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QUANTIFICATION OF BENEFITS AND COST FROM APPLYING A PRODUCT CONFIGURATION SYSTEM

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Abstract: *This article aims at analyzing the long-term benefits and the cost from developing, implementing and maintaining product configuration systems (PCSs). The results presented indicate that over 5 years period a case company has achieved significant savings as a result to reduced workload of generating the products' specifications. In addition the lead-time for generating products' specifications has been reduced and indications of improved quality of the products' specifications and additional sales are identified. The research verifies the benefits described in the current literature and contributes by linking the benefits to the direct cost savings companies can expect from utilizing PCSs.*

Key Words: ***Mass Customization, Poduct Configuration System (PCS)***

1. INTRODUCTION

In today's competitive business environment, customers are increasingly demanding customized products, which are supposed to be delivered in short time period, with high quality and at competitive prices [1]. In order to respond to those challenges mass customization strategies have received increased attention both from practitioners and researches. Mass customization refers to the ability to make customized products and services, which fits every customer's needs through flexibility and integration at cost similar to mass produced products [2]. One way of obtaining this is by designing more modular based products where product configuration systems (PCS) are used in the customization process. PCSs are used to support design activities throughout the customization process, where a set of components along with their connections are pre-defined and where constrains are used to prevent infeasible configurations [3].

The literature describes various benefits that can be gained by implementing PCSs to support the sales and specifications processes to different extent. Where companies utilizing PCSs have achieved increased ability to manage product variety, improved product quality, simplification of the customer order process and complexity reduction [4]–[7]. Furthermore, preservation of knowledge, use of fewer resources, optimization of products designs, less routine work, improved certainty of delivery, reduced time for training new employees and increased customer satisfaction [1], [8]–[12] has been claimed as the benefits from utilizing PCSs. As the various benefits are described in the literature, it can be assumed that those benefits will result in direct cost savings. However, the linkage between the various benefits and the direct cost savings that companies can anticipate has not been addressed to great extent in the previous research. This article aims to capture this research opportunity by quantifying the long-term benefits from implementation of PCSs and comparing it to the cost of development, implementation and maintenance of the system.

The overall aim of this article is therefore to quantify the long-term benefits from implementing PCS in terms of resource consumption, lead-time and the quality of the products' specifications and increased sale as those benefits are thought to be directly linked to the cost savings. The cost savings will then be compared to the cost of development, implementation and maintenance in order to quantify the direct cost savings traced to the utilization of the system and the return on investment (ROI). The results presented in this research are based on a case study and indicate that significant cost savings can be achieved in terms of saved man-hours and reduced lead-time for generating the specifications. Furthermore, indications of improved quality of the products' specifications due to more standardized product data and fewer errors, and additional sale due to faster response time to the customer are identified.

2. LITTERATURE REVIEW

The literature review is aimed to identify previous research describing the benefits from implementing PCSs in terms of man-hours, lead-time, data quality and increased sale aligned with the focus of the study. Furthermore, the cost of developing, implementing, and maintaining the systems along with the ROI are addressed. Finally, quantifications of the benefits and the cost of the systems are elaborated in the literature review. In Table 1, the main findings from the literature are summarized.

Table 1. *The main findings from the literature review*

Benefits / Authors	Man-hours	Lead-time	Data quality	Increased sale	Cost of PCS	ROI	Quantifications
Aldanondo et al. [13]	x	x	x				Not quantified
Ardissono et al. [10]	x	x	x				Not quantified
Ariano & Dagnino [14]		x	x				Not quantified
Barker et al. [15]	x	x	x			x	The overall the net return of the system is estimated to be in excess of $40 million.
Fleischanderl et al. [16]			x			x	By using PCS to support the complete configuration process can reduce the configuration costs up tp 60% over the the products' life cycle. The system achieved a possitive ROI within its first year of operation
Forza & Salvador [4]	x	x	x		x		Errors in the configurations reduced to almost 0.
Forza & Salvador [17]	x	x	x			x	Reduction of manned activities in the tendering process from 5–6 to 1 day. Iincreased level of correctness of product information to almost 100%.
Forza et al. [18]	x	x	x				The aveage time to make an offer has been reduced from 1-2 days to few hours and for technichal specifications 2.5 days to few minutes
Gronalt & Benna [19]		x	x				Not quantified
Haug et al. [20]		x	x				The average lead- time reduction is 83.7 % for genrerating quotes The average man-hours saved are 78.4%
Heatley et al. [21]	x	x	x	x			Not quantified
Heiskala et al. [22]	x		x				Average selection time has been reduced from 2 hours – 6 minutes Throughput cycle has been reduced from 6-1 day. The quality of specifications has been improved from 60% - 100% beeing manufacturable. Pricing errors have improved from 80% of orders containied to 100% correctness.
Heiskala et al. [23]	x	x	x	x			Not quantified
Hvam et al. [24]	x	x	x				Reduction in lead time from 15-25 days to 1-2 days for the generation of tenders. Engineering hours for making quotations was reduced from 5 man-weeks to 1-2 man-days.
Hvam [25]	x	x	x				The real working time for preparing offers and production instructions is close to 0. Delivery time has been reduced from 11–41 days to 1 day. The number of assembly errors has been reduced from 30% to less than 2%.
Hvam [26]	x		x	x	x		Reduction in resources for generating quotations by 50%. Enabled the company to respond to all customer requests with a quotation. The overall costs of development and implementation of the PCS is approximately USD 1 million and operating costs is around USD 100,000 per year.
Hvam et al. [27]	x	x	x	x			The lead-time has been reduced by 94-99%. Resoucres for making the specifications have been reduced by 50-95%
Petersen [28]	x	x	x				Not quantified
Sviokla [29]	x	x	x			x	By eliminanted a complete step in the manufacturing process by the implementation an estimated $15 million savings are stated plus ohter savings from previous years. Correctness prior to the implmentation 65-90% after 95-98%
Tiihonen et al. [30]	x		x				Not quantified
Trentin et al. [6]			x				Not quantified
Yu & Skovgaard [31]			x				Ensuring configuration corrextness where 100% accuracy is achived by the implementation of the system.

The results from the literature review shows that by utilizing PCS reduced man-hours and lead-time for generating the specifications is acknowledged in numerous of research [4], [10], [13]–[15], [17]–[30]. The reduction can be traced to automation of routine tasks and as product information are made available in the sales phase and therefore iterative loops between sales and other departments can be eliminated. The improved data quality is also well described in the literature [4], [6], [10], [13]–[31]. The data quality is described in terms of improved correctness of different specifications generated by the PCS. Significant improvements are described where errors are considerably reduced. The increased sale can be traced to enabling sales persons to respond to all customers as a result to increased throughput when using PCS, which is elaborated in previous research [21], [23], [26], [27]. Even though an increased sale is mention as one of the benefits from implementing PCS, the impact is not addressed to great extent. Hvam [26] mentions that if the implementation of the PCS will lead to additional sale of one plant that will have more impact than all other benefits combined.

In terms of cost of developing, implementing and maintaining PCS it is addressed few by researches. Forza & Salvador [4] mention that high investment in terms of man-hours might be needed for the introduction of the system. Hvam [26] quantifies the cost of development and implementation of approximately USD 1 million, where the operating costs of the PCS are around USD 100,000 per year. The cost is compared to the usage of the system, where basic budget quotations for approximately USD 3.2 to 3.5 billion and detailed quotations for approximately USD 5.5 billion have been generated in the system, resulting in orders of about USD 0.5 billion. This study does however not link the direct savings in terms of benefits that are achieved by utilizing the system to the cost as the cost is justified based on sum of the total value of the quotations generated with the system.

Finally in terms of ROI, few researchers have elaborated on it. Barker et al. [15] does not mention the ROI but the net return of the system, which is estimated to be in excess of $40 million. Fleischanderl et al. [16] stated that the system achieved a positive ROI within its first year of operation. Finally, Forza & Salvador [17] describe how small enterprise can benefits from implementing PCS where not only a rapid payback of the investment can be anticipated but also a competitive advantage.

As can be concluded from the literature review, the linkage between the direct cost savings and the cost of development, implementation and maintenance has not been addressed in previous research to great extent. This research will therefore address these topics along with identifying the ROI companies can expect from implementing and operating PCSs.

3. RESEARCH METHOOD

Aiming to investigate the effects from implementing and operating a PCS, a case study was conducted at a manufacturing company providing mechanical equipment. The company implemented the first PCS in the year 2001 in order to support the sales and design

processes and at the same time increased standardization in the product range. The results presented in this study are based on in-depth analysis at the company over five year period from 2009-2013. Project team was formed at the company, which included two researchers from the Technical University of Denmark and experts from the company. During the period of the case study, regular meetings were held to validate the processes of the project, access to internal databases was provided and workshops with key employees were held.

4. CASE STUDY

4.1. Background

The company analyzed in this case study provides highly customized products, which are made to suit different types of industries. The market is highly competitive where delivery time and cost are critical. The main motivation for implementing the PCSs initially was to reduce response time to customers inquires in order to increase the company's overall competitiveness.

The PCS is both used by the local sales offices and technical support at the company's headquarters. The local sales offices operate globally and are responsible for all interactions with the customers in the sales process. In total 43% of the sales offices have access to the PCS, which allows them to configure a product without having to go through technical support at the company's headquarter. Thereby, the implementation of the PCS has empowered the sales offices globally to send proposals to greater extent directly to customers. In those cases where the local sales offices do not have an access to the PCS, the technical support makes the configuration and the local sales office is the contact to the customer.

The products structure at the company contains a high degree of modularity. Even though the numbers of components are limited, the overall number of possible configurable solutions is nearly unlimited. For each product family at company there exist a predefined range of configured products, which are referred to as standard products. In cases, where the customer requirements exceed the coverage of the PCS, the products specifications have to be created manually outside the PCS. Depending on the degree of complexity, products are created either partially or fully manual. The scenario of partially implies that the PCS is used in order to take over product data of similar existent configured products and only some attributes are created manually. This is defined as Light ETO. The scenario of fully manual is when the customer requirements are highly complex and more resources are required to design the products and generate the specifications, it is defined as Heavy ETO. In Table 2, the different products types are summarized along with the degree of how they are supported with PCS in terms of automation.

Table 2. *Description of the product range at the case company*

Scenarios	Description	Process
Standard products	Predefined range of configured products.	Standard documentation – Support from PCS not required
CTO products	Contain a high degree of modularization where PCS can be used to configure the product according to predefine constrains.	Fully automated by the PCS
Light ETO products	The PCS can only be used partially to configure the product, where only attributes are created manually outside the PCS.	Partially automated and partially manual
Heavy ETO products	The PCS cannot be used to configure the product as result to complex and specialized customer's requirements that are not covered by the system.	Manual process

The most desirable way for the company is to cover all aspects of the product configuration through the PCS. Therefore, the company's goal is to provide each product family with the largest possible solution space so least amount of resources for product configuration are required in the customer order process.

4.2. Customer order process - Before and after implementation of the PCS

This section will elaborate on the customer order process before and after the implementation of the PCS and how different products types are supported by the system. Finally the company introduced further standardization in their product range by defining CTO products aligned with the implementation of the PCS, which will be further explained in this section.

4.2.1. The customer order process before implementation of the PCS

Before the implementation of the PCS, two different scenarios were associated with the customer order process and the generation of the product specifications.

The former scenario represents the process for standard products. In this case, the products were available on the company's homepage and in different product catalogues. The customer then orders the product through from one of the local sales offices. If the customer was not available to find the required product, the sales office recommended a suitable product. For standard products, all documentations were available which allowed the local sales offices to treat the customer order without involvement of the technical support.

The latter scenario includes all non-standard products or Light and Heavy ETO products. Since the knowledge of available modules and constrains regarding their combination was unavailable in the local sales offices, technical support is always required in the sales process. Every new requested product could therefore lead to a time consuming process between the customer, the sales office and the technical support. This could result in multiple iterations, where the technical support suggests solution, the sales offices clarifying them with the customer and then requesting some changes, which often resulted in redesign loops. In these cases, the product specifications are generated manually but the time duration is highly dependent on whether Light ETO or Heavy ETO product is under design. For Light ETO products, the technical support was able to generate the products' specifications and make a quotation but for Heavy ETO, the engineering department and the

production department had to be involved before a quotation could be generated.

The time to respond to the customer is one of the main criteria to get the order. Due to the amount of orders going through the technical support at the company's headquarters, there was a severe bottleneck in the customer order process leading to weeklong response time to the customers' inquiry. In order to streamline the process, reduce the lead-time for generating quotations and to reduce the workload, a PCS was implemented to support the sales process of Light ETO products. The implementation of the PCS does not affect the sales process of standardized and Heavy ETO products and therefore they will not be further discussed in this study.

4.2.2. Customer order process after implementation of the PCS

The PCS is aimed to support the customer order process for Light ETO products, which were further divided into Light ETO and CTO products. By defining CTO products increased standardization of the company's products range is enabled as CTO products are built on predefined modules that can be combined according to constrains which suits the customers' needs. For CTO products they are either configured by the local sales offices or by the technical support when the sales offices do not have access to the PCS. In those cases where the sales offices have access to the PCS they can configure the products without assistance from technical support, where the product specifications are generated and a quotation is sent to the customer. However, in the cases where the sales offices do not have access to the PCS, the customer requirements are sent to the technical support that configure the product via the PCS and sends the quotation to the sales offices, which then forwards it to the customer.

In case of Light ETO products, the customer requirements exceed the solution space of the PCS. Therefore, the local sales offices need to be supported by the technical support in all cases. The product specifications are then created partly manually and partly automatically with the support from the PCS.

4.3. The impact from applying the PCS on resource consumption and lead-time

In order to estimate the impact from implementing and operating the PCS, the quantity sold over the years 2009-2013 is compared to the same quantity if PCS would not have been used. In total 276,267 pcs. were sold of CTO and Light ETO products over the five year period.

From information gathered from the company's ERP system the total quantity of product sold could be extracted. However, the sale is not categorized based on the different scenarios, therefore estimations were made based on a sample from historical data. It is estimated that CTO products configured by the sales offices count for 66% of the product sold, CTO products configured by the technical department count for 25%, and finally Light ETO products that are always configured by the technical support count for 9%. In Fig. 1, the distribution of CTO products (configured either at the sales offices or by the technical support) and Light ETO products are demonstrated.

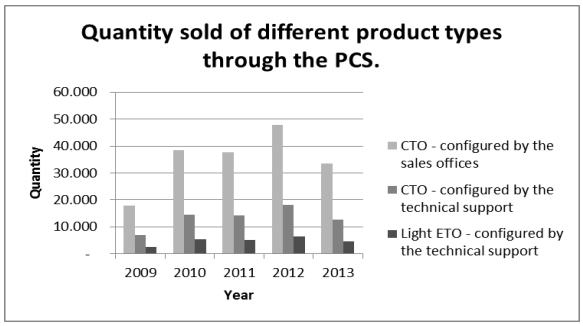

Fig. 1. Quantity sold of different product types through the PCS

In order to quantify the savings, the time spent on the product configuration process had to be evaluated both when the customer order processes is supported with PCS and when PCS is not in used to generate the products' specifications. It should though be noted that the time spent on the different scenarios could vary due to employees' capabilities and the complexity of the products. Therefore a minimum and maximum time for making the specifications time is given to increase the accuracy of the calculations. Furthermore, the distribution of the likelihood of the minimum and the maximum time is given. The time consumption to make the configuration for different scenarios is listed in Table 3.

Table 3. *Time consumption to respond to customer order before and after implementing the PCS*

Responsible for the configuration	**CTO** Local sales offices		**CTO** Technical support		**Light ETO** Technical support	
	Min	*Max*	*Min*	*Max*	*Min*	*Max*
Distribution *(hours)*	50%	50%	50%	50%	80 %	20%
Sales offices *(hours)*	0,20	0,58	0,13	0,25	0,13	0,25
Technical support *(hours)*	-	-	0,20	0,33	1,00	1,50
Engineering *(hours)*	-	-	-	-	0,08	1,00
Production *(hours)*	-	-	-	-	0,03	7,00
Distribution *(hours)*	-	-	-	-	0,05	0,08
Total man-hours *(hours)*	**0,20**	**0,58**	**0,33**	**0,58**	**1,30**	**9,83**
Quotation Lead-time *(days)*	**1**	**3**	**3**	**7**	**7**	**12**

The savings are then calculated by comparing the different scenarios to the time consumption without the PCS. As all CTO products were treated as Light ETO products prior to the implementation of the PCS. The time for Light ETO products is therefore used as an indicator for how much time the product configuration would have taken if not supported by the PCS. In order to make the calculations more conservative, it is assumed that no savings are gained in case of configuration of Light ETO products as it is only partially supported by the PCS. In Table 4, the calculation of the total average time consumption and the average quotation lead-time is given when the product configuration process is supported with PCS and when not supported with PCS.

Table 4. *Time consumption to respond to customer order before and after implementing the PCS*

	With PCS						Without PCS	
	CTO – local sales offices		*CTO – technical support*		*Light ETO - technical support*		*Light ETO - technical support*	
	Min	*Max*	*Min*	*Max*	*Min*	*Max*	*Min*	*Max*
Distribution	50%	50%	50%	50%	80%	20%	80%	20%
Total man-hours per order *(hours)*	0.20	0.58	0.13	0.25	0.13	9.83	0.13	9.83
Average time per order *(hours)*	0.39		0.46		3.01		3.01	
Total quantity sold 2009-2013 (pcs.)	175,699		66,553		23,960		266,212	
Total time spent on orders 2009-2013 (hours)	68,815		30,503		72,040		800,411	
Weighted average for total man-hours spent on orders 2009-2013 (hours)	**171,359**						**800,411**	
Quotation lead-time per order (days)	1	3	3	7	7	12	7	12
Weighted average for quotation lead-time per order (days)	**3,29**						**8,00**	

The lead-time for generating quotation has been reduced from an average 8.00 days to 3.29 days, which means that on average 4.71 days are saved. Furthermore, the time consumption for generating the quotation has been significantly reduced, where 629.052 man-hours have been saved due to the implementation and operation of the PCSs over the five years period. Assuming the average salary is 50 €/hour, that means that the company has saved 31,452,606 € in direct salary cost in the sales and the specifications processes over the five year period.

4.4. Increased quality products' specifications

In order to measure whether the quality of the product specifications have been improved by the implementation of the PCS, the errors that occurred in the specifications were measured. The errors are then grouped according to whether they were caused automatically by PCS or as a result of manual mistakes caused by employees. This analysis covers all the product specifications generated by the technical support at the company's headquarters, which is responsible both for automatically quotation generation by the use of PCS and manually when the requirements exceed the solution space of the system. In Fig. 2, the results from the analysis for the year 2013 are demonstrated.

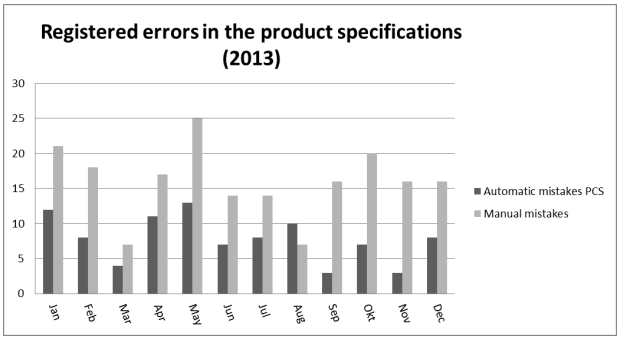

Fig. 2. The number of errors reported in 2013 dived into errors caused by as a results to manually mistakes and the PCS

It can be identified that in most cases the PCS causes less line returns per month than when the product specifications are generated manually. However, when the requirements exceed the solution space in the PCS, the products' specifications have to be generated manually. The comparison has therefore limitation, as the complexity of the products can be considered higher when the specifications are generated manually. The result nevertheless indicates that manual work leads to more errors. Based on interviews, specialists from the company, it is confirmed that the PCS leads to a higher data quality due to a standardized and guided structure. Furthermore, the explanations given, for the errors in the specifications generated by the PCS, were that the errors were not caused by the system itself but in most cases due to wrong input in the system. Therefore, it can be assumed that if not supported by the PCS, the number of error would be even higher,

4.5. Increased sales due to faster response time

Time and cost are critical aspects for the company to get the order. Therefore, the assumption is made that increased responsiveness in the customer order process can lead to increased sales. The increased responsiveness is measured through productivity of the employees and lead-time to respond to customer inquiry.

The increased productivity is a result of less man-hours required to respond to the customer order when using the PCS. The results show that for the same amount of sold products over the five years period (266,212 pcs.), with the use of PCS it would require 171,359 man-hours to respond to the customer and without the PCS 800,411 man-hours. That means that with the use of the PCS the productivity is increased by the factor of 4.67. Consequently, the assumption can be made that 4.67 times more resources are available to treat additional customer inquiries. As previously explained, prior to the implementation the technical support became the bottleneck in the sales process as a result of great number of orders going through the department. However, after the implementation of the PCS and increased standardization of the product range the number of orders going through technical support has been significantly reduced and the productivity has been increased. Therefore, it can be concluded is that the technical support not be the bottleneck in the customers' order process and the time to respond to customer order has been significantly reduced or from 8.00 days to 3.29 days, or on average by 4.71 days. Consequently, this

should reduce the threat of losing customers because to one of the competitors due to insufficient response time. If this factors would lead to just 1% increase in sale that would result in additional revenues of 4,152,892 € and 5% increase would lead to 20,764,458 € over the five year period.

4.6. Cost of development, implementation and maintenance of the PCS

In the development and implementation, numbers of different stakeholders are involved. After the development of the configuration model, it has to be tested, training sessions are needed, and licenses have to be bought in advance. Finally, both the system itself and the product data have to be maintained to secure that it is up-to-date. In this section, different cost factors associated with the development and the implementation, and operation of the system over the five years period (2009-2013) are elaborated. For the calculations of the cost factors, it is estimated that the salary cost is 50 €/hour, working week consist of 37 hours and 52 working weeks per year. In Table 5 the main cost factors are listed.

Table 5. *Cost factors from operating PCS over five years period*

Cost Factors by using PCS	**Amount**	**Unit**
Development		
Weekly workload	88.80	Man-hours
Duration of development (2 years)	104	Weeks
Total	9235.20	Man-hours
Total	461,760	€
Training and Software		
Estimated Total	300,000	€
Maintenance of PCS		
Weekly workload	92.50	Man-hours
Duration of maintenance (5 years)	260	Weeks
Total	24,050	Man-hours
Total	1,202,500	€
Maintenance of product data		
Weekly workload	34.00	Man-hours
Duration of maintenance (5 years)	260	Weeks
Total	8,840	Man-hours
Total	442,000	€
Total cost of development, implementation and maintenance	**2,406,260**	**€**

4.6.1. Cost of development and implementation

In the development and implementation process, there is a range of roles and responsibilities. Most of the workload is covered by two product configuration engineers each spending 80% of their time and product data engineer supervisor spending 20% of his time. Other responsibilities have less than 10% of their weekly workload involved but when summarized it correspond to one person working 60% of his time on the project. Therefore, in total about 88.8 man-hours per week were spent for the development of the configuration model. The development took two years, which results in a total workload of 9235.2 man-hours for the complete development of the system.

For the implementation of the configuration model, training for the PCS at different local sales offices is required. One specific person is responsible to manage the educational training both for the PCS and the ERP system at the company. The cost of the implementation and software that includes licenses as well software maintenance and upgrading was estimated to be around 300,000 €.

4.6.2. Maintenance

Besides, development and implementation work, the data maintenance of configuration models is another factors, which has to be taken into the account. The maintenance is categorized according to involved activities concerned with PCS software and the product data.

For the maintenance of the actual PCS models two persons working full time and on one person working 50% are allocated to the task. The weekly workload is therefore estimated to be 92.5 hours. For the time period of this study (2009-2013) result therefore in a total of 24,050 man-hours spent on maintenance of the software.

The maintenance of the data mainly covers product specific data of three different levels: sales offices, production sites and distribution centers. At each level, there is at least one product data engineer working in close collaboration with the configuration engineers, as the product specific data has to be constantly updated. Based on the interviews with the product data engineers, several estimations considering the weekly workload has been made. The workload for sales offices and the distribution centers is relatively low, estimated with 0.5% for each location. However, the production facilities have to allocate more resources. The total estimated man-hours per week are 34.0 for the maintenance of product specific data. In total, for the five years period studied, estimated man-hours would therefore be 8,840.

5. DISCUSSIONS AND CONCLUSION

In this study, significant benefits from implementing a PCS in a case company are identified. By comparing the direct cost savings in terms of reduced man-hours to the direct cost of developing, implementing and maintaining the PCS, it can be concluded that PCSs are highly beneficial for the company based on the five years period analyzed (2009-2013). The main benefits quantified in this study are summarized in Table 6.

Table 6. *Benefits from implementing PCS of five years period*

Benefits of using PCS	**Amount**	**Unit**
Cost savings based on saved hours (2009-2013)	31,452,606	€
Cost of development, implementation and maintenance (2007-2013)	2,406,260	€
Total savings (2009-2013)	**29,046,260**	**€**
ROI (in the first year after implementation)	477.76	%
ROI (five years after implementation, 2009-2013)	1207.12	%
Lead time savings in days (average)	4.71	Days
Factor more sales output through PCS	4.67	Factor

In addition to these benefits, comparing the mistakes caused by humans and the PCS indicates of improved data quality when quotations created automatically by the PCS. Finally, indications of increased sale and potential revenues due to faster response to the customers are identified.

In order to increase the benefits from operating the PCS at the company, serval facotors have been indentified. Implementation of automatic quotation generation is expected to provide savings from reduced workload of approximately 1.5 million EUR for the next 5 years in addition to improve the data quality even further. Finally, development of an external configurator frontend could lead to savings of over 21 million EUR for the next five years, while eliminating lead-time for generating the quotations.

The limitation of this study is that it only includes analysis of a single company. However, the findings are based on in-depth analysis at the company, which is based on historical data and interviews. The results have then been verified by numbers of specialists at the company. Hence, the results presented are believed to be generalizable for other companies operating a PCS to support their sales and design processes. Further studies will include quantifications of the cost and the benefits from implementing PCSs in other companies in order to verify the findings presented in this research. Furthermore, a targeted ROI needs further research, in order for companies to identify what should be the targeted ROI for PCSs projects.

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