

# PROCESS-BASED ORGANIZATION DESIGN AND HOSPITAL EFFICIENCY

Antonio Vera and Ludwig Kuntz

## ABSTRACT

*Background.* The central idea of process-based organization design is that organizing a firm around core business processes leads to cost reductions and quality improvements.

*Purposes.* We investigate theoretically and empirically whether the implementation of a process-based organization design is advisable in hospitals.

*Methodology.* The data comes from a database compiled by the Statistical Office of the German federal state of Rheinland-Pfalz and from a written questionnaire, which was sent to the CEOs of all 92 hospitals in this federal state. We use data envelopment analysis to measure hospital efficiency, and factor analysis and regression analysis to test our hypothesis.

*Findings.* Our principal finding is that a high degree of process-based organization has a moderate but significant positive effect on the efficiency of hospitals.

*Practice Implications.* The main implication is that hospitals should implement a process-based organization in order to improve their efficiency. But to actually achieve positive effects on efficiency, it is of paramount importance to observe some implementation rules - in particular to mobilize physician participation and to create an adequate organizational culture.

*This is a non-final version of an article published in final form in:*

**HEALTH CARE MANAGEMENT REVIEW, 2007, 32 (1), 55-65.**

[http://journals.lww.com/hcmrjournal/Abstract/2007/01000/Process\\_based\\_organization\\_design\\_and\\_hospital.8.aspx](http://journals.lww.com/hcmrjournal/Abstract/2007/01000/Process_based_organization_design_and_hospital.8.aspx)

## KEY WORDS

Process-based organization, organization design, efficiency measurement, Data Envelopment Analysis.

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## INTRODUCTION

In the 1990s, process orientation received considerable attention from organization theory and practice. The central idea of process-based organization design is that organizing a firm around core business processes leads to cost reductions and quality improvements. These benefits of process-based organization also apply to the hospital industry (Kaluzny, 2000). The breakthrough of the concept took place at the beginning of the 1990s under the buzzword “business process reengineering”. Hammer (1990) and Davenport and Short (1990) initiated an unprecedented surge of publications. Some years later the interest in process orientation waned, and today few new publications on this topic can be found. Nonetheless, process orientation has held up well to criticism and has become integral element of other organization concepts such as modularization (Schilling & Steensma, 2001) or supply chain management (Handfield & Nichols, 1999).

Many authors have investigated different aspects of process orientation from an empirical point of view (Stebbins, Shani, Moon, & Bowles, 1998; McNulty & Ferlie, 2004; Luck & Peabody, 2000). Much rarer, however, is quantitative empirical research on process-based organization design as a whole (Hall, Rosenthal, & Wade, 1993; Ho, Chan, & Kidwell, 1999). These few studies deal with the effects of reengineering projects which were implemented in organizations over a specific period and, therefore, do not measure the degree of process-based organization, but rather the outcome or the success of reengineering projects. However, a process-based organization design needs not necessarily be the result of the “fundamental rethinking and radical redesign of business processes” (Hammer & Champy, 1993, p. 332), as is typical of reengineering projects. A process-based organization design can also emerge incrementally as the result of continuous enhancements of existing organizational structures (Manganelli & Raspa, 1995).

Our study addresses the shortcomings of existing research by measuring the degree of process-based organization in hospitals - irrespective of reengineering projects carried out previously. We investigate the usefulness of the concept by comparing our measured degree of process-based organization with a measure of hospital efficiency.

## THEORY

### *Process-Based Organization Design*

The central idea of process-based organization can be described as “structure follows process”, that is, the organization design is dominated by cross-functional business processes.

Although the implementation of a process-based organization design has a massive and lasting impact on the organization, processes cannot become the only basis for organizational structure (Vanhaverbeke & Torremans, 1999). Functional skills and product-orientation remain indispensable. So, process-based organization design is not an independent and self-contained concept, but must be combined with other organization designs. Accordingly, an organization cannot be characterized as process oriented or not process oriented, as organizations are always process oriented to a greater or lesser degree.

A business process is defined by Hammer and Champy (1993) as “a collection of activities that takes one or more kinds of input and creates an output that is of value to the customer” (p. 35). We distinguish core processes and support processes. A core process is focused on the strategic objectives that determine competitive success of a firm and targets external customers, whereas a support process is less important and targets internal customers.

A process-based organization design is created by dividing a firm into organizational units, which handle a business process as comprehensively as possible, and which have relatively few interdependencies with other organizational units, thereby reducing coordination costs and throughput times. Within the organizational units the tasks are performed autonomously

and integratively by cross-functional teams (Majchrzak & Wang, 1996). In comparison to functional organization designs, employees are confronted with more diversified and multifaceted tasks. In the case of complex processes the functional division of work within the team can be kept up; the coordination is still facilitated by the elimination of departmental borders between the team members.

Of particular importance is the rigorous customer orientation of the business processes (Talarwar, 1993). Organizations can achieve significant quality improvements by measuring the added value of the business process exclusively from the perspective of the internal and external customers. Ensuring a high level of both output quality and process quality is an essential aspect of process-based organization design. Thus, process-based organization is very closely related to concepts like Lean Management, the Toyota Production System (IHI, 2005), Total Quality Management, or Six Sigma (Woodard, 2005).

Another important aspect is decentralization. The response to internal and external customer requests can be accelerated and improved by “putting the decision point where the work is performed” (Hammer, 1990, p. 111). This can be achieved by the implementation of profit centers. As a general rule, decentralization has positive effects on the working atmosphere and the motivation of the employees (Ford & Fottler, 1995). Additional positive motivation effects can be realized by linking pay to individual or team performance.

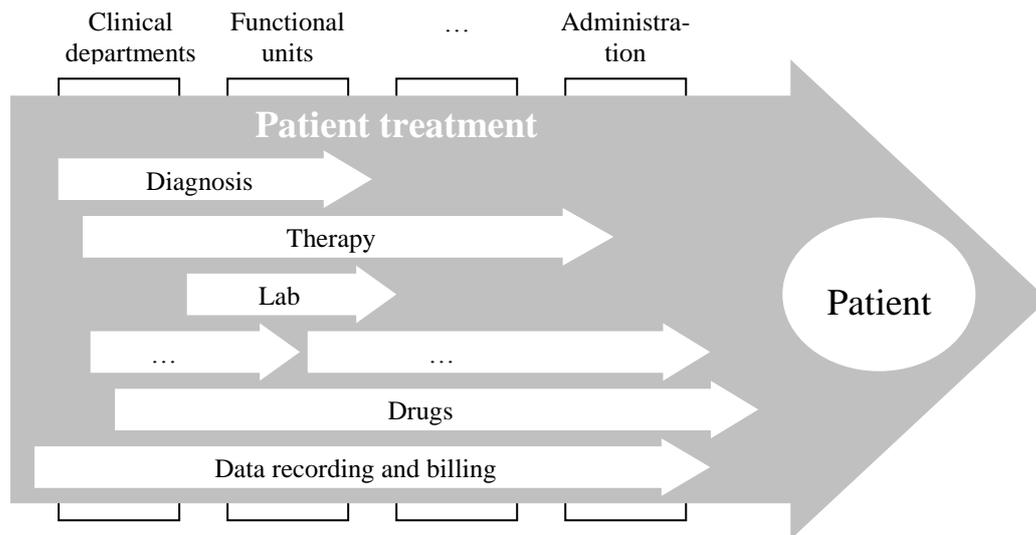
### *Implementation of Process-Based Organization in Hospitals*

Traditionally, hospitals are organized internally into clinical departments and functional units supporting these clinical departments (Aas, 1997). All the organizational units of hospitals usually are organized around anatomical divisions, organs, medical technologies or patient age groups (Montgomery, 1990). As a result of their education and training, physicians - and to a lesser degree also nurses - differentiate themselves into clinical specialties according to these criteria. This task differentiation and specialization is the main reason for the typical

functional organization design of hospitals (Braithwaite, 1993). However, to implement a process-based organization, it is necessary to overcome this functional division of labor.

The starting point of process-based organization design in hospitals requires the identification of the central business process of the hospital - namely the medical treatment of the patients.

This process, which can be broken down into partial processes, is illustrated in Figure 1.



*Figure 1.* Process View of a Hospital.

These processes have to be analyzed, optimized and then handled autonomously and integratively by cross-functional teams that include physicians and nurses. The focal point of any optimization measures must always be the added value from the point of view of the primary customer: the patient. Furthermore, the business processes have to be designed in a way that emerging problems are identified and eliminated as soon as possible. Physicians, nurses and managers have to internalize “lean thinking”, that is, determining the value of any given process by distinguishing value-added steps from non-value-added steps, and then eliminating waste systematically (IHI, 2005). Thus a continuously self-improving organization is established (Spear, 2005; Jimmerson, Weber, & Sobek, 2005; IHI, 2003).

A very important instrument to implement a process-based organization design is clinical pathways (Bragato & Jacobs, 2003). Clinical pathways are guidelines, which define specifi-

cations for the services to be provided in the course of the medical treatment process and for the quality of the treatment on the basis of evidence-based standards. They specify the goals of medical treatment and the sequence and timing of actions necessary to achieve these goals with optimal efficiency. Clinical pathways enable the uninterrupted care of patients beyond departmental boundaries and lead to a systematic process optimization. Thus they represent a popular tool to implement a process-based organization design in hospitals.

Another instrument to increase the process orientation of hospitals is clinical directorates (Braithwaite & Westbrook, 2004). Clinical directorates are intermediate organizational arrangements through which certain parts of larger hospitals are managed. There are many different types of clinical directorates. From the point of view of process orientation, the most interesting is the so-called institute design, which is logically constructed from the way that hospital services are delivered to patients and which leads to the integration of services with titles such as cardiac services or cancer services in one organizational unit. Typically, clinical directorates are headed by a chief physician who also has clinical responsibilities, so that his managerial involvement is only part time. Clinical directorates are multi-disciplinary organizational units, bringing together physicians, nurses, paramedical, administrative and clerical staff. They are focused upon the treatment processes and the outputs of patient care. Therefore, clinical directorates represent an appropriate instrument to implement a process-based hospital organization.

The full realization of the benefits of a process-based organization design is only possible if the business processes are processed adequately by cost accounting and financial controlling. Activity-based costing is a feasible instrument to achieve this goal (Upda, 1996). Activity-based costing can be described as a method of improving cost management of complex work processes. It determines the cost for a business process by examining the individual activities or tasks contained in the process and by assigning an accurate amount of cost to each activity,

thereby, providing very insightful information regarding the actual costs incurred when performing work processes. This improved cost transparency is a critical prerequisite to optimize the treatment processes. Nonetheless, activity-based costing continues to be underutilized in hospitals, although cost control is fundamental in the hospital sector these days.

The decentralization typical of a process-based organization is often achieved by organizing the organizational units in the clinical area as profit centers (Zelman, McCue, Millikan, & Glick, 2003). In this case, the process interdependencies between organizational units require the use of transfer pricing to calculate the financial result of the profit centers (Kuntz & Vera, 2005). The decentralization can be emphasized by transferring decision-making authority to assistant doctors or nurses within the profit centers. The profit center concept usually creates incentives to improve efficiency, in particular if the remuneration of the employees is linked to the performance of their profit center. Accordingly, the use of profit centers and performance-based pay support the implementation a process-based organization design.

### *Limits of Process-Based Organization in Hospitals*

However, the implementation of a process-based organization design in hospitals is complicated by some factors that result from specific features of hospital services. The heterogeneity of the hospital output as well as political and ethical obligations prove to be particularly problematic (Arndt & Bigelow, 1998). These factors prevent hospitals from deleting services and from focusing on the strategically important services with the same freedom as most firms in other industries.

In view of the multitude of different clinical pictures and disease patterns that hospitals have to deal with on a regular basis, the number of core processes - even in small hospitals - should be very high compared to organizations in other industries. This complicates the identification of the business processes in hospitals. In hospital practice this flaw often results in resorting to vague definitions, for example “using a rhetoric of four core business processes”

(McNulty & Ferlie, 2004, p. 1401). Eventually, only “a handful of core processes” (p. 1404) is optimized, because a thorough analysis and optimization of all the important service processes of a hospital is simply not practicable.

Furthermore, the feasibility of process oriented team building is limited by the pronounced functional specialization of the physicians, which is indispensable due to the know-how intensity of many hospital services (Shortell & Kaluzny, 2006). The comprehensive and integrative handling of business processes by cross-functional teams and the multifaceted task structure of the team members typical of process-based organizations are thus clearly restricted in hospitals. Only large hospitals have enough manpower to allow that an appropriate number of physicians overcome their functional specialization and practice a more interdisciplinary approach to medicine. Smaller hospitals can also set up process oriented, interdisciplinary teams, but they will have to keep up the functional specialization of the team members and thus not fully realize the benefits of a process-based organization design.

Moreover, the professional status of physicians has to be taken into account (Abernethy & Stoelwinder, 1995). As a consequence of their training and their socialization, physicians primarily identify with their professional group, are committed to developing the power and prestige of the profession, and look for professional colleagues for support and censure. This strong orientation to professional values often conflicts with the managerial goals associated with a process-based organization design. The implementation of this concept is, as a result, often complicated by the distinctive research orientation, the poor cost consciousness or extreme autonomy needs of many physicians.

Another limitation results from the non-profit status of a large number of hospitals owned by public, clerical or charitable institutions. In these hospitals it is much more difficult to introduce performance-linked pay than in for-profit organizations (Luck & Peabody, 2000). However, this is not necessarily a disadvantage as many researchers challenge the usefulness of

performance-linked pay. Instead they emphasize the advantages of systems of accountability for achieving long-term goals, which harness the imagination and the participation of the workforce, and which require a high degree of trust in many forms (Berwick, 2003).

Finally, the fact that the patient treatment process also includes partial processes which cannot be directly influenced by the hospital must also be considered. The treatment of many patients begins before hospitalization and continues after hospital discharge. Consequently, hospitals with a pronounced customer focus have to cooperate closely with physicians in private practice, emergency medical services, rehabilitation centers, nursing homes, etc. The implementation of process-based organization in hospitals therefore requires the optimization of the business processes beyond the boundaries of the hospital using approaches like supply chain management (Handfield & Nichols, 1999).

Recapitulating, it can be stated that the implementation of a process-based organization design in hospitals encounters considerable difficulties. However, the benefits of a process-based organization apply in principle also to hospitals. Hospitals that implement a high degree of process orientation in their organization design should therefore be able to increase their efficiency. This leads to the following hypothesis:

*Hospitals that exhibit a high degree of process orientation in their organization design are more efficient than hospitals with a low degree of process orientation.*

## METHODOLOGY

### *Study Setting*

The following empirical analysis was carried out in the German federal state of Rheinland-Pfalz, which has a hospital sector quite representative of Germany. In Germany, 74% of the hospitals are non-profit (36% public, 38% welfare) and 26% are private for-profit hospitals. As private hospitals are relatively small, about 90% of hospital beds are located in non-profit

hospitals. However, the market share of private hospitals has risen significantly in the last years. The main reason for this development have been the extensive reforms of the hospital sector over the past years. The most fundamental reform was the introduction of a DRG-based prospective payment system similar to that used by Medicare in the U.S. (Lungen & Lapsley, 2003). The new system contrasts sharply with the previous cost reimbursement system and has led to a significant increase in competition in the German hospital sector - making it more comparable to the traditionally quite competitive U.S. hospital sector.

From the point of view of organization design, German hospitals are quite similar to most U.S. hospitals. In the clinical area, they are usually organized within clinical departments and functional units. The administrative and managerial staff is separated organizationally from the clinical area and thus has little insight into the clinical processes. The main difference between German and U.S. hospitals is the fact that physicians as a general rule are employees of the hospital. However, hospital physicians cannot be considered as typical employees. Due to their status as professionals they enjoy a pronounced autonomy of decision and a high hierarchical status compared to the other personnel. Thus, their organizational role is quite similar to that of physicians in U.S. hospitals.

Recapitulating, we can state that although there are differences between German and U.S. hospitals, these are negligible with regard to implementing process-based organization. Thus, the results of this study also apply to hospitals in the U.S. and in most other countries.

### *Database*

We used data from two different sources. Information about the efficiency of the hospitals was obtained from a database compiled by the Statistical Office of the federal state of Rheinland-Pfalz, which contains cost and performance data on all 92 hospitals in this federal state. However, 12 of these 92 hospitals were excluded from the survey for technical reasons. Information about the organization design of the remaining 80 hospitals was collected by a

standardized written questionnaire, which was sent out by post between December 2003 and November 2004 to the CEOs of the hospitals. A total of 43 questionnaires were completed and returned, giving a return quota of 53.75%. Some questionnaires, however, were only partially completed, so that only 41 data sets were available with regard to some variables.

	staff	beds	cases per year
hospitals surveyed	670	418	12,089
hospitals in Germany	464	245	7,873

*Table 1.* Size of the hospitals surveyed.

Table 1 contains some information about the size of the hospitals surveyed and of German hospitals. Obviously, the hospitals replying were relatively large. The results of the following analyses therefore apply primarily to hospitals of above-average size.

### *Measurement of Hospital Efficiency*

Measurement of performance in health care organizations is very complex (McCracken, McIlwain, & Fottler, 2001). Financial measures like financial growth or operating income are generally considered to be the best indicators of hospital performance. However, the use of such financial measures is inappropriate in this study, particularly because of the rather weak link between organizational arrangements and financial performance. Modifications of the organizational structure of a firm usually affect financial outcomes in the long run if at all, while the effect on the efficiency of the service processes is much more immediate. Therefore, in order to evaluate the possible benefits of a process-based organization design in hospitals, we measured and analyzed the effects on hospital efficiency.

A very accurate description of the efficiency of hospitals can be achieved by means of Data Envelopment Analysis (DEA) (Cooper, Seiford, & Tone, 2000). The DEA approach is commonly used to evaluate the relative efficiency of a number of hospitals (Kuntz & Scholtes, 2000; Olesen & Petersen, 2002). It defines efficiency as the ratio of the weighted sum of out-

puts of a hospital to its weighted sum of inputs. DEA is an extreme point method and compares each hospital with only the best hospital. The heart of the analysis lies in finding this best hospital using mathematical linear programming. The most important advantage of DEA is that it allows for the simultaneous consideration of multiple inputs and multiple outputs. In the present study we consider two inputs:

- the annual treatment costs, which are financed by the statutory health insurance companies in Germany. Treatment costs are directly related to the provision of in-patient services and include personnel costs, pharmaceuticals, food, etc. However, they do not include investment costs for facilities and equipment as these are refunded by the federal states due to the German dual hospital financing system (Lungen & Lapsley, 2003);
- the total number of beds in a hospital as indicator of the investment costs for facilities and equipment.

Both inputs - bed capacity and annual treatment costs - define the resource basis of a German hospital for the treatment of patients. The output is also not measured in terms of one single figure. Here, to take account of the patient structure of a hospital, a distinction is made between cases on the basis of clinical specialties, thus producing a multiple output defined by the case numbers per clinical specialty. The resulting input/output structure is outlined in Table 2 and includes 2 inputs and 21 outputs.

Output	Cases differentiated by clinical specialties	1. Internal medicine	
		2. Pediatrics	
		3. Surgery	
		4. Neurosurgery	
		5. Plastic surgery	
		...	
		18. Dermatology	
		19. Dentistry	
		20. Other clinical specialties	
		21. Released part stationary patients	
		Input	Quantity of beds
			Annual costs

*Table 2.* Input/Output Structure.

However, the decision on how the efficiency index should be defined still remains. At this point, DEA comes into play. The DEA approach is conservative: leave the choice of the weightings for inputs and outputs to the hospital, so that the best possible efficiency measure is achieved for this hospital compared to the other hospitals. After a hospital has chosen the weightings for inputs and outputs, then that hospital is used as “benchmark”, which achieves the highest input/output ratio of all the hospitals with the selected weightings. The efficiency of a hospital is calculated by means of the percentage variance of its output/input ratio from that of the “benchmark hospital”. The strength of DEA is that it calculates mathematically which selection of weightings maximizes the efficiency of every hospital. The optimization problem to be solved in the selection of the weightings is a linear program. The resulting efficiency measure is referred to as the standard DEA efficiency measure.

This standard DEA efficiency measure has the disadvantage that all efficient hospitals end up with a value of 1, so that it allows no further differentiation between these hospitals. To obtain a complete efficiency ranking, we use a modification of this measure, which enables a ranking of the DEA-efficient hospitals (Andersen & Petersen, 1993). The basic idea is to compare the hospital in question with a linear combination of all other hospitals in the sample, while the hospital in question itself is excluded. The difference between the so-called extended DEA efficiency and the standard DEA efficiency consists only in the fact that in the calculation of the extended DEA efficiency of a hospital, the own output/input ratio is compared in relation to the output/input ratio of the other hospitals. Consequently, the extended DEA efficiency provides an efficiency rating of efficient hospitals similar to the rating of inefficient hospitals provided by the standard DEA efficiency.

### *Measurement of Process-Based Hospital Organization*

As already mentioned above, there is no empirical research on the degree of process-based organization design in hospitals. Therefore, we had to develop a new measurement concept

for the theoretical construct “process-based hospital organization”. Since process orientation is not directly observable, the measurement concept demands several indicators, which together characterize the features of process oriented hospitals as comprehensively as possible.

In our study we used the following six items to measure process-based hospital organization:

- definition and optimization of business processes (variable OPTPRO),
- clinical pathways (variable CLPATH),
- multi-disciplinary teamwork, e.g. within clinical directorates (variable MULTDIS),
- activity-based costing (variable ABCOST),
- profit centers (variable CENTER) und
- performance-based pay (variable PERFPAY).

These items represent organizational instruments, which have been discussed in the “Implementation of Process-Based Organization in Hospitals” section of this paper, and which are particularly characteristic of a process-based hospital organization. We assume that the intensive application of these instruments in a hospital leads to a pronounced process orientation.

Therefore, in our questionnaire we asked the CEOs of the hospitals to estimate the degree of application of these six organizational instruments in their hospital. We turned to the CEOs because we assume that to answer to these questions correctly, the respondents should have received a managerial education and be members of the top management team.

The six items were rated by the CEOs on a scale from 1 to 5, 1 standing for “not at all” and 5 for “very high”. The value of the variable “process-based hospital organization” (PROORG) was calculated as the mean of these six items. The reliability was evaluated on the basis of Cronbach’s Alpha. This estimator should be at least .6 for newly developed scales and at least .7 or .75 for established scales (Crano & Brewer, 2002). Cronbach’s Alpha is a conservative estimator and therefore a high threshold for the acceptance of a measurement concept. With respect to PROORG, Cronbach’s Alpha is .75, thus the internal consistency is acceptable.

Furthermore, we applied exploratory factor analysis to the data to identify underlying dimensions that might drive common sets of measured items (Harmann, 1976). But previously we had to check whether the use of factor analysis was admissible (Dziuban & Shirkey, 1974). We used the Kaiser-Meyer-Olkin (KMO) criterion for measuring sampling adequacy and Bartlett's test of sphericity. The KMO-value of .6 is rather low but clearly higher than the minimum acceptance value of .5. And Bartlett's  $\chi^2$  of 73.610 leads to a significance at the .1%-level. Hence, both tests support the use of exploratory factor analysis.

We carried out a principal components analysis with varimax-rotation and Kaiser normalization on the six items to explore the underlying factor structure. Inspection of eigenvalues suggested the existence of two primary factors, both with eigenvalues greater than 1. Together, these two factors account for more than two thirds of total response variation. The factor loadings, eigenvalues and percentages of variance explained are shown in Table 3. Obviously, the items load into two clearly defined factors, while cross-loadings of items are significantly lower. After closer examination of the items we identified two different aspects of a process-based organization design that are consistent with the theoretical framework.

Item	Factor 1	Factor 2
OPTPRO	.761	.281
MULTDIS	.621	.327
CLPATH	.719	.347
ABCOST	.836	-.257
CENTER	.085	.882
PERFPAY	.228	.865
Eigenvalue	2.813	1.326
% of variance explained	46.88	22.10

*Table 3.* Results of Factor Analysis.

On the one hand, the first four items (OPTPRO, CLPATH, MULTDIS, ABCOST) represent tools that are closely connected with the business processes of a hospital. They focus on the identification, analysis, and optimization of the business processes of a hospital and therefore

can be characterized as process management tools. On the other hand, the remaining two items (CENTER, PERFPAY) represent tools that are not directly connected to the business processes, but that are implemented additionally to increase decentralization. They are intended to create a favorable incentive structure within a process-based organization design and thereby support the process management tools. Both factors represent different dimensions of the theoretical construct “process-based hospital organization”, but nevertheless both dimensions are indispensable to measure the construct.

Consequently, the items loading on the same factor were combined to define two new variables. The variable “process management” (PROMGT) was calculated as the mean of the four variables loading on factor 1 (OPTPRO, MULTDIS, CLPATH, ABCOST) and the variable “decentralization” (DECENTR) as the mean of the two items loading on factor 2 (CENTER, PERFPAY). To ensure that these variables are internally consistent, a reliability assessment was performed using Cronbach’s Alpha. The Alpha coefficients of .74 for PROMGT and .78 for DECENTR indicate an acceptable reliability. The measurement model for process-based hospital organization is illustrated and summarized in Figure 2.

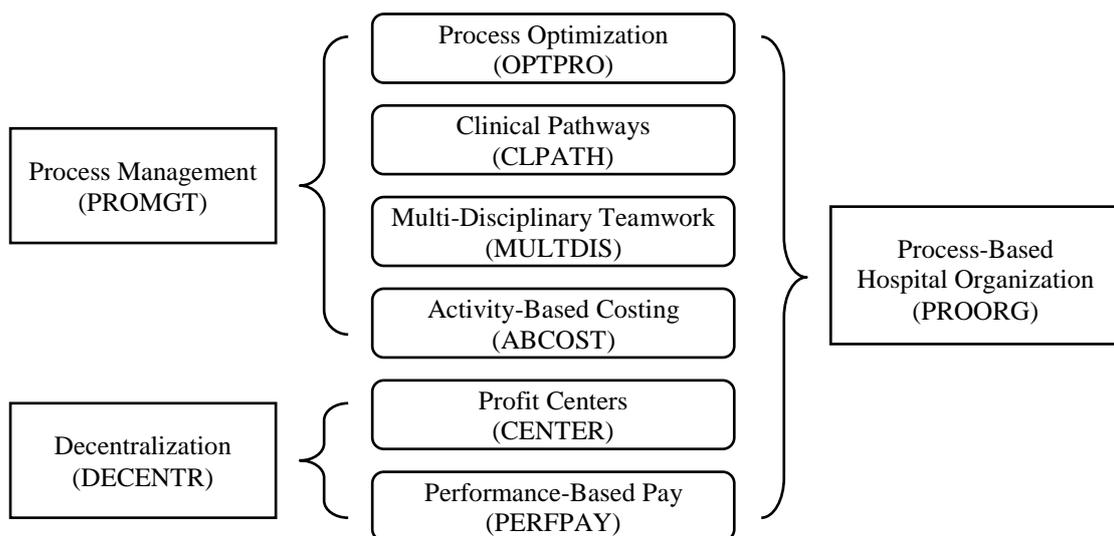


Figure 2. Measurement Model for Process-Based Hospital Organization.

## RESULTS

Our hypothesis states that hospitals that exhibit a high degree of process orientation in their organization design are more efficient than hospitals with a low degree of process orientation. This is investigated empirically by carrying out two linear regression analyses, both with the hospital efficiency (HOSPEFF) as dependent variable. Model 1 has only one independent variable: the degree of process-based hospital organization (PROORG). And model 2 represents a multiple regression as it has the two dimensions included in PROORG as independent variables: PROMGT and DECENTR.

But first we examine if the variables comply with a normal distribution, because this determines the statistical tools that may be used. To this end we carried out Kolmogorov-Smirnov goodness-of-fit tests (Siegel & Castellan, 1988). They test how well a set of observations fits some specified distribution function, which can also be a normal distribution. The goodness-of-fit tests result in z-values of 1.246 for HOSPEFF, of .953 for PROORG, of 1.030 for DECENTR and of .962 for PROMGT indicating that there are no significant differences between the distributions of these variables and a normal distribution. Thus we can use a regression analysis to test our hypothesis. The results of the regression analyses are shown in Table 4. Furthermore, in Figure 3 we visualize the distribution of the hospitals surveyed with respect to PROORG and HOSPEFF and the regression line of model 1 in a range diagram.

The adjusted linear coefficients of determination  $R^2$  of .257 in model 1 and of .245 in model 2 mean that approximately 25% of the variation in hospital efficiency is accounted for by the degree of process-based organization. This value is relatively low, but a significantly higher value was not to be expected in view of the multitude of factors that influence the efficiency of hospitals. The F-tests carried out lead to significance at .1%-level with respect to both models. Therefore, we can conclude that there is a weak but highly significant linear relationship between process-based organization and hospital efficiency.

	Model 1	Model 2
PROORG	.525***	
PROMGT		.367*
DECENTR		.270+
R <sup>2</sup>	.275***	.281***
Adjusted R <sup>2</sup>	.257***	.245***
F	15.564	7.807
df	42	42
Dependent variable:	HOSPEFF	
***:	p < .001	
*:	p < .05	
+:	p < .1	

Table 4. Results of Regression Analyses.

To find out about the direction and the strength of this linear relationship we have to look at the standardized regression coefficients for the independent variables. In model 1 with only one independent variable, the standardized regression coefficient for PROORG is equal to Pearson's correlation coefficient R. The coefficient of .525 indicates that there is a moderate positive linear relationship between the degree of process-based hospital organization and hospital efficiency. The T-test carried out with respect to this coefficient leads to a highly significant result at .1%-level. The positive effect of PROORG on the efficiency is also reflected by the positive slope of the regression line in Figure 3.

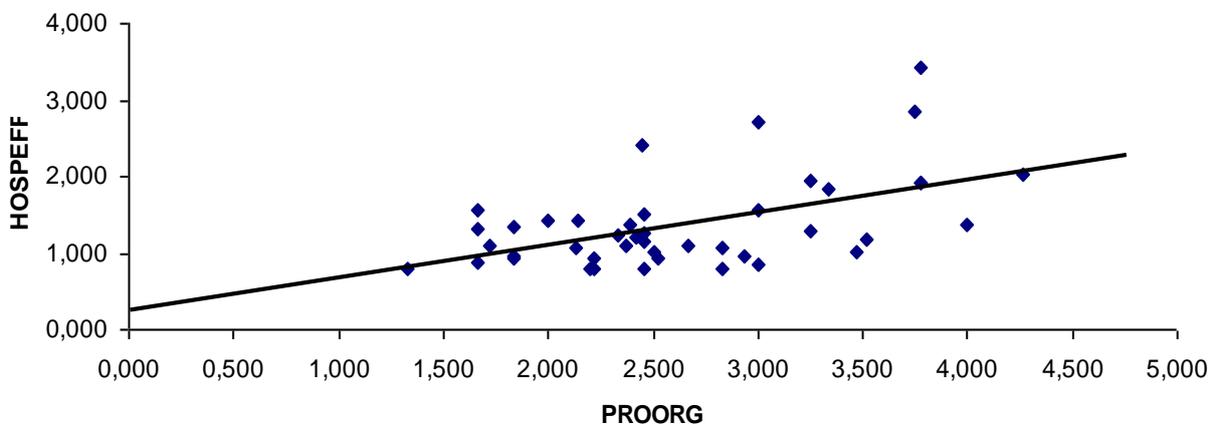


Figure 3. Range Diagram with Regression Line.

Model 2 with standardized regression coefficients of .367 for PROMGT and .270 for DECENTR indicates that both dimensions included in PROORG have a positive effect on hospital efficiency, but that the effect of PROORG is slightly stronger. The T-tests carried out with respect to these coefficients lead to a significant result at 5%-level with respect to PROMGT, but only to a marginally significant result at 10%-level with respect to DECENTR.

Nevertheless, since both models are highly significant and since all the standardized regression coefficients are positive and (at least marginally) significant, we can conclude that our hypothesis is confirmed. Hospitals that exhibit a high degree of process orientation in their organization design are more efficient than hospitals with a low degree of process orientation.

## DISCUSSION

The realization of cost reductions and quality improvements by implementing a process-based organization design constitutes a central guideline of organization theory and practice. Numerous case studies and empirical investigations of reengineering projects indicate that a positive relationship between process orientation and organizational performance exists.

Nevertheless, a solid empirical verification of this central guideline has not happened yet.

One aim of the present study was to contribute to the reduction of this deficit. Another aim was to investigate if a process-based organization design is advisable in hospitals that are traditionally characterized by a distinctive functional organization design and by a strong functional specialization of its employees.

We suggested that successful implementation of the central ideas of process-based organization in hospitals is possible and should improve efficiency. The measurement of the variables “process-based hospital organization” and “hospital efficiency” proved to be particularly challenging. A new measurement concept had to be developed with respect to the degree of process orientation in hospitals. Using an explorative factor analysis, we identified two underlying dimensions of process-based hospital organization: process management and decen-

tralization. Additionally, to measure the efficiency of hospitals, it was necessary to include multiple inputs and outputs using DEA. On the basis of two regression analyses the hypothesis could be confirmed. The collected data indicates that a high degree of process-based hospital organization has a positive effect on hospital efficiency.

The confirmation of this positive relationship between process-based organization design and hospital efficiency is, of course, the main result of the present study. Although the concept of process orientation is well established in this area of research and well proven in many industries, the link between process-based organization and organizational performance has always been rather weak - in particular with respect to health care organizations. The previous empirical research on this topic measured the success of reengineering projects, and did not really try to measure the theoretical construct that forms the basis of reengineering. Other previous empirical studies were focused on financial performance data, although organizational tools have a much more direct effect on efficiency. And again other studies focused on subjective performance assessments by managers and consultants involved in reengineering, although these persons usually do not tend to criticize expensive reengineering projects that they have been significantly involved in. These flaws are avoided in the present study by measuring the degree of process-based organization and the DEA-efficiency of hospitals. The results of our study, therefore, mark a substantial advance on this field of research.

Another interesting result arises from the multiple regression analysis with the two underlying dimensions of process-based hospital organization as independent variables (model 2). Here we can see that both dimensions have a positive effect on efficiency, but that the effect of process management is stronger than that of decentralization. Apparently, the positive efficiency effects are mainly the result of organization tools that are closely connected with the identification, analysis, and optimization of the business processes - such as clinical pathways or activity-based costing. Supplementary decentralization measures that are intended to create

a favorable incentive structure are essential within a process-based organization, but their impact on hospital efficiency is less pronounced than that of process management.

The present study highlights the core of the concept of process-based organization: efficiency improvements result primarily from the optimization of business processes. This central idea of process-based organization often becomes blurred in reengineering projects that focus on buzzwords like “fundamental rethinking”, “radical redesign” and “dramatic improvements” (Hammer, 1990). The successful implementation of a process-based organization design is neither dramatic nor radical. Basically, it consists of finding, analyzing and optimizing the processes of an organization.

## PRACTICE IMPLICATIONS

The main practice implication of the present study is obvious: hospitals should implement a process-based organization in order to improve their efficiency. However, to actually achieve positive effects on efficiency, it is of paramount importance that the implementation process is appropriate. Many case studies have shown that the non-observance of some implementation rules often leads to disappointing results (McNulty & Ferlie, 2004).

The most important is probably the involvement and engagement of the physicians (IHI, 2003). For process-based organization design to be successful in hospital practice, physicians need to be supportive. Physicians occupy the key position in the service process of hospitals and are in an extremely powerful position to prevent process-based organization. And case studies show that physicians make use of this power, in particular when the process logic challenges the identity of their medical specialty in its own right and their established work jurisdictions (McNulty, 2003). Of course there are also managers and nurses who try to impede process orientation and to preserve functional organizing arrangements, but generally their resistance is significantly lower than that of physicians. Therefore, to avoid hostility and

conflict on the part of the clinical staff, it is important to blend process orientation with the clinical agenda in a way that physician participation is mobilized.

Other very important factors are leadership and culture (IHI, 2005). Introducing a process-based organization design in a hospital is a whole-system strategy that requires major change management throughout the entire hospital. Therefore, for the implementation to be successful, middle managers and front-line clinicians need intense support from the top management. Furthermore, strong commitment and inspiring leadership from senior management are essential to create an organizational culture compatible with a process-based organization. It can be very difficult for skilled personnel - and in particular for highly qualified healthcare professionals - to admit that much about their daily tasks is wasteful and should be handled differently. But positive efficiency effects will only be realized in hospital practice if the staff has a positive attitude towards interdisciplinary teamwork, self-criticism, sharing information, customer-orientation, etc. Thus, top management must create a clear vision statement that focuses on such values and allow for a corresponding organizational culture to evolve.

## LIMITATIONS

Finally, we would like to mention that, as with any study, this paper has obvious limitations that should be recognized. A very important limitation is the small sample size of only 43 hospitals, which is not appropriate for a clear demonstration of a causal connection between process orientation and hospital efficiency. In addition to the fact that the hospitals replying were relatively large compared to the whole sample, we also cannot rule out that the narrow sampling has led to other biases. Furthermore, the measurement of the degree of process-based organization should be refined. The items used were quite global, so that responding to these items for a whole hospital leaves a great deal of room for measurement error. Furthermore, to avoid the restriction to the CEO perspective, the questionnaire should also be sent to other members of the top management team, in particular to the chief physicians.

Follow-up studies can expand on and improve these results in several ways. Above all, to verify if a generalization of the results of our study is appropriate, the number of hospitals surveyed should be increased. And it would be very useful to analyze longitudinal data on this topic in order to investigate the long-term effects of a process-based organization design.

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