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Conference Paper

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Provided in Cooperation with:

Governance Research and Development Centre (CIRU), Zagreb

Suggested Citation: Baćun, Dinko (2019) : Temporal Anomalies in Budgetary Cost Control of Municipal Corporations, In: Tipurić, Darko Hruška, Domagoj (Ed.): 7th International OFEL Conference on Governance, Management and Entrepreneurship: Embracing Diversity in Organisations. April 5th - 6th, 2019, Dubrovnik, Croatia, Governance Research and Development Centre (CIRU), Zagreb, pp. 27-40

This Version is available at:

<https://hdl.handle.net/10419/196071>

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Temporal Anomalies in Budgetary Cost Control of Municipal Corporations

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Abstract

The last financial crisis revealed anomalies in corporate ability to face adverse economic conditions and fast exchange of new developments. Relying mostly on accounting data for budgetary cost control, the Management found that the data, although fiscally correct and valid for strategic assessment and outside reporting, was too old for tactical business decisions. Budget costs are traditionally tracked through End of Month report. But, the data that is fed into accounting is of different age. There is no consistent synchronized set of data, at any single point in time that could be used with confidence. When the synchronization is finally reached, the data is a post mortem analysis of a past point in time which cannot help in establishing current cost position. This is in particular true in a holding company with multiple subsidiaries where results are reported with arbitrary lags that are favorable to a particular business unit.

This paper analyses time lag of accounting data in a large municipal holding subsidiary over the period of 10 years. The results show that in the last five years, almost half of the financial End of Month Reports failed to include between 30% and 78% of the costs for a particular month. The paper further proposes a model of an information system, that touches both inside and outside the accounting, enabling run time current data reporting. An early warning system, oblivious of subsidiary or departmental boundaries, detects the breach of set tolerances and alerts immediately selected professionals of new developments, increasing corporate accountability at all altitudes.

Keywords: *Budgeting, Cost control, Information system*

Track: *Management*

Word count: 7.052

1. Introduction

Adverse economic conditions in the past decade forced enterprises to search ways to improve performance and reduce costs. New technologies introduced a level of speed in communication that made new business conditions emerge at a rate that was difficult to follow. Enterprise managers at all altitudes were forced to make operational decision frequently and swiftly.

Since the beginning of information age, accounting was first to exploit the benefits of computer data processing. Many of the traditional accounting tasks dealing with recording and processing of accounting transactions could be reliably automated (Hunton, 2002) reflecting accountants worth in higher-order critical-thinking skills. Automating accounting improved managerial decision making process but no evidence was found that it improved performance evaluation process (Sajady, Dastgir, Nejad, 2008). System integration is one of the important factors in fluid document flow inside the company and it is directly associated with perceived system success (Chapman, Kihn, 2009).

The abundance of data and complexity of information systems that was provided to them, led to managerial overconfidence in corporate decision which consequently produced suboptimal results (Malmendier, Tate, 2005).

Organizational effectiveness and efficiency are greatly determined by the quality and timeliness of organizational intelligence and decision making (Galliers, Leidner, 2014) which are directly affected by computer assisted decision aiding technologies.

Information systems are often very large and complex and control of their Management Control packages does not imply straightforward decision-making. Numerous challenges emerge in the process of using such data (Malmi, Brown, 2008). One of the problems is the impact of information overload, the information diversity and its repetitiveness. The impact of data overload on the quality of decisions made is significant (Hwang, Lin, 1999).

The managers soon found out that data abundance introduced doubts to the quality of data that supports decision making process. Research showed that data they rely on is too old, and more than that, data used in decision process was of different age, and as such, could not represent true company position in any single point in time.

Oracle (2011) led a research among 1500 companies trying to assess the challenges in decision making that managers face at all altitudes. They found out that data used for decision making is 4.2 months old and that 28% of the managers don't even know the age of the data. It takes them on average 1.7 month to become aware of new business or market conditions. It takes almost 18 months to amend a failing business process and 83% of the managers admit such a poor agility produces consequences, 55% incur unnecessary costs and 43% witness a negative impact on employee morale.

In municipal utilities companies, cost control is implemented with budgeting techniques. Utilities involving construction use project cost management to estimate, budget and exercise cost control. Two main indicators are used to establish the progress and health of the project: Schedule Performance Index (SPI) and Cost Performance Index (CPI) (ANSI,

Accounting is the source of financial reports used for decision making and traditionally the company's financial position is established monthly in the End of Month report based on transactions recorded in General Ledger (GL). This is why accounting personnel are doing their best towards the end of the month, to include all the transactions they can, so that data presented to the management would be most accurate.

The Accounting cannot carry out transaction posting to General Ledger without establishing the correctness of data. This is done by a verification process that reflects the complexity of business processes involved and the number of participants in the process. In construction this often means that particular transaction details have to be verified by multiple participants stationed in multiple dislocated business units, which implies different verification times. This results in General Ledger data which is not consistent in any single point in time. Accounts Payable is especially susceptible to such an environment. In the data sample of this study, there were four times as many inbound invoices than outbound. This means that the costs assessment for a particular point in time is tainted and hence the profit projections unreliable, which is consistent with Oracle study where 82% of businesses admitted not having complete visibility into the profits by line of business.

Intentional and unintentional managerial misrepresentation of financial reports used to prepare financial statements is more common if, as this paper shows, it is difficult to determine the exact cost position of the company. This often leads to overstatement of earnings (DeFond, Jiambalvo, 1991).

The documentation lag in time of different proportions was called Cognitive Time Distortion by Von Scheele and Haftor (2015). In their paper they conclude that even a moderate time distortions cause significant deviations in budgeted profit as well as causing large delays.

This paper proposes that the delays of invoice visibility in General Ledger financial reports in a municipal construction company are of such magnitude that they make significant impact to managerial decision making process. An alternate approach is presented, that eliminates cost visibility delay giving accurate cost assessment at any point in time, and as such, can effectively complement traditional financial reporting.

2. Methods

The purpose of the study was to test the significance of the delay between cost detection and its appearance in financial reports to assess the value of financial data that managers use to reach tactical business decisions. The focus of the study was cost data which is based on invoices in Accounts payable. There is a lag between the appearance of the inbound invoice and the moment it appears in financial reports of the General Ledger.

Data used in the study was obtained from everyday business life of a municipal company, a subsidiary of a large municipal holding company. The holding has sixteen subsidiaries and owns another eight companies and one institution. It employs a total of eleven thousand employees.

The records were extracted from carpio-ERP information system, which was implemented in 2005. Every document that enters the company is registered upon entry with a unique ID. It then circulates different departments in the company, until verified and ready to be included in General ledger and thus, visible in financial reports. The system detects the date of the document transfer to General ledger. Once that an invoice reaches General ledger there is practically no delay, because it is committed daily to proper accounts.

For stability of the study, the first two years of the system use were not considered (Hall, 2012) (Spathis, Ananiadis, 2005) and the study includes received invoices from 1st January 2007 to 31st December 2016, a period of 10 years. For each invoice in Accounts Payable, the date of the invoice was compared to the date it was transferred to General Ledger and delay was calculated. A total of 129.335 were considered, and 1546 were rejected due to defective dates. The same analysis was done for the 29235 invoices in Accounts Receivable.

The data analysis was performed during the third quarter of 2017.

The delays were grouped into four different groups that seemed relevant: up to 10 days, 11 to 20 days, 21 to 30 days and more than 30 days of delay. Both the number of invoices in each group was examined, as well as their financial value. The VAT was stripped from the invoice so that true costs could be assessed. Maximum delay in each year was detected and average delay for the year calculated.

Data was analysed at the yearly level but to verify tactical value of the data, an analysis for each month during this period was also performed. This was needed to understand the reliability of the data that the Management faces when it needs to reach a decision each week or month. As the cost assessment is mostly based on monthly financial balance report, it is important to asses that all the costs are reliably evaluated.

3. Results

The results were collected into twenty five tables of data which are summarised in Table 1.

Year	Total No of invoices	Valid invoices	Returned invoices	Delay up to 10 days	Delay up to 20 days	Delay up to 30 days	Delay > 30 days	Max days	Average delay	% up to 20
	1	2	3	4	5	6	7	8	9	
2007	14.835	14.701		3.881	4.446	2.263	4.111	449	25,54	56,64

Year	Invoices Tested	Correct Values	Rejected	0-10 days	11-20 days	21-30 days	Over 30 days	Max Delay (days)	Average Delay (days)
2008	14.549	14.529	378	3.509	4.288	2.464	4.268	363	25,94
2009	13.856	12.677	226	5.891	1.972	3.000	1.814	288	17,31
2010	12.446	12.398	167	5.805	2.104	2.582	1.907	273	16,49
2011	13.957	13.951	143	7.142	2.132	3.047	1.630	306	15,29
2012	14.650	14.641	118	6.231	2.272	3.096	3.042	286	18,19
2013	14.536	14.500	131	3.698	1.932	3.325	5.545	350	25,03
2014	10.817	10.801	37	2.787	1.856	3.216	2.942	284	21,97
2015	9.622	9.558	68	1.343	1.704	3.172	3.339	297	27,24
2016	10.067	10.033	112	2.377	1.969	3.213	2.474	327	22,14
Totals	129.335	127.789		42.664	24.675	29.378	31.072		

The table shows the number of invoices that fall in different groups of delay. A delay for a single invoice is calculated as the number of days between the date the invoice entered General Ledger and the date of the invoice. There is a little, but, for the purpose of this study, insignificant difference between the actual invoice date and the day it was received by the subsidiary. Column 1 shows the number of invoices tested and column number 2 the number of invoices that had correct values and were considered as study data. Column 3 represents the number of invoices that entered the system, but were later returned to the supplier because they were rejected in one of the verification steps. Column 4 to 7 represent the number of invoices that had a delay in range of up to 10 days, 11 to 20 days, 21 to 30 days and over 30 days respectively. For each year the maximum delay of an invoice is calculated and shown in column 8. The average delay in days is shown in column 9.

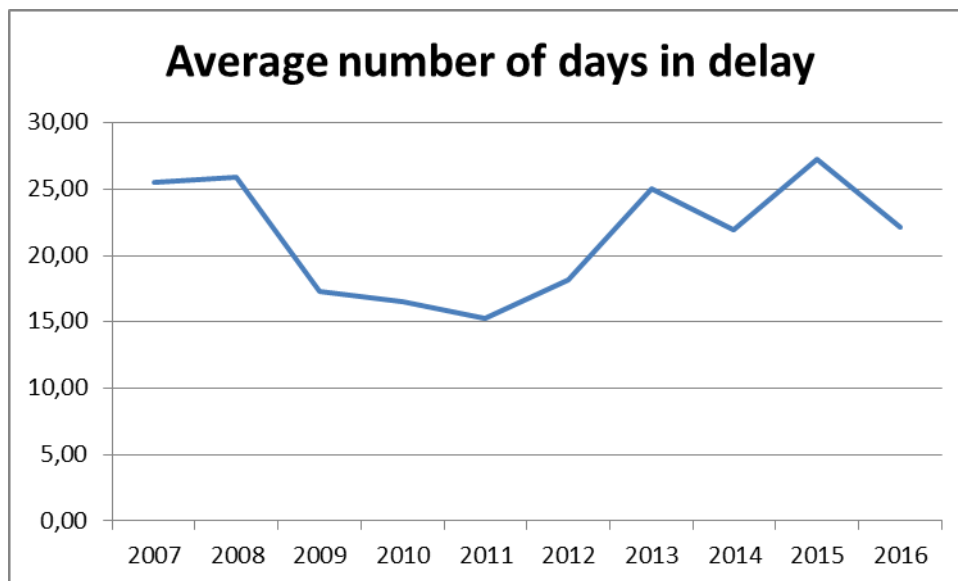


Figure 1: Average number of days in delay

Column 8 from Table 1 was plotted in Figure 1 to show the behavior of the delay across the whole period.

Mon/Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Jan	10,41	48,84	9,67	10,31	11,27	15,17	16,14	22,75	34,69	21,72
Feb	9,38	39,05	14,42	13,47	11,12	15,98	13,42	14,12	28,28	25,47
Mar	14,94	35,11	20,62	24,86	18,66	17,86	20,71	17,17	27,37	24,93
Apr	20,09	30,97	18,34	12,05	17,24	15,41	23,27	22,17	26,64	21,78
May	28,54	24,53	20,39	16,66	17,78	22,57	26,86	25,30	28,60	24,39
Jun	28,87	23,10	21,08	21,50	17,29	21,91	25,92	23,51	33,31	26,07
Jul	48,45	29,18	17,33	25,14	16,99	16,08	34,87	30,35	29,06	23,96
Aug	31,98	22,07	21,50	15,50	15,84	17,20	31,27	25,04	28,79	23,52
Sep	28,12	29,82	28,57	20,49	16,95	28,44	34,38	22,97	25,75	20,35
Oct	38,11	13,36	12,52	14,70	14,30	21,00	30,49	26,74	22,67	22,40
Nov	27,77	12,19	12,09	12,09	13,38	15,19	29,07	21,74	22,19	19,03
Dec	11,43	8,39	11,23	9,79	11,31	10,24	9,48	13,49	20,69	14,32

Table 2. shows delay in days for each month during the observed period. Highlighted in red are delays over 30 days.

	No of invoices tested	Up to 10 days delay	11-20 days delay	21-30 days delay	Over 30 days delay	% of over 30 in total number of invoices
	1	2	3	4	5	6
Jan	530	52	44	138	294	55,47
Feb	723	125	148	111	338	46,75
Mar	884	84	160	453	186	21,04
Apr	912	198	145	204	363	39,80
May	935	82	205	362	282	30,16
Jun	813	30	146	218	415	51,05
Jul	849	111	131	270	333	39,22
Aug	846	55	195	382	206	24,35
Sep	818	101	139	200	368	44,99
Oct	761	167	114	399	78	10,25
Nov	773	166	160	182	262	33,89
Dec	778	172	117	253	214	27,51
Totals included	9622	1343	1704	3172	3339	

Table 3 summarizes the number of invoices in delay groups for the year 2015. There is a 0,66% difference between the number of tested invoices and the number that was actually taken into accepted data. Again, columns 2 to 5 show the number of invoices that fall into a particular group. Column 6 shows the percentage of “Over 30 days” group in the total of invoices in a particular month. Data for January 2015 shows that out of 530 received invoices, 294 were submitted to General Ledger after 30 or more days. In column 6, the rows with more than 30% of “Over 30 days” group were highlighted with yellow background.

	Monthly total ammount	Up do 10 days delay	11-20 days delay	21-30 days delay	Over 30 days delay	Average delay (days)	% of Over_30 group
	1	2	3	4	5	6	7
Jan	11.611.781,61	4.384.827,76	524.778,29	2.380.030,34	4.324.686,24	34,69	37,24
Feb	14.405.311,01	7.744.988,94	1.777.395,59	648.131,64	4.232.851,84	28,28	29,38
Mar	14.614.871,46	1.715.322,16	2.897.203,90	8.099.836,69	1.909.343,59	27,37	13,06
Apr	15.200.245,58	1.483.077,95	3.199.741,95	4.156.297,86	6.360.236,28	26,64	41,84
May	11.889.594,97	484.044,61	1.426.594,19	6.312.760,33	3.663.847,66	28,60	30,82
Jun	16.019.109,04	57.630,58	2.850.852,84	4.280.320,76	8.859.324,95	33,31	55,30
Jul	14.725.039,77	2.415.543,80	2.403.132,52	3.441.553,37	6.064.017,83	29,06	41,18
Aug	16.330.865,03	1.877.705,62	2.800.159,92	7.647.554,31	3.893.156,23	28,79	23,84
Sep	13.181.082,43	418.208,57	2.666.482,31	3.358.024,23	6.397.000,49	25,75	48,53
Oct	12.345.514,14	2.468.031,44	2.141.119,34	6.782.979,34	954.786,05	22,67	7,73
Nov	15.606.851,51	4.613.381,89	3.669.843,46	3.063.236,21	4.259.954,95	22,19	27,30
Dec	19.338.279,34	4.880.287,03	3.049.590,65	6.299.311,78	4.540.305,38	20,69	23,48

In Table 4, the number of invoices from Table 3 was substituted by their accrued amount in each group. The data is represented for the year 2015. Column 1 contains the total of invoices received (stripped of VAT) for each month. Columns 2, 3 and 4 represent the accrued amount for each test group, namely all the invoices with delays up to 10 days, 11-20 days, 21-30 days and over 30 days respectively. Column 6 is duplicated from 2015 column of Table 2 for reference and represents the average delay for a particular month. Column 7 contains the percentage of “Over 30” group in monthly total, the ratio of column 5 and column 1. It says how much of the monthly payables total arrived into General Ledger after more than 30 days. The percentage above 30% is highlighted in yellow.

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Jan	2,55	39,62	13,47	5,39	19,77	21,43	6,53	13,24	37,24	2,35
Feb	4,15	65,93	12,63	5,95	12,96	34,24	37,21	26,79	29,38	35,07
Mar	13,85	53,84	15,24	18,71	21,77	32,53	21,91	20,75	13,06	1,7
Apr	11,72	67,95	21,67	17,73	15,41	14,48	46,36	53,2	41,84	39,49

May	31,55	60,49	23,56	13,15	27,59	29,16	34,06	24,94	30,82	9,08
Jun	32,43	63,18	42,8	36,53	36,82	27,2	24,41	34,83	55,3	42,33
Jul	90,21	66,41	22,28	53,34	22,66	12,63	69,68	63,91	41,18	47,35
Aug	62,09	52,99	5,09	12,73	9,25	19,38	48,84	10,82	23,84	5,68
Sep	52,59	69,92	36,74	32,98	28,11	42,15	78,13	37,36	48,53	40,14
Oct	59,33	25,58	12,64	10,37	14,05	15,72	51,36	22,75	7,73	13,94
Nov	74,36	55,81	15,12	24,89	15,36	25,51	56,52	29,97	27,3	21,34
Dec	0,28	0,46	0	0,39	2,81	0,17	0,15	0,69	23,48	7,72

Table 5 contains the participation of invoices with delay over 30 days in monthly totals across the whole 10 year period. Column 7 from Table 4 was copied into the column 2015 in Table 5. Similarly, the calculated participation of invoices with delay over 30 days for each year was copied into the appropriate column of Table 5. The percentages above 30 % are highlighted in yellow.

4. Discussion

Traditional accounting practice calls for a monthly financial reporting which is basis for evaluating company's financial position. Financial accounting systems provide direct input to corporate control mechanisms (Bushman, Smith, 2001). Companies that are in construction business have a number of cost related unique accounting transactions which highlight the importance of cost assessment (Peterson, 2005a).

Towards the end of the month, the accounting employees are doing extra effort to encompass all the payables they can, so that costs can be evaluated more precisely. In larger enterprises, especially in case of dislocated units, this is not always easy.

The analysis for outbound invoices showed that most of those were registered in General Ledger inside 10 days, and only few random cases were registered after 20 or more days, so they were not pertinent for this study.

The data in Table 1 shows results for inbound invoices that one would consider acceptable. The average number of days in delay is between 15 and 25 for the ten years period. Although the maximum registered delay is high, those are random cases that do not influence the result and can be ignored. The number of invoices which are delayed over 30 days is relatively low, in the range of 10% to 30%, while the number of invoices with delay under 20 days is rather high, in the range of 60%, so one would expect that most of them would be present in monthly financial reporting.

Drilling down to a monthly data gives somewhat different picture. The data for the year 2015 in Table 3 shows that during eight months, almost three quarters of the year, invoices with delay over 30 days participate between 30% and 55% in total number of invoices. Data for November 2015 for example, show that 33.89% of November invoices could not have possibly been in financial reports for November, because they had delay over 30 days and will not be visible until December. Data for May shows that one third of all May invoices could not have made the May End of Month report. Looking into April data, shown in Table 4, we can see that 41.84% of costs could not have possibly been reported in the April End of Month report, because those invoices were delayed more than 30 days and will be shown in May.

Year 2015 was selected for presentation because it was about average. There were years that were worse and those that were better. Year 2016 seems a bit better in Table 1. with an average of 22.14 days of delay, and only 24.58% of invoices with delay over 30 days. The analysis performed at the monthly level shows that during 5 months (Feb, Apr, Jun, Jul and

Sep) between 35% and 47% of the costs could not have been reported In the End of Month report for those months.

Table 5 shows that in the last five years, almost half of the financial End of Month reports failed to include between 30% and 78% of the costs for those months.

However, the actual situation is somewhat darker. In June, the End of Month report might report May invoices that were delayed more than 30 days, or the ones that were in the 20 day period but arrived late in May. Only 44.7% of June invoices made the June End of Month report. The rest of the report was filled with at least 30.82% of May invoices and some of 41.84% of April invoices that came late in April. If, at the same time, all of June Receivables made the June report, it is highly questionable that management was supplied with sound data. So at any point in time, there is a significant amount of costs dispersed in time in such a way that End of Month report based on General Ledger data, cannot give company's financial position accurate enough so that operational decisions could be based on them with confidence.

The reason for such large time lags lies in the complex nature of business processes which leads to complex and lengthy invoice verification. The subsidiary is organized territorially with different business units managing different parts of the city. A number of subcontractors complement the company's own resources (transport, machinery, suppliers of materials). By default, a single subcontractor will be participating in construction activities on multiple sites in different parts of the city which fall under jurisdiction of different business units. Commonly, the subcontractor would issue a single monthly invoice to the subsidiary with specification of work performed. Different subcontractors or different groups of subcontractors are contracted under different contract terms and often different prices, so each received invoice has to pass a verification process that would ensure that the invoiced quantities and prices are correct. Further, the costs incurred have to be assigned to a particular project, which means that a single subcontractor's invoiced amount has to be split among different projects. The verification can only be done by the field personnel. The project manager or site supervisor are the only ones that can verify data, like the number of trips a subcontractor truck has made on a particular date and hence, the distance of transported asphalt invoiced, as each distance range has a different price tag. This means that a particular invoice has to traverse different business units and different employees inside each business unit. These professionals are seldom in the office, but rather spend most of the day in the field.

Accounting generates reports for external parties based on General Ledger data which cannot contain data that is not fully verified. That, consequently, renders General Ledger data that lags behind real situation and is useless for comparison against budget costs.

The situation is even more somber in controlling project costs against planned budget. Cost Performance Index (CPI) is used to evaluate whether the project is under or over budget. The critical factor governing CPI is the actual cost of work performed which is measured as actual costs spent on the construction work to a specific date and is obtained from accounting (Peterson, 2005b). In the case of this particular subsidiary and other enterprises with similar business processes, it is evident that progress reports cannot be correct, as CPI renders results that have little to do with reality.

Traditional approach to General Ledger organization suggests Accounts Payable and Accounts Receivable are not separate ledgers and that their transactions reside inside General Ledger accounts. In such a configuration, subcontractor invoices would not be visible by the system until full verification process is completed and is clearly an inferior solution. Separate AP and AR ledgers are mandatory in this situation, as costs can preliminarily be registered, synchronization with outbound invoices achieved and project costs for a particular project evaluated the moment they are known, regardless of state of other projects.

Xu (2003) studied critical success factors for accounting information systems data quality and concluded that the top three success factors are top management commitment, nature of the Accounting Information System and input controls. But top management support is dependent on the quality of the financial reports, and their hesitance is understandable.

Scapens and Jazayeri (2003) suggest that ERP systems are having only a relatively moderate impact on the character of management accounting and the work of management accountants, although they open new opportunities. This is no surprise because same practices on different infrastructure cannot render evolutionary different results.

Temporal anomalies of data also affect internal control procedures. Internal control quality has an economically significant effect on management guidance (Feng, McVay, 2009).

It is obvious that financial reporting based on General Ledger data has to be complemented with reports outside General Ledger, with both financial and nonfinancial reports. Temporal anomalies revealed in this paper render comparison to planned budget inaccurate. Budget overruns cannot be detected on time. The management cannot intervene into the business process on time to prevent consequences. They force the management to base operational decisions on intuition. The only time when General Ledger data gives true cost position is at year end, after all the transactions have been committed, which happens, at earliest, about a month after fiscal end of the year.

In the next section, a model of an information system is proposed that should diminish, if not annul, temporal anomalies studied in this paper.

5. Model proposal

In municipal utilities corporations every subsidiary manages one aspect of municipal services, like road maintenance, water supply, gas supply etc. Each one of them has a primary business domain, but beside this, it has maintenance projects for existing infrastructure and projects to build new infrastructure. This makes them project oriented to a degree that makes them susceptible to the problems highlighted in this paper, especially when work to be done involves roads. It is often the case where multiple subsidiaries participate at the same construction site, each one with their own team and jurisdiction, site designation and budget control. Poor planning will produce situations where the same site is reopened in a few weeks or months, or the site will lay inactive due to poor coordination between subsidiaries. Temporal anomalies of budget monitoring will multiply at the corporate level. Lack of accuracy in cost monitoring makes budget cost control ineffective.

To remedy this situation, various steps have to be taken. First, common accounting infrastructure should exist, that would enable run time reporting per subsidiary, per business units inside each subsidiary, per project at all levels and combined reporting at corporate level free of intercompany transactions. This is discussed in section 5.1. Next, temporal anomaly of inbound invoices should be solved, so that cost data is current and comparable to budgeted values, which is addressed in section 5.2. The verification process for each inbound invoice should be accelerated and actions taken should be recorded. The invoice should not travel around the corporate and should not stay overlooked in someone's drawer. Interested parties should be alerted if an invoice is delayed at a particular corporate intersection so that corrective actions can be taken as described in section 5.3. Finally, an early warning system should be put into operation, that would detect not only budget overruns, but also anomalies in relations between financial positions, external values or preset parameters pretty much like an auditor searches for illogicalities. Drift from preset values should be flagged and appropriate professionals alerted so that closer analysis could be performed. Such a system is suggested in section 5.4.

5.1 Five dimensions of General Ledger

A modern, multi subsidiary corporate information system should allow multiple report structures that will present data current as much as possible. Each subsidiary should be able to report transactions by charts of accounts containing just the data for this subsidiary, regardless of other subsidiaries. This effectively defines an independent accounting package, where each subsidiary sees only its data, virtual inside the corporate information system, governed by Related Company ID. A subsidiary contains multiple business units, cost centers, whose performance has to be evaluated and balance reports printed based on Business Unit ID. Subsidiaries, especially construction ones, are project organized and need to report the balance of a single project at intervals defined by the budget, even in case that multiple business units performed activities on a single construction site. It is evident that in such case, Project ID cannot be part of chart of accounts and it cannot be included in cost center structure, as multiple business units may perform works of different types, which implies different positions in the chart of accounts.

Finally, subsidiaries interact among themselves. Often, work is performed for another subsidiary. Thus, subsidiary A issues an invoice to subsidiary B. It is an effective income to subsidiary A and expenditure for subsidiary B. At the corporate level this is neutral and should be eliminated from combined or consolidated corporate reports. General Ledger transactions need to have a Subsidiary ID for any transaction that involves another subsidiary. Subsidiary ID is filled automatically every time that a transaction target is identified as another subsidiary and is equal to Related Company ID of the subsidiary.

Obtaining consolidated data in a multi subsidiary situation can prove a lot of work (Potter, 1991a) because of the frequently different General Ledger account structure. Different types of subsidiaries perform different business activities. There is no easy way to define one account structure at the holding level that would fit all its companies. In any multi company environment, there is an internal registry of related companies where each company is assigned a unique identifying code, the Related Company ID. The corporate has view and report privileges across multiple virtual accounting systems. When a combined report across all subsidiaries is needed at the corporate level, transactions with Subsidiary ID are simply filtered out. The same principle applies to reporting by project across multiple subsidiaries, where the actual cost, free of intercompany transactions, is provided.

As established in this paper, General Ledger transactions carry a temporal anomaly. If Accounts Payable is created as a subsidiary ledger inside General Ledger, it will also be subject to the same temporal anomalies. Thus, a separate ledger for Accounts Payable and Accounts Receivable is far better solution. In them, all the transactions can be registered immediately, although the project designation is not fully known. Periodically, after the full correctness of the transaction is established, it can be posted to General Ledger accounts.

Such a corporate system needs to have some common assets, like partner table and project designations. Project designations are organized in hierarchical structure allowing grouping of projects as an additional reporting structure. The Chart of accounts is also a tree like structure, where one or two lowest levels are left to subsidiaries to cover their particularities.

General Ledger transactions are not the only ones that should be subject to Related Company ID constraint. Transactions from any other module (Inventory management, Invoicing, Procurement, AR or AR, etc.) should also be marked with the Related Company ID rendering fully functional separate accounting package for each subsidiary.

5.2 Temporal anomalies avoidance

Every document that enters the subsidiary, including inbound invoices, is filed into the Document Registry at the Reception Office, where basic data about the document is captured (supplier, date, due date, amount, suppliers, etc.). The invoice data is presented to Accounts

Payable (AP) employee as a roster, from which he grabs data into AP ledger, checks the validity of the data and assigns it a Transaction Type that is auto numbered by the system.

The invoice then follows the standard verification path. When the verification process is finished, the transaction is marked ready for transfer to General Ledger. Once ready, sets of invoices are transferred to General Ledger journal in named batches, each batch identified by a type, unique number and system assigned time stamp. This time stamp was basis for delay calculation in the study. Once the invoice is in General Ledger journal, the accountant can further adjust a particular transaction before posting to General Ledger.

Each account in Accounts Payable ledger has two distinct states: committed to General Ledger or not, so that synchronization of both ledgers is easy.

Transaction Type has the function to prequalify the invoice, and is common practice in modern automated accounting systems that integrate project costing (Potter, 1991b). Until all invoice data is not verified and the invoice is not transferred to General Ledger journal, the actual invoice General Ledger account position is not known, but broad cost position is easily determined, especially for recurring type of invoices like utilities, materials, different type of service, etc.

Each Transaction Type can be associated with a particular General Ledger account, a posting schema, so that it can arrive to General Ledger journal prequalified, and be adjusted there if needed, amounts split as defined in the Type schema.

Accounts Payable reporting per Transaction Type will give the actual cost structure at any particular point in time, and will be synchronized in time with the outbound invoices.

The detail of Transaction Type structure should be sufficient to provide cost data for management operational decisions. This type of reporting should effectively complement standard financial reporting.

The structure of Transaction Types can be imposed by the corporate, guarantying the same reporting structure across all the subsidiaries. Locally, however, each subsidiary might associate each Transaction Type to a different subaccount, pertinent to its local account structure, performing account prequalification needed locally.

5.3 Accelerating verification process

The acceleration of the verification process in the proposed model is based on the Multidimensional Preemptive Coordination (Bacun, 2013) which, in essence is a closed corporate social network oblivious of company or department boundaries. It is based on Request for Action (RFA) which implies a Sender, a Recipient and a group of professionals from different companies, different departments and different corporate altitudes. They are gathered in a corporate social network environment by invitation, where they discuss or solve a particular problem or task. They may initiate threads to any depth involving other professionals to focus on a particular aspect of a problem. A post at any altitude will propagate vertically across the thread causing immediate awareness of the participants. Upper level management is included in discussion by default, and has privileges to reassign participation of different employee. RFAs can include attachments. The system logs viewing the document or any other action made to the RFA. It includes a deadline and alerts any participant's lack of activity.

When a verification of an inbound invoice or daily batch of invoices is required, a RFA is issued, in this case Request for Verification which includes all the relevant employees in different business units. Everybody is presented the RFA simultaneously and each participant verifies pertinent part of the document. Missed deadline alerts the Sender, the log shows which part of the verification process is missing.

The documents do not travel across departments, invoices cannot be forgotten inside a drawer, and the completed RFA can be printed with log showing audit trail of verification.

This significantly shortens the time needed to verify a particular document.

5.4 Early warning system

Over the years one of the largest challenges in corporate life, especially in multi company environment was the lack of ability to detect that some special condition occurred. If something happened somewhere in any of the companies, that might influence the corporate as a whole, it took weeks, even months before proper officials were faced with the facts. Beside an actual unfavorable occurrence in daily business, an event that immediately comes to mind is the kind of creative accounting that might be benignly inside fiscal rules, but influence the time line or cost position of the holding. There are numerous reasons for this, from complex vertical communication structure, to management subjectivity. Managers tend to be protective about their companies, they don't boost anomalies and they highlight their accomplishments.

If an early warning system is to be implemented, it evidently needs to be an automated process that would periodically evaluate certain points inside and outside Accounting, compare with set thresholds and trigger a warning to a particular group of monitoring professionals. Such a system, also based on Multidimensional Preemptive Coordination, was described by Bacun (2016) in the context of automatic risk status change detection.

The Transaction Types will have a significant role in this situation, because they would enable ratio change detection across the holding as a whole.

The early warning model has two distinct parts: an alert infrastructure and a Periodical Evaluation Process (PEP).

The PEP can interact with any RFA listed as a trigger and can post to a particular point in the thread, exploiting its alert capabilities. As its name suggests, it periodically visits each trigger in the trigger base, evaluates it and, if preset low or high threshold is breached, posts a message to a particular RFA or a point in the thread.

A trigger has a particular set of attributes but for the purpose of this discussion, only five are interesting: a name, measurement frequency, thresholds, posting point and ratio. Only ratio needs further explanation, as it is calculated at each visit to the trigger. The result of calculation determines whether a post will be made or not.

The ratio consists of a numerator which is calculated as an actual value and a denominator which is a constant or calculated reference value. When doing the calculation, two circumstances have to be considered: the data source and the computational method. The data sources are the exposed values from any of the subsystems (General Ledger or auxiliary ledgers, invoicing, inventory, purchasing, project schedule, or any other application that can expose data). The computational method can be either simple (+-*/()%), an aggregate function (sum, count, average, min/max inside an interval) or temporal (simple or aggregate function calculated for an interval within observation period).

One can easily imagine a trigger defined as sum of values of a particular Transaction Type exceeding 30 day delay as a numerator, and the sum of values of total invoices for the same period. If the threshold was set to fifteen, when the amount reaches that percentage, a post to the RFA will make the proper professionals aware and corrective action could be taken.

The early warning system is a living thing and should be adjusted for new developments, increasing accountability across the enterprise.

5. Conclusion

Traditional End of Month reporting from General Ledger data falls short of providing basis for managerial operational decision making. This study shows that for the last five years, almost half the time, financial reporting failed to include between 30% and 78% of costs for the current period, confirming temporal anomalies in budget cost control procedures. This

paper proposes a model of an information system which provides current cost assessment at any point in time at all levels of the corporate. Inbound cost verification is accelerated by providing all the parties with documents at the same moment. The system audits the verification process establishing accountability at all corporate altitudes.

In today's volatile environment, an early warning system is needed to compensate for fast emerging of new developments. The presented model proposes user definable triggers which are periodically evaluated with current data from different subsystems. Threshold breaches are detected and selected group of professionals alerted in a dedicated corporate social network.

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