards and improved competitiveness. These are company-specific and are grouped under the heading 'Business Improvements'. Therefore the variable 'Programme Objectives' is hypothesized to be defined by 'Business Improvements' and 'Savings'.

The importance of the project objectives varies from programme to programme. Generally an on-time introduction is considered important, as it is highly visible in the organization and directly drives costs. On the other hand, the traditional trade-off between scope and time is always imminent. While in-budget programme completion is desirable, many programmes have multiple budget revisions due to the long timeframe of implementation and the constantly changing conditions during the roll-outs. While in-scope has many company-specific definitions, one common theme was the avoidance of business interruptions during go-live, and functioning maintenance and support. Therefore the variable 'Project Objectives' is defined by 'On-Time', 'In-Budget' and 'In-Scope'.

3.2 Common Success and Endangerment Factors

A number of success and endangerment factors are common to all ERP programmes and influence the programme outcomes of each site. Each factor has a number of management actions associated which drive the respective success factor. All of these success factors and management actions were verified by expert interviews in prior research. The list of these indicators to be verified in this research can be found in Table 1.

CSF	Description	Management Actions
Change Management Approach	Company has an effective approach to handle the organizational changes induced by the ERP roll-out.	• Change management is local • Change management is formal • Vision established for new business models • Communication is effective • End-to-end view trained • Technical and organizational concepts are aligned
Management Attention	All levels of management have been aligned towards the ERP programme.	• Top management sponsorship established and • engaged throughout life cycle • Middle management buy-in generated
Funding Model	Funding model chosen supports efficient and effective ERP implementation.	• Aligned to programme approach • Generates incentive for roll-out • Generates cost-effective requirements • Ensures efficient project operation
Human Resources	Human resources are adequately provided to the ERP programme to fulfil its tasks.	• Top process skills available • Intercultural know-how available • Joined business and IT, global and local teams • Team stability is ensured • Team can interact face-to-face • Team is full-time • External resources are well managed
Governance Model	A stringent governance model is established to manage the ERP programme.	• Efficient scope change management • Governance board to handle mgmt. effectively • Programme management established • Stable objectives • Plans sustain of global ERP
Method Selection	Selection and execution of a method for design, deployment and localization.	• Follows a method consistently • Blueprint is comprehensive • Method is made company specific
Tools	Early deployment of suitable tools.	• Selected early • Suitable to drive efficiency
Technical Factors	All technical challenges are addressed.	• Technical challenges are addressed • Compliance, data conversion, master data, security, unicode, availability, time zones, translation, infrastructure

Table 1. Common success factors

3.3 Site-specific Success and Endangerment Factors

A number of success and endangerment factors are site-specific. These influence the programme outcomes for each site individually and must be aggregated over all sites to estimate their impact on the overall programme. Each factor has a number of management actions or indicators associated which drive the respective success factor. All of these success factors and management actions /

indicators were verified by expert interviews in prior research. Table 2 summarizes the site-specific factors to be verified in this research.

CSF	Description	Management Actions
Market and Business Cultures	Impact of the local market and business culture has been handled adequately.	• Local process requirements addressed • Intercultural work aspect handled
Unwillingness to Change	Initial level of resistance to a change of the site and the measures addressing it.	• Initial level is low • Handled adequately
Inability to Change	Limitations in the ability of people to embrace the changes.	• Language abilities • Innovation potential • Inflexibility
Necessary preconditions	Site is suitable for a roll-out.	• Suitable size & business model • Technology life cycle • Resource availability

Table 2. Site-specific success factors

4 RESEARCH APPROACH

The research conducted prior has led to the generation of twelve success factors for global ERP programmes. These factors were derived from the *opinions* of experts captured in interviews. For each success factor a number of management actions to drive each success factor were identified.

The current research step described here now brings the success factors to another level of certainty and operationalisation. It proves the validity of the success factors as valid drivers of overall ERP programme success as defined in the preceding section based on the actual outcome of a statistically relevant number of ERP programmes, focussing on *outcomes* rather than *opinions*. In addition it generates relative weighting of the success factors and the management actions driving them. This will enable a forecast of the ERP programme success based on the implementation of the relevant management actions in early set-up and blueprint phases of global ERP programmes.

4.1 Research Method

The structure to be verified with SEM was generated from the results of the qualitative research conducted prior. This is an acceptable approach according to Skrondal & Rabe-Hesketh (2004): "Instead of defining hypothetical constructs on theoretical grounds, they are sometimes 'derived' from an exploratory analysis (Skrondal & Rabe-Hesketh, 2004, p.5)". Albers (2007) states that "selecting the relevant factors [...] should be done on the basis of expert interviews and a thorough literature review (Albers, 2007, p.9)". While the analysis which has lead to the model is based on expert *opinions*, this research step focusses on the situation of actual programme *outcomes* and therefore verifies the model beyond the distortion of opinions.

There will be a number of variables which cannot be directly observed or measured – so called hypothetical constructs of latent variables. This is either because the variable is unobservable by nature (one example is 'Unwillingness to Change' as a collective attitude, which cannot be measured directly) or has not reached the final state which the model intends to predict (one example is 'Programme Objectives' which eventually can be measured but shall be predicted in early stages of the ERP programme). For these latent variables a measurement model has to be specified which defines "the relationship between latent variables and suitable indicators, which allow to measure the latent variables indirectly (Backhaus, 2006, p. 11, translation of the author)".

While the factors related to 'Programme Objective' and 'Project Objectives' are elements which describe the underlying latent variables, the causal relationship is different for the critical success factors. By the design of capturing these factors they are described as elements which can be used to change (i.e. to cause) the latent variables of the twelve success factors. This is often the case in success factor research as was pointed out by Albers & Hildebrandt (2006). Therefore the success factors are formative indicators and the ERP programme outcomes are reflective indicators. This assertion was verified by a list of criteria stipulated by Fassott (2006).

In Herrmann *et al.* (2006) variance and covariance based SEM approaches are contrasted. While the covariance based approaches result in a model structure to minimize covariance error terms, the variance based approaches aim for an optimal reproduction of the real data structure, i.e. the indicator values. As one of the goals of the SEM based verification is to generate a quantifiable prediction, a variance based approach was chosen in this research.

Based on the software review by Temme *et al.* (2006) the software SmartPLS version 2.0.M3 (Ringle *et al.* 2005) was chosen to conduct the analysis. The software is platform independent and without license fees. It supports graphical modelling, the bootstrapping procedure to generate significance measures, and different handling approaches for missing data.

4.2 Data Gathering

The development of the questionnaire was directly based upon the qualitative research conducted in prior research. In particular for each success and endangerment factor a number of management actions driving them were defined (see Table 1 and Table 2) which were asked individually in the questionnaire grouped by the respective success factor. The questionnaire can be found under http://www.gunter-seidel.de/phd/questionnaire_DSAG.pdf. Design guidelines to avoid common method bias as outlined in Podsakoff *et al.* (2003) were considered in the questionnaire design, but practical limitations of survey administration as 5 point likert scale, anonymous data collection, and non-availability of secondary sources limited their applicability. In particular the anonymity of respondents did not allow to assess whether they possess a complete picture of the EPR programme they assessed. Instrument validation as demanded by Straub (1989) was partially ensured by the development of the questionnaire based on expert interview guides and peer review, but no multitrait-multimethod comparison (comparing multiple measures of the same research subject gathered by different methods) nor pilots of the survey were conducted.

The chosen Likert scale interval data do generally violate the normality assumption. The degree of impact under different estimation methods was investigated by Muthén & Kaplan (1985) with the conclusion that “it is therefore reassuring to find that these normal theory estimators perform quite well even with ordered categorical and moderately skewed/kurtotic variables (Muthén & Kaplan, 1985 p. 187)”. In particular PLS is very robust against non-normal data.

For the *sample size* the recommendation for PLS based analysis as indicated by Ringle (2004) is the highest number of paths leading to any latent variable times ten (Ringle, 2004, p. 16) – in case of the final model this implies 80 data points. As PLS is considered robust against small sample size (Chin & Newsted, 1999) a number below the theoretical optimum stipulated was deemed acceptable.

The *target for the survey* was the DSAG (Deutschsprachige SAP Anwender Gruppe), an organisation with 2000 member companies of which more that 400 are subscribed to the globalization group. The survey was administered in a period of three months with multiple reiterations to address potential participants. It resulted in 67 admissible data sets (data sets with incomplete outcome indicators and two test data sets entered by the researcher were excluded). Although the intended sample size had not been reached, the analysis was conducted with the available data in full understanding of the limitations of applicability resulting hereof.

There are a number of *missing observations* for success indicators in the data set. A visual inspection of the data set resulted in the assertion of data missing at random (MAR). Therefore a number of

approaches could be used to handle the missing data set (Byrne, 2001, p. 289ff) as casewise or listwise deletion or imputation of the missing data via means, regression or pattern matching. The approach of mean replacement was eventually chosen as a method supported by the analysis tool which does not decimate the number of cases further.

The data was analysed regarding *kurtosis and skewness* with the help of SPSS 16. The kurtosis of the indicators is between -1 and +3 with an average of 0; skewness is between -2 and +.5 with an average of -.6. These values are generally not considered extreme skewness or kurtosis, nonetheless it would have distorted the covariance based SEM approach which relies on normal distribution – fortunately the same does not apply for the chosen PLS approach.

Non-response bias was analysed by comparing the responses received until one week before end of the initial response period, and further responses received thereafter including based on reiterated requests and extended periods. In particular the design choices of the programmes as centralization, process standardization and adherence to package standards as being the closest to demographic data were compared for these groups. Deviations between both groups were within single digit percentages indicating limited non-response bias. Due to the limited sample size a full PLS model comparison of both groups were not conducted as results were deemed not statistically relevant.

The extent of *common method bias* was assessed using Harman's single-factor test according to Podsakoff *et al.* (2003). All variables of the study were loaded into a principal component factor analysis and the unrotated factor solution examined. Although one factor accounted for 28% of the total variance, it was not concluded that neither "(a) a single factor [did] emerge from the factor analysis [n]or (b) one general factor [did] account for the majority of the covariance among the measures (Podsakoff *et al.*, 2003, p. 889)". Therefore no significant common method bias was corrected for in the remainder of the analysis.

5 RESULTS

Henseler *et al.* (2008) provides a general structure for validity analysis. It recommends to check for reflective and formative measurement portions according to different procedures and subsequently for the validity of the structural portion. PLS based analyses does not generate any overall goodness-of-fit measures similar to covariance based SEM outlined in Hu & Bentler (1999).

For the reflective measurement models of the endogenous variables 'Programme Objectives' and 'Project Objectives' the size of the load is one criteria to be used to assess *indicator reliability*. According to Hulland (1999) "items with loadings of 0.7 or more, which implies that there is more shared variance between the construct and its measure than error variance (Hulland, 1999, p.198)" should be accepted. Given the factor loads in the range of 0.708 to 0.921 for the reflective measurement variables the model fulfils this requirement.

Composite Reliability (for the reflective measurement models) can be assessed with Dillon-Goldsteins Rho with a suggested value of higher than 0.7 as benchmark for modest composite reliability. It replaces Cronbach's alpha used in regression as "in comparison to Cronbach's alpha, this measure does not assume tau-equivalency among the measure with its assumption that all indicators are equally weighted (Chin, 1998, p. 320)". Both 'Project Objectives' and 'Programme Objectives' do fulfil the requirement with a value of 0.910 and 0.803 respectively.

Convergence validity (for the reflective measurement models) can be assessed by a value of the Average Variance Extracted (AVE), which should be higher than 0.5 (Fornell-Larcker-Criteria). Again, 'Project Objectives' and 'Programme Objectives' do fulfil the requirement with a value of 0.772 and 0.675 respectively.

	Change Management Approach	Funding Model	Governance Model	Human Resources	Inability to Change	Management Attention	Market & Business Cultures	Method Selection	Necessary Preconditions	Programme Objectives	Project Objectives	Technical Factors	Tools	Unwillingness to Change
Change Management Approach	n/a													
Funding Model	0.500	n/a												
Governance Model	0.476	0.518	n/a											
Human Resources	0.510	0.486	0.667	n/a										
Inability to Change	0.096	0.235	0.196	0.298	n/a									
Management Attention	0.540	0.527	0.499	0.580	0.202	n/a								
Market & Business Cultures	0.308	0.330	0.558	0.751	0.389	0.344	n/a							
Method Selection	0.437	0.376	0.663	0.476	0.049	0.424	0.446	n/a						
Necessary Preconditions	-.047	0.186	0.323	0.380	0.433	0.167	0.474	0.285	n/a					
Programme Objectives	*0.459*	*0.486*	*0.483*	*0.496*	*0.248*	*0.454*	*0.310*	*0.439*	*0.324*	*0.822*				
Project Objectives	*0.425*	*0.375*	*0.555*	*0.579*	*0.401*	*0.344*	*0.534*	*0.389*	*0.154*	*0.261*	*0.878*			
Technical Factors	0.478	0.414	0.429	0.447	0.344	0.387	0.463	0.217	0.264	*0.360*	*0.468*	n/a		
Tools	0.511	0.408	0.545	0.433	0.192	0.344	0.415	0.702	0.289	*0.396*	*0.468*	0.374	n/a	
Unwillingness to Change	0.361	0.293	0.400	0.521	0.364	0.269	0.474	0.171	0.163	*0.209*	*0.473*	0.299	0.139	n/a

Table 3. Root of AVE larger than correlation

Discriminant validity (for the reflective measurement models) can be shown when the root of Average Variance Extracted (AVE) is larger than the correlation to any other latent variable. In case of the reflective measurement models 'Project Objectives' and 'Programme Objectives' this can be confirmed as indicated in Table 3. On the diagonal of the matrix the square root of AVE for the reflective measurement models are shown, below the diagonal are the correlations. The square root of AVE is larger than the correlation in the respective column and row for both 'Project Objectives' and 'Programme Objectives'.

	Change Management Approach	Funding Model	Governance Model	Human Resources	Inability to Change	Management Attention	Market & Business Cultures	Method Selection	Necessary Preconditions	Programme Objectives	Project Objectives	Technical Factors	Tools	Unwillingness to Change
BI	0.44	0.43	0.57	0.47	0.2	0.44	0.34	0.49	0.36	0.92	0.27	0.37	0.44	0.18
IB	0.31	0.3	0.48	0.45	0.26	0.22	0.44	0.26	0.09	0.17	0.88	0.42	0.35	0.36
IS	0.47	0.42	0.52	0.63	0.47	0.4	0.54	0.39	0.25	0.29	0.89	0.46	0.48	0.58
OT	0.29	0.24	0.45	0.39	0.28	0.25	0.4	0.35	0.02	0.21	0.86	0.33	0.37	0.23
S	0.3	0.38	0.12	0.32	0.22	0.28	0.13	0.16	0.12	0.71	0.13	0.19	0.14	0.16

Table 4. Cross loadings – row with formative indicators were excluded due to space constrains as measure for discriminant validity is only applicable for reflective indicators

Another measure for discriminant validity is the cross loading of indicators assigned to the reflective measurement model variable against any other latent variable. For the indicators 'Business

Improvement' (BI) and 'Savings' (S) as well as for the indicators 'On-Time' (OT), 'In-Scope' (IS), and 'In-Budget' (IB) the highest load is on 'Programme Objectives' and 'Project Objectives' respectively as can be seen in Table 4.

For the formative measurement portion of the success factors the "examinations of correlations or internal consistency have been argued as inappropriate and illogical (Chin, 1998, p. 306)". To rely on the path estimates it is recommended to analyse the data regarding multicollinearity indicated by the variance inflation factor (VIF). As Albers (2007) indicates that "intercorrelated factors do not imply indicators reflecting a construct but are rather the result of applying certain holistic strategies in practice (Albers, 2007, p. 10)". Therefore they are not due to be removed for unidimensionality reasons, but rather as they generate unstable results in the signs and size of the weights. With the help of SPSS 16 a multiple regression was run for each group of indicators belonging to a formative measurement against an arbitrarily chosen indicator of an endogenous variable. The analysis resulted in VIF generally below 2, which does not give raise to serious concerns regarding multicollinearity as level of concerns are stipulated to be above 10 (Henseler *et al.*, 2008, p. 25).

No review of absolute size of loads and t-test were conducted, as these elements were confirmed in the prior qualitative research and only the load onto the objectives were of interest. Albers & Hildebrandt (2006) strongly objects to model changes based on pure statistical criteria, as the causal relationship was established prior and remains even in case of small quantifications. Only loads which signs were in contradiction to the prior established direction of causality were excluded.

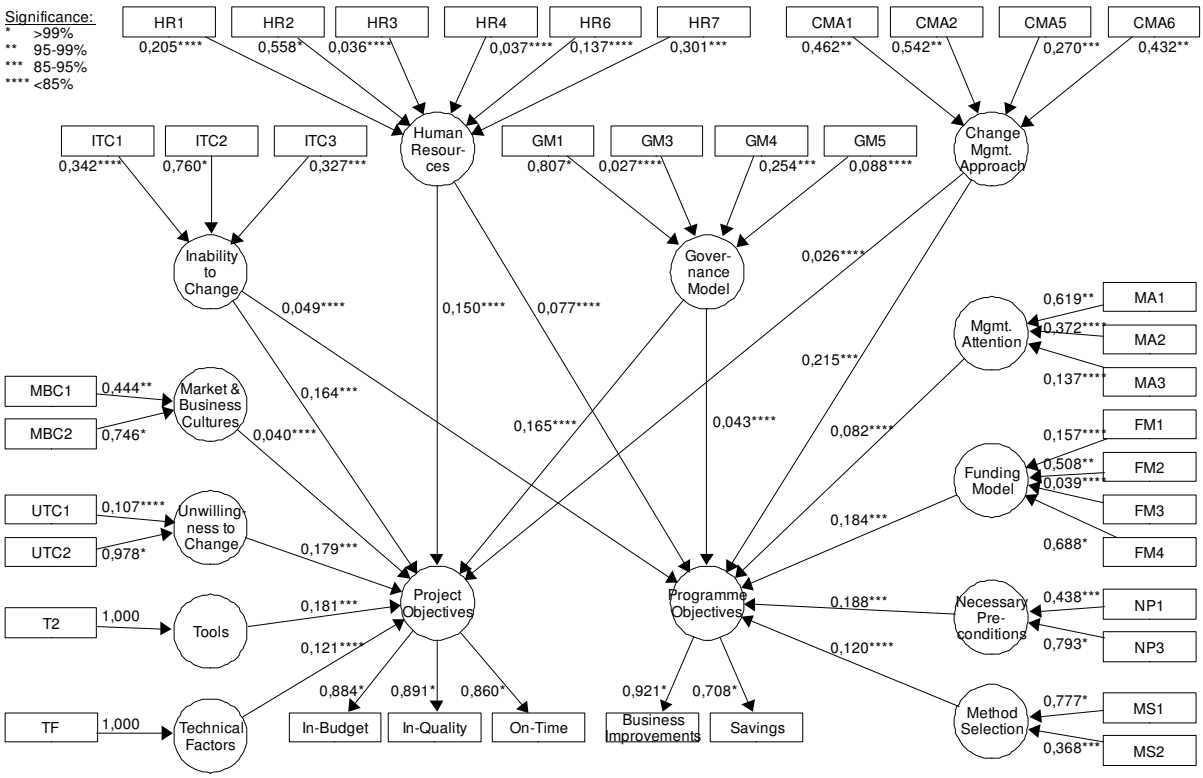

Figure 1. Revised critical success factor model

Having established the validity of the measures scales the validity of the structural portion to explain the success is of interest next. As for the PLS algorithm no model improvement process is established similar to covariance based SEM the review based on path coefficients was proposed by Henseler *et al.* (2008): "Structural paths, whose sign is in keeping with a priori postulated algebraic signs, provide

a partial empirical validation of the theoretically assumed relationships between latent variables. Paths that possess an algebraic sign contrary to expectations do not support the a priori formed hypotheses (Henseler *et al.*, 2008, p. 26f)". Therefore from an initial n:m (many-to-many) relationship relating all success factors to both success variables 'Project Objectives' and 'Programme Objectives' all paths with a negative loading were removed to come to the final model outlined in Figure 1. The reported values are the weights for the formative measurement, the loadings for the reflective measurements, and the path coefficients for the inner model.

The measurements to be reviewed follow the logic of multiple regression. First the degree to which the model is able to explain the data set is defined by the R^2 value. The value of 0.503 and 0.410 for 'Project Objectives' and 'Programme Objectives' respectively define that about half of the success can be explained by the model, while the other half is driven by factors not captured in the defined success factors. Chin (1998) describes an R^2 of .67 as "substantial", and R^2 of .35 as "moderate", and an R^2 of .19 as "weak" (Chin, 1998, p. 323). Others define an R^2 of at least 50% as desirable, as it explains more than it does not explain. While a better R^2 would clearly be desirable, already a moderate explanation of the success of global ERP programmes can be considered an addition to the understanding of these programmes.

All prior tests were focussed on the model itself in regard to the data sample. To ensure that the model represents the population requires to assess confidence levels of the relationships. As PLS does not rely on distributional assumptions as covariance based SEM does, no implications can be made based on it. Therefore a distribution has to be generated based on the bootstrap procedure. This procedure generates a number of random samples of same size drawn from the main sample with replacement and calculates the model. The distribution of each path loading can be assessed by the students t-test. According to Albers (2007) "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 (Albers, 2007, p.15)". Therefore the significance levels have been added to Figure 1.

While the figure shows that all indicators to the reflective measurement model are of a confidence of above 99%, some of the indicators to the formative measurements are even below the 85% confidence. Nonetheless as stated by Henseler *et al.* (2008) "the researcher should keep both significant and insignificant formative indicators in the measurement model as long as this is conceptually justified (Henseler *et al.*, 2008, p. 25)". Given the source of the success factors (expert interviews) none of the factors were removed due to confidence considerations. On the other hand for the paths with lower confidence a substantial relationship remains to be verified. Therefore a review based on a larger data set would be desirable.

In addition based on the weights in Figure 1 a relative impact of each management action to the success factor and a relative impact of each success factor to either 'Project Objectives' or 'Programme Objectives' or both was established. The results can be used for predictive purposes when the implementation or intention of a management action can be gathered. To apply the weights on unstandardised raw scores the effect of standardisation must be reversed. SmartPLS offers the output of index values for the measurement model which are unstandardised and sum to 1 for each CSF (personal communication via SmartPLS forum, Diógenes de Souza Bido, Universidade Presbiteriana Mackenzie, Sao Paulo, Brasil). Building a sum of each index value multiplied by the path coefficient to 'Project Objective' or 'Programme Objectives' leads to an overall impact factor for each management action.

6 CONCLUSIONS AND DIRECTIONS FOR FUTURE RESEARCH

While the model derived from this research fits the data reasonable well, it should always be noted that any "model - regardless of how well it fits the data - remains only one possible means of its [the data's]

description and explanation (Raykov & Penev, 2001 p. 298)". A replicated analysis therefore should always start again with a full many-to-many relationship of all success factors to both 'Programme Objectives' and 'Project Objectives'.

The data set gathered allowed to verify a positive impact of 34 of the initially gathered 41 management actions to drive success of the global ERP programmes (which does not imply the other must be rejected, rather that the limited sample does not allow to verify them). The positive impact of each of the twelve success factors to either 'Project Objectives' or 'Programme Objectives' or both could be verified, although not always generalized to the whole population due to insufficient significance levels. These factors jointly allow to explain about half of the success of global ERP programmes.

Future research to improve the extent of success prediction could take into consideration the lifecycle of the ERP programme, design choices of the programme as mediating factors, a more detailed analysis of the dependent variable of success, or a replication of the survey in a different national culture to compare the impact of management cultures.

To allow prediction of success of global ERP programmes the individual contribution of each management action to either 'Programme Objectives' or 'Project Objectives' or both was established. This will allow to forecast the success probability of a global ERP programme once the implementation of the respective management actions has been decided in an early set-up or blueprint phase of the programme.

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