Process Redesign for Liquidity Planning in Practice: An Empirical Assessment

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Abstract. The financial crisis has kept the world busy since 2007. The resulting difficulties in accessing liquidity and low interest rates on deposits strengthened the importance of proper liquidity planning. These challenges are even greater for globally spread enterprises in which currency-specific liquidity planning implies decentralized processes. These have to be coordinated within the local partitions such that proper and consistent overall financial planning is eventually ensured. Although extensive research has been conducted in the field of process redesign, most models lack applicability, either because of strict process restrictions or because they are too complex and, hence, hard to realize and communicate. To close this gap and to demonstrate the potential of business process redesign in practice, we *(i)* analyze the requirements of the financial planning domain to identify an appropriate redesign framework, and *(ii)* evaluate the impact of an industrially implemented process redesign with respect to process runtime and quality.

Keywords: business process redesign, financial planning, process quality, semi-structured processes.

1 Introduction

The financial crisis has kept the world busy from 2007 to the present day. As a result, the confidence in the creditworthiness of most enterprises, banks, as well as industrial corporations, suffered, and the risk premium for liquidity procurement rose. The fact that even large enterprises were hit by the crisis resulted in an increased awareness for the striking importance of a high credit rating to be able to access the capital market at reasonable costs. On the other hand, the governmental rescue measures induced cheap liquidity which accounted for low interest incomes and, hence, increased the cost of carry for companies that produce a liquidity surplus. The high risk premium along with the low interest on deposits strengthened the importance of proper liquidity planning, independent of a company's structure and size.

Certainly, it has been recognized long before the crisis that a precise forecast of business figures like sales, production and investments is essential to accomplish a correct liquidity and exposure planning and, thus, enables companies to cope with

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uncertainties as exemplified above [1-3]. However, the financial crisis made it painfully obvious how difficult it is, even for large and apparently established companies with solid business models and secure sales, to assure constant liquidity. These challenges are even greater for globally spread companies, since the relevant data for the central currency-specific liquidity plan is distributed amongst the local partitions. Each of these local departments is confronted with the complex generation of planning data driven by the multitude of distributed data sources like sales development, operative goals, or macroeconomic indicators, altogether summing up to an extensive process [4-5]. Hence, an efficient and effective global risk management requires the definition of company-wide standards with respect to the structure of the planning data. To eventually ensure the compliance with these standard and to guarantee a proper and consistent overall financial planning, the decentralized planning processes have to be coordinated within the local partitions and internal transactions between them have to be monitored by a central entity.

For this reason, the process of data transmission and validation accompanied by an intensive communication between local and global management is of utmost importance. Regardless of all challenges arising within complex company structures, the requirements placed on sensitive processes like financial management continuously increase [6]. Simultaneously, due to the constant pressure to reduce costs, the number of employees remains constant or reduces.

In order to tackle this challenge, multinational companies oftentimes opt for a corporate financial portal, including IT support for the process of centralized currency-differentiated liquidity risk-management. Such a portal can, for example, provide services like report upload and validation as well as other corporate services [7-8], e.g. monitoring, or communication services. Implementing such an information system, major challenges arise from *(i)* the high heterogeneity of applications and business processes within multinational enterprises due to historically grown structures as well as mergers and acquisitions and *(ii)* a potentially low willingness to change and to abandon known structures and workflows of employees [9].

Literature has brought about several approaches to redesign and improve complex processes, however most articles include either strong process restrictions or complex redesign procedures which are hardly applicable in practice. The approach evaluated in this work is the flexible *objective-based process redesign model* [10], which we were able to realize in a renowned, globally operating large company acting in the chemical and pharmaceutical sector. Driven by the fact that process redesign literature is mostly of theoretical nature, this work addresses the following two research questions:

RQ 1: Does the objective-based process redesign reduce process runtime in practice?
RQ 2: Does the objective-based process redesign increase data quality in practice?

Since June 2010, the redesigned processes are a part of our industry partner's daily routines which provides us with empirical evidence regarding RQ1 and RQ2.

The remainder of this paper is structured as follows: In the next chapter, we introduce the related work with respect to (semi-structured) process redesign and the measurement of routines and structures in business processes along with a broader motivation and introduction of the applied redesign model. Chapter 3 includes, besides the KPIs to be evaluated, the initial and final process structure as implemented at our industry partner along with a brief description of the technical implementation. In Chapter 4, we present the detailed evaluation of the realized redesign based upon real world data from our industrial partner. The evaluation includes a description of the sample data produced in two years of productive use, the applied methodology, and finally the results and their interpretation. Chapter 5 interprets and generalizes the results and experiences of the work at hand.

2 Related Work and Choice of Redesign Framework

Generally, business processes can be distinguished by their level of structure. In this vein, Deiters [11] distinguishes between structured, semi-structured, and completely unstructured business process as follows: structured processes are applied in standardized scenarios and, therein, the sequence of tasks and business rules is predetermined and prescribed. In semi-structured processes, some tasks are not ordered at all and some of the rules may be modified or added latter “on the fly”. Hence, only parts of the sequence of tasks and the business rules are structured. Finally, unstructured processes do not have any repeatable patterns at all, are executed spontaneously, and are difficult to automate.

To provide further insights into the characteristics of processes, lots of work has been performed on the analyses of processes’ structuredness. Pentland [12] introduces routines in business processes as a metric for the degree of standardization. Thereby, the identification of routine patterns allows for the definition of a lexicon per process and, hence, the comparison of different process parts. Furthermore, changes in the sequential execution of the identified process patterns reflect either development or variety and, thus, a lower level of structuredness in the process [13]. Rosenkranz et al. [14] try to derive a unique pattern base to compare different workflows and to detect joint aspects as a foundation for a process standardization approach.

However, their experiences in multiple case studies reveal complex challenges in redesigning business processes. In addition to these complex metrics for measurement and treatment of variety, recent academic work is strongly focused on either structured or unstructured processes. Van der Aalst [15], for example, introduced a framework to verify workflows which, however, only runs in a standardized scenario. Moreover, van der Aalst et al. [16] presented process support strategies for unstructured processes in which the unstructured parts of the process are handled as individual cases.

Academic literature also offers multiple criteria for an efficient process that can be applied as redesign goals: Reijers and Mansar [17] try to get rid of *(i)* unnecessary tasks, *(ii)* reduce contact and *(iii)* reduce waiting times. Moreover, Redman [18], presents solutions focused on *(iv)* task automation. In addition, the *(v)* focus on data quality is explicitly included [18]. Davenport et al. [19] enrich this data perspective by the need for *(vi)* data completeness. Data quality and completeness often depend on the process integration level. Therefore, van der Aalst and Weske [20] as well as Davenport et al. [19] claim the need for an increase of the level of integration. Finally, Balasubramanian and Gupta [21] present a structural metric for business processes containing most of the above-mentioned objectives.

The process of financial data integration focused on in this paper is a semi-structured process as financial planning data transmission and interaction processes are usually driven by historically grown organizational characteristics in multinational enterprises. Due to the variety of process characteristics, the process redesign and optimization in processes with numerous workflow patterns is a highly complex process [22]. To date, literature has put forth a large body of models and frameworks that tackle the measurement and classification of routines in processes and, hence, enable the classification of semi-structured processes and process redesign in general. Yet, they are all of theoretical nature and hardly provide hands-on advices for flexible redesign necessary in practical applications. To address this research gap and to equip practitioners with a flexible redesign model, Martin et al. [10] propose the *objective-based process redesign model*. It is an approach for semi-structured, non-standardized processes, which inherits both aspects from workflow management systems (WFMS) and case handling and integrates the idea of sequential patterns. The resulting Redesign Model combines the above-detected general objectives *(i) - (vi)* with shortcomings and constraints dependent on the specific application domain. Based upon the detected process pattern and the predefined objectives, Martin et al. [10] identify process shortcomings and define serviceable process units taking the constraints into account. Along with the proposed stepwise implementation of these services, their approach represents an agile redesign model which allows for a practical handling of the process to be redesigned.

3 Use Case

After having made a decision for the appropriate redesign methodology (cp. Section 2), this chapter introduces the use case that underlies this paper. Section 3.1 briefly describes the initial situation we came across at our industrial partner, followed by an introduction of the key performance indicators (KPIs) to be evaluated (cp. Section 3.2). This chapter closes with a short description of the implemented redesign realization and its effects in our partner's processes.

3.1 Financial Planning Process Prior to Redesign

As above-mentioned, financial planning processes in multinational companies are typically semi-structured. Fig. 1 shows the historically grown planning data delivery and validation process that is part of the actual planning process at our industry partner's site. It reflects the situation after introducing a financial portal as an interface between subsidiaries and holding, yet prior to any process redesign.

The process may be separated into three main layers, which represent the three roles involved in the planning data delivery. The first layer is the holding layer that is responsible for data integration. The holding exercises the central liquidity management function. The (enterprise) portal layer represents the gateway at which data is both delivered (by the subsidiaries, representing the decentralized data generation) and received (by the holding).

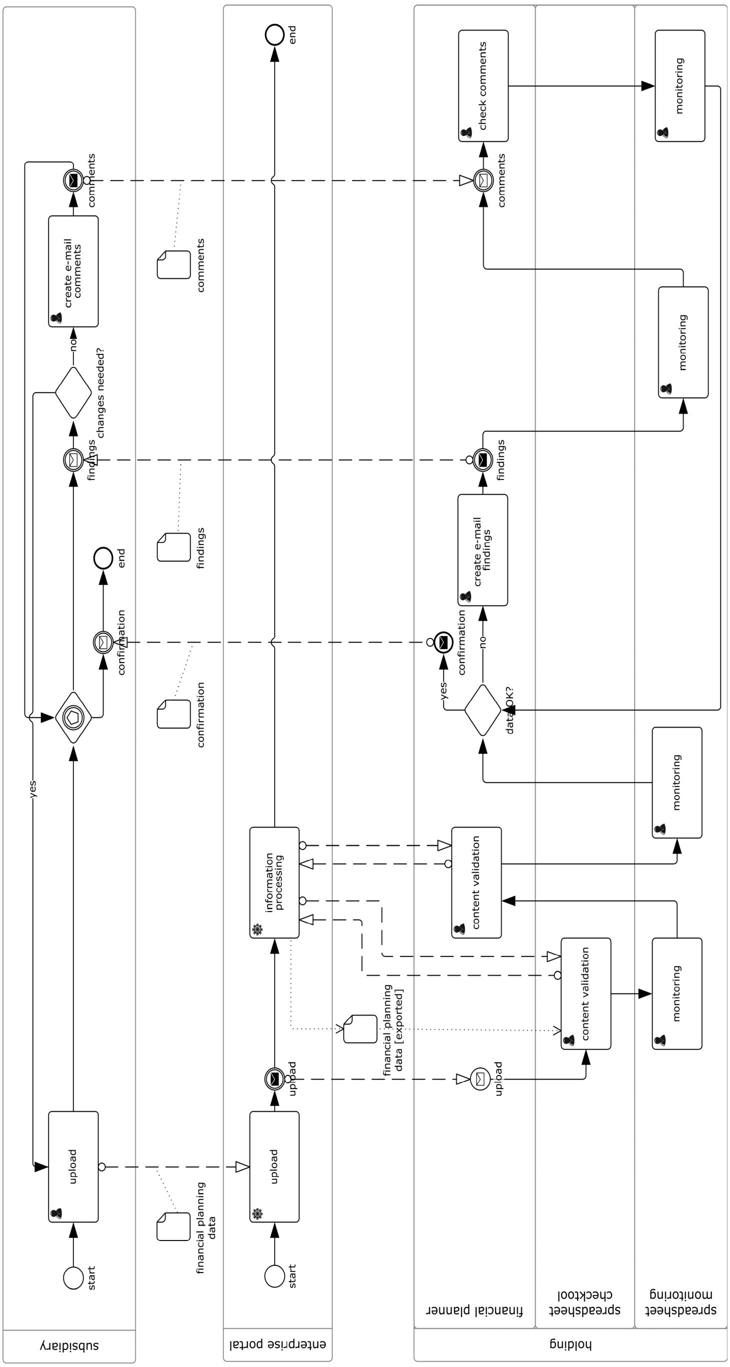

Fig. 1. Financial planning process prior to redesign. The Business Process Modeling Notation as the de facto standard in academic and practice communities for business process modeling is used for illustration [23-24].

The process as shown in Fig. 1 is initiated by the subsidiary which uploads a set of financial planning data. If the basic data structure is compliant with all business rules, an upload notification via email, addressing both subsidiary and holding, is sent. Receiving this email, a (human) financial planner performs a detailed, spreadsheet-based validation that goes beyond the structure of the data. If the financial planner does not identify any issues in the data, the subsidiary is informed by the holding and the process ceases. If issues are identified, they are communicated to the subsidiary via email. In this case, the subsidiary can either correct the reported issues or submit comments via email that justify the delivered data as-is. Data corrections trigger a new upload and validation process. If the data is still erroneous or the comment is declined, another feedback loop is initiated. Otherwise, the process is completed. During the complete process, the current status of the entities including information about validation results is documented in a monitoring spreadsheet.

3.2 Key Performance Indicators

As reflected in this work's research questions (cp. Section 1), the evaluation presented is focused on the *time* necessary to perform all process tasks and the *quality* of the process, i.e. the data output. As we do not aim at cost reduction but rather at decreased runtime and increased quality, costs are required to remain constant. Hence, they are considered indirectly through the KPIs related to runtime. For instance, waiting time reflects waiting costs.

Buchsein and Machmeier [25] and Kuetz [26] describe a set of KPIs for a best practice process. In order to validate the KPIs proposed in literature, we performed semi-structured expert interviews among knowledge workers at our industrial partner's site to ensure their practical relevance. The results are presented in Table 1 that is sub-divided into literature-based and expert interview-based KPIs.

Table 1. KPIs derived from literature and expert interviews

	Buchsein and Machmeier [25], Kuetz [26]	Expert interviews
Time	Processing Time (PrT), Waiting Time (WaT), Planning Time (PlT)	80% Resolution Time (ReT)
Quality	Number of Cycles (NoC) denoting increased communication	

The process time is expressed through the indicators *Processing Time*, *Waiting Time* and *Planning Time*. Waiting Time and Processing Time are considered from the holding perspective: Processing Time is defined as the time the holding is active. Such an activity is, for instance, the validation of the subsidiary's planning data. Waiting Time is defined as the time the holding is passive, that is, waits for a subsidiary's response. Finally, the Planning Time is defined as the sum of Processing and Waiting Time. In addition to these straightforward KPIs extracted from literature, the expert interviews suggested an indicator that documents the workload development of the knowledge workers both within the subsidiaries and the holding. The resulting *80% Resolution Time* represents the time interval between delivery deadline and the completion of 80% of the considered subsidiary's plan. Thereby, the 80% benchmark is a value derived within the expert interviews.

Furthermore, Kuetz [26] proposes the *Number of Cycles* to reflect data quality. The expert interviews revealed that data quality is likely to increase with the number of validations. Since each validation causes communication activities, an increased Number of Cycles is likely to highlight quality improvements. Based thereupon, we defined the Number of Cycles as an indicator to be increased or at least to be kept on a constant level.

3.3 Redesign Realization

In order to realize the redesigned process and to enable a generalizable implementation, we have created several modular, de-coupled service units based upon the service oriented architecture (SOA) paradigm. The components that facilitate the redesigned process are: *(1)* an upload and validation service, *(2)* a comment management service, *(3)* a Rule Engine and database, *(4)* a management service for risk and operations, *(5)* monitoring services, and *(6)* an underpinning technical infrastructure (for the detailed implementation cp. Martin et al. [27]).

To assure the agility of the redesign realization, Martin et al. [10] propose an iterative implementation of the above-mentioned services. Based upon that, Chapter 4 presents the evaluation of the conceptualization and implementation of the first service. Therein, data validation and the communication of the results are automated which results in a process as depicted in Fig. 2.

The automated data validations include both checks of *intra-subsidiary planning* and *inter-subsidiary planning* that were conducted manually prior to the redesign. The former denotes validations based on the planning data within a single subsidiary and related to only one single planning period. For instance, comparison of invoices and payments for a specific time horizon. The latter defines validations that take up data delivered by at least two subsidiaries, yet still relates to one single period. That is, for example, the consolidation of invoices issued and received between two entities. Along with the automated checks, the respective notifications of the validations have also been automated. Additionally, new and more sophisticated verifications of data deliveries over several planning periods (*inter-subsidiary/inter-period planning*) to further increase data quality, have been added.

4 Evaluation

In this section, the research questions

RQ 1: Does the objectives-based process redesign reduce process runtime in practice?
RQ 2: Does the objectives-based process redesign increase data quality in practice?

are evaluated via empirical data accumulated during the real-world application of the redesigned financial planning process at our industrial partner's site. Section 4.1 presents the underlying sample data, followed by a brief overview of the applied

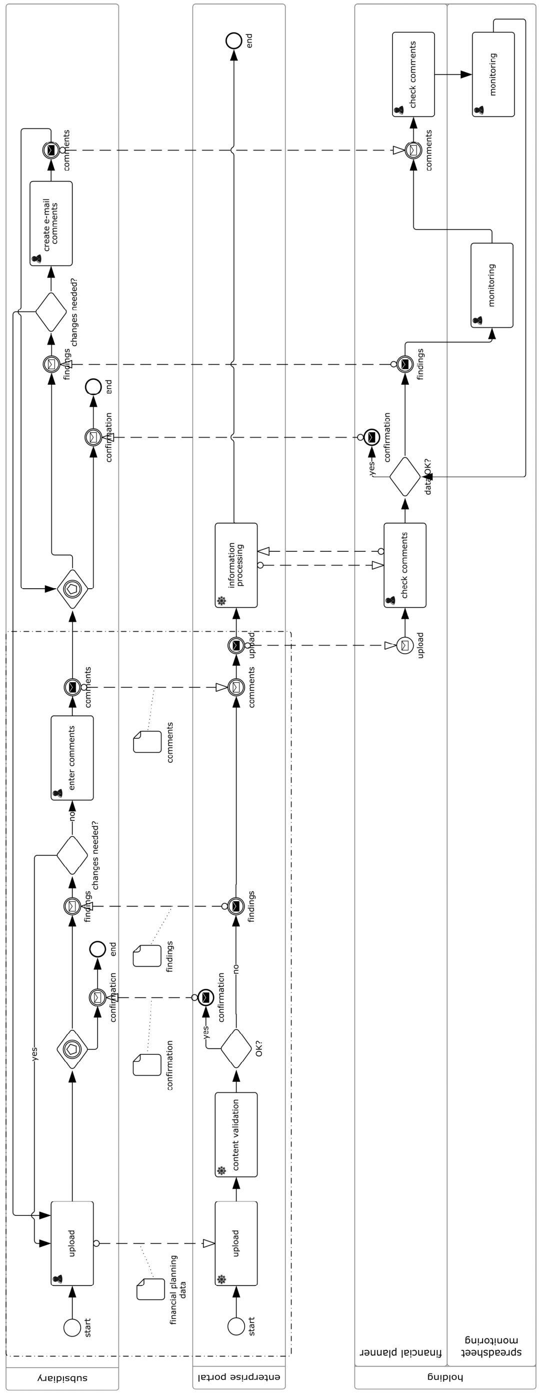

Fig. 2. Redesign Status – process after the redesign (automation of the data validation and the communication of the results)

methodology in Section 4.2. Section 4.3, as the major contribution of this paper, presents the statistical analysis of the empirical data. Chapter 4 concludes with an interpretation of the evaluation results and the implications to be drawn.

4.1 Data Sample and Preparation

The data that underlies our evaluation includes seven data deliveries, starting in June 2009. The data has been delivered in regularly recurring time periods as shown in Tab. 2. Therein, the number of delivering subsidiaries ranges between 99 and 113, owed to mergers and acquisitions that took place during the evaluated time periods. 89 subsidiaries constantly delivered data in all seven periods, which serves as the data basis for the following evaluation. Furthermore, the data sample comprises two data delivery eras: the *pre-redesign phase*, which includes four deliveries from June 2009 (06/2009) to November 2009, and the *post-redesign phase*, including three deliveries from June 2010 to November 2010. The data delivered in March 2010 was distorted due to redesign implementation activities that took place during this delivery period. Therefore, this data set was excluded from the evaluation. It is important to note that our industrial partner has not only incorporated the redesign approach for the conceptual reorganization of the planning process, but has also integrated the services into its daily business immediately after their implementation (three pre-redesign deliveries are included in the evaluation). The data set per period includes the entire email communication between the holding and all subsidiaries that provides a detailed documentation of the validation and communication process. The email communication contains both manually and automatically generated messages. Automated notifications include information about the upload status and the validation results, while manual messages query, for instance, further planning data explanations.

Table 2. Number of subsidiaries per data delivery during the evaluation. There is an overlap of 89 subsidiaries between the deliveries, i.e. they constantly delivered data from 06/2009 to 11/2010.

Delivery	06/2009	09/2009	11/2009	03/2010	06/2010	09/2010	11/2010	Overlap
# Subsidiaries	99	100	106	104	113	113	113	89

The emails are classified into *Email Sender*, *Email Receiver*, *Email Subject,* and *Email Date*. That way, one can distinguish whether the email was sent automatically or not, whether it was sent by the holding or the subsidiary, and when it was sent. In this vein, an email sent by the holding to a subsidiary marks the switch from Processing Time to Waiting Time. Automated notifications are treated as generated on holding side, therefore, they also belong to this category. An email sent by a subsidiary marks the opposite switch, accordingly.

Since the structure of the data sample is essential for the correct choice of statistical analyses, a careful examination of the data is required. According to the

Shapiro-Wilk test for normality in SPSS 19, the distribution of the Planning Time is significantly non-normal (pre-redesign phase, $W(267) = 0.72$, $p < .001$; post-redesign phase, $W(267) = 0.68$, $p < .001$) and hence non-parametric interferential analyses have to be conducted (cp. next section).

4.2 Methodology

Clustering: In the context of a multinational enterprise, our expert interviews have revealed that a time reduction of one or two working days has only a small business impact. To increase practical relevance, we changed the data structure from working day intervals *to working weeks*. In more detail, the original data (measured in working days) has been transformed into the corresponding *number of working weeks after deadline* with a cap at the end of the fifth week to exclude extreme outliers. The transformation is defined by the following function:

$$t : R_+ \to \{1,2,3,4,5\}, t(x) = \begin{cases} \left\lfloor \frac{x}{5} \right\rfloor + 1 & if\ 0 \leq x < 20 \\ 5 & else \end{cases},$$

where $\lfloor\rfloor$ denotes the floor function. Based upon the resulting values $v \in [1,5]$ we can calculate the average number of working weeks (compared to working days). The clustering is, however, not applicable to the Number of Cycles, since NoC is measured in a different unit, and the 80%-Resolution Rate, which is a strongly aggregated value per definition. As we focus on working weeks where possible, we perform an inferential analysis on the clustered values only.

Comparability and Seasonal Regression: Planning data generation depends on multiple inputs, some of which include seasonal effect. At our industrial partner, for instance, new controlling numbers for the following year are available in November which are included into the forecast generation. Therefore, the information available for planning is not constant for all periods which requires a differentiation of the planning data by its delivery period. To avoid any mistakes caused by these seasonal effects, we proceed twofold: *(i)* we compare values of the same month (in 2009 and 2010), and *(ii)* we increase the comparability within one year through a seasonal regression. It is based on the additive component model as it can be found, in standard literature. In this manner, we are able to compare values of the same year and between the years.

Non-parametric Analyses: For the inferential analysis we conduct the non-parametric Wilcoxon signed-rank test as the compared two data samples always include the same subsidiaries and the data sample distribution for all phases are non-normal (cp. Section 4.1). Based upon this inferential analysis we examined the deviations between the pre-redesign values in 2009 and the post-redesign values in 2010. According to Field [28], we always add the 1- tailed level of significance p and the test statistic T (denoting the smaller value of the two rank sums) to the reported absolute value.

4.3 Results

In this section we present the detailed evaluation results of the productive use of the "Upload and Validation Service" at our industrial partner using the sample data and methodology described in Sections 4.2 and 4.3.

Tab. 3 shows the results for the average Number of Cycles (NoC) and the average Processing Time (PrT). The latter is listed on a working day basis and on a working week basis (clustered). For each delivery period, Tab. 3 shows the KPI's values of 2009 and 2010 along with the relative deviation Δ(09,10). In addition, the overall line prints out the aggregated results over all planning periods per year, representing the average over 267 subsidiaries.

Table 3. Evaluation results: absolute KPI values (Average Number of Cycles, Average Processing Time unclustered and clustered) for 2009 and 2010 along with the relative deviation and the 1-tailed significance level (**p* < .05; ***p* < .01; and ****p* < .001).

KPI / Period	Average Number of Cycles			Average Processing Time			Average Processing Time Clustered		
	Value 2009	Value 2010	Δ(09,10)	Value 2009	Value 2010	Δ(09,10)	Value 2009	Value 2010	Δ(09,10)
Jun	1.90	1.89	-1%	3.68	1.91	-48%	1.51	1.21	-19%**
Sep	1.48	1.72	+16%	2.82	1.51	-47%	1.40	1.16	-18%*
Nov	1.66	1.91	+15%*	3.03	2.01	-34%	1.42	1.24	-13%*
Overall	1.68	1.84	+9%*	3.18	1.81	-43%	1.44	1.20	-17%***

Table 4. Evaluation results: absolute KPI values (Average Waiting Time, Average Planning Time, both clustered, and 80%-Resolution Time) for 2009 and 2010 along with the relative deviation and the 1-tailed significance level (**p* < .05; ***p* < .01; and ****p* < .001).

KPI / Period	Average Waiting Time Clustered			Average Planning Time Clustered			80% Resolution Time		
	Value 2009	Value 2010	Δ(09,10)	Value 2009	Value 2010	Δ(09,10)	Value 2009	Value 2010	Δ(09,10)
Jun	1.73	1.56	-10%	2.38	1.92	-19%**	18	13	-28%
Sep	1.44	1.38	-4%	1.91	1.67	-12%	15	11	-27%
Nov	1.56	1.39	-11%	2.00	1.72	-14%*	14	9	-36%
Overall	1.58	1.45	-8%*	2.10	1.77	-16%***	16	11	-30%

Starting with the average NoC, Tab. 3 indicates no deviation in June, however, clear increases of NoC in September (16%), November (15%) and in the overall numbers (9%). NoC in November (Overall) is significantly higher in 2010 than in 2009, with $T = 497.50$, $p < .05$ ($T = 3678.50$, $p < .05$). For the average PrT (working days), the improvement through redesign varies from 34% in November to 48% in June. For the clustered average PrT, the improvement ranges between 13% and 19%. The PrT is significantly lower in 2010 than in 2009 for all four observations,

$T = 73.50$ and $T = 192$, $p < .05$ in September and November, $T = 119$, $p < .01$ in June and even $T = 1079.50$, $p < .001$ in Overall.

Tab. 4 is structured analogously to Tab. 3. The Average Waiting Time (WaT), the average Planning Time (PlT) and the 80% Resolution Time (ReT) clearly decreases for all periods in 2010 compared to 2009. For WaT, the reduction ranges between 4% in September and 11% in November. The relatively small reduction in September is likely to be caused by the small absolute value (1.44 and 1.38 working weeks). Moreover, the Overall WaT 2010 is significantly lower than in 2009, $T = 1723$, $p < .05$. The average PlT improves from 12% to 19% after the redesign. Again, Overall PlT 2010 is significantly lower than Overall PlT 2009, $T = 365.50$, $p < .05$ in November, $T = 317$, $p < .01$ in June and even $T = 2905$, $p < .001$ in Overall. Finally, ReT indicates a strong workload reduction. In 2009, ReT varied from 14 to 18 working days. In 2010, the highest value was observed in June with 13 working days. With respect to the Overall ReT decreasing from 16 to 11 working days, we can observe a reduction of one entire working week (which equals 30%).

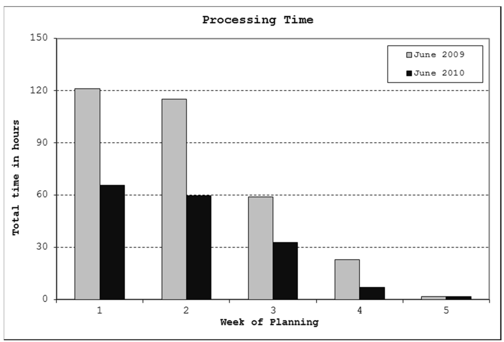

Fig. 3. Processing Time in hours per week after delivery deadline. Comparison between June 2009 and June 2010.

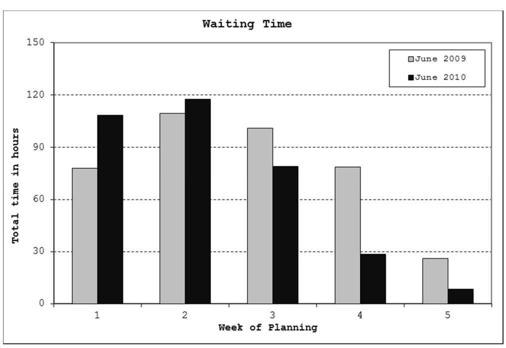

Fig. 4. Waiting Time in hours per week after delivery deadline. Comparison between June 2009 and June 2010.

We now turn our discussion to the results in Fig. 3 and Fig. 4 that illustrate the changes in PrT and WaT for the first delivery after the "Upload and Validation Service" was entirely rolled out (June 2010). They depict the working hours per week for the first five weeks after the delivery deadline. According to the original values printed out in Tab. 3, the PrT in June 2010 decreased by 48% compared to the values measured in June 2009. This development is clearly reflected in Fig. 3. In addition, Fig. 4 illustrates the reduced WaT in June 2010 which decreased by 10% compared to June 2009. Fig. 4 shows a second development which is certainly worth discussing: the WaT workload's balance point shifts to the left, from approximately 2.7 in 2009 to approximately 2.1 in 2010. This shift towards the delivery deadline is a direct consequence of the reduced Processing Time. The subsidiaries receive the results of the holding validations earlier than before and, hence, can start to work on their response earlier, too. The Planning Time as the sum of PrT and WaT is consequently affected by both above-described effects. Since the shift of WaT towards the delivery deadline suggests that the validation process itself relocates, the ReT as the KPI to express a workload reduction or increase, is considered. Fig. 5 depicts the development of ReT for the six deliveries from June 2009 to November 2010 for *(i)* original values and *(ii)* for deseasonalized values (cp. Section 4.2 for more details on the seasonal regression applied).

The original values show a nearly linear decrease of ReT, from 18 working days in June 2009 to 9 working days in November 2010. If we are able to show that seasonal effects are present within the different delivery periods, a deseasonalized view of the data is appropriate. This is the case for the underlying data: ReT is calculated based upon PlT (cp. Section 3.2) and the aggregated 2009 and 2010 values for September significantly differ from the aggregated values for June (T = 1084,50, p < .01). The same holds for the aggregated November values, which also significantly differ from the June values (T = 1544, p < .01). Hence, it is legitimate to perform a seasonal regression on the ReT values. The result is depicted on the right side of Fig. 5 – the level of ReT before redesign (2009) is an entire working week higher than after redesign (2010), decreasing from an average of approximately 16 working days to an average of approximately 11 working days.

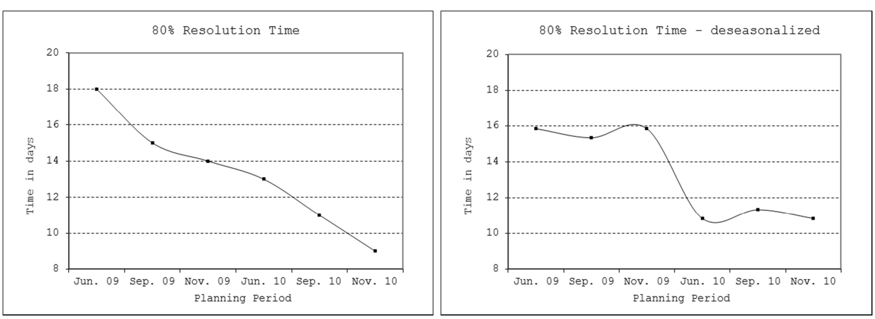

Fig. 5. Time necessary to finish 80% of the subsidiary plannings in working days. The original values are shown on the left side, the deseasonalized values are shown on the right side.

At large, all time-related KPIs (WaT, PrT, PlT) are significantly lower in 2010 (overall) than in 2009 ($T = 1723$, $p < .05$ for WaT, $T = 1079.50$, $p < 0.001$ for PrT, $T = 2905$, $p < .001$ for PlT). This reduction comes along with a one working week decrease in ReT. This improvement of all time-related KPIs is even more striking when we look at NoC at the same time. NoC, and hence the communication activity between subsidiaries and holding, increased significantly in 2010 (overall) compared to 2009 (overall), $T = 267$, $p < .05$. In the following section, we discuss these findings and their implications, thereby also taking the industry perspective of our partner.

4.4 Interpretation and Implications

The evaluation presented in this paper provides strong and significant improvements caused by process redesign in the financial planning domain. We are aware of potential biases in the data which may, for instance, be caused by organizational changes. Nevertheless, including the significantly increased NoC in November and additional expert interviews that were conducted after the study, we can definitely demonstrate the increased communication activity in September 2010 and November 2010. This activity is caused by the realization of intra- and inter-subsidiary as well as inter-period planning validations. Such an extension of quality assurance measures would not have been possible without reducing the process runtime. It provides knowledge workers (who are the holding's financial planners) with additional capacity to perform valuable other tasks such as more sophisticated validations. These have, in turn, a huge potential to further improve liquidity management. Remarkably, the improvement of all time-related KPIs is striking even though the above-mentioned, new and probably time-consuming extended validations came into effect in March 2010. The reduction in process runtime unleashes valuable capacity and, hence, generates measurable business value.

Undoubtedly, the most important contribution of the evaluation performed in this work is its ability to actually quantify the benefit of a theoretical redesign model proposed in academia by implementing it in a *real-world setting of substantial business impact*. To date, such a redesign model has neither been implemented and integrated in business-relevant processes in a large company that acts worldwide nor been run over a significant time, producing a large set of real performance data.

5 Conclusion and Outlook

This article identified the requirements of redesigning semi-structured processes. Based upon that, the *objectives-based process redesign* [10] was chosen as the appropriate approach to put redesign into practice. We have implemented the proposed measures at our industry partner, a globally acting, large enterprise in the chemical and pharmaceutical sector, including a short note on its technical implementation ”as-a-service”. In this use case, we identified evidence to quantify the positive effects of the objectives-based redesign model. That way, we were able to show that theoretical redesign models cannot only be successfully realized in highly relevant domains and enterprises, but also have the potential to significantly improve process time and data quality.

We scrutinized several key performance indicators of the financial planning process prior to and after its redesign to show and substantiate these findings. The core results of the evaluation demonstrated a reduction in Processing Time of up to 48% in working days and 19% in working weeks. Interferential analysis showed significant results for all deliveries in overall data. Moreover we showed an improvement of the overall Planning Time of up to 19% which is again significant for three of the four regarded data samples. These changes in Planning Time are strengthened by the KPI 80% resolution time. Here, we observed a reduction of up to one entire working week. These results clearly and favorably answer RQ1 (Does the objectives-based process redesign reduce process runtime in practice?)

Certainly, several business-related benefits for industry partner come along with the evaluation results (for detailed explanation cp. Section 4.4). Most importantly, the reduced Processing Time has unleashed resources that allowed for additional validations to increase financial planning accuracy and quality. The quality improvements yielded by the additional validations are strongly indicated by the significant NoC increase of 15% in November 2010 compared to November 2009. These findings provide a very strong indication to also positively answer RQ2 (Does the objective-based process redesign increase data quality in practice?). However, in order to be fully able to confirm RQ2, we will evaluate the results of future redesign iteration and service roll outs (cp. Section 3.3).

Critically assessing our approach, we were only able to implement iterations of the redesign model within one single enterprise so far. Nevertheless, our industry partner can be rated as archetypal for multinational enterprises and the challenges that arise from this kind of company structure. To enrich the practical experiences with the objective-based process redesign model, future work contains, besides the complete roll out of the implemented services, further evaluation cycles in intervals of one year to document the long-term effects of the redesign.

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