ENHANCING MANAGEMENT REPORTS: THE CONTRIBUTION OF PROCESS CHARTS

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Summary

Management reporting is of relatively recent origin. Financial reporting such as bookkeeping and accounting has been around much longer. Because of this, it is not surprising that managers adopted financial reporting method to get the information for managerial control. Such methods, however, were not designed for managerial control. A tool invented for process quality performance measurement, the Process Control Chart, is ideal for giving managers maximum information at minimum cost. Examples contrasting usual management reports with the Process Chart are presented.

Introduction

Those who manage businesses need reports to see the state of the business and to make decisions for future action. There is a long history associated with reports used by managers. This paper discusses the origins of report formats and suggests that the quality tool of Process Charts can materially enhance Management Reports.

Financial Reports

When the Franciscan, Fra Luca Pacioli published his *Summa de Arithmetica* in 1494 he included a section on bookkeeping. Many of the Venetian methods of bookkeeping described by Pacioli are still in use today. Pacioli's work appears to have been translated into English within 50 years of its publication (George, 1972, p. 40).

The Arsenal at Venice

The arsenal at Venice, founded around 1105, used the system of accounting described by Fra Pacioli. The arsenal may have been the world's first assembly line requiring warehousing of raw material, finished goods and work in process. It was an industrial complex that employed thousands of workers with different skills. By insisting that each galley be made alike, the arsenal was one of the earliest users of standardization. In an hour it could turn out a completely outfitted and armed galley from the parts that they kept on hand.

All issues of operations management were experienced by the Lords of the arsenal and solved in a manner reminiscent of today. For example, the issue of quality was solved as described by George (1972, p.41): "The arms steward also kept records of goods received, but special officials were used to keep track of certain goods bought by the Arsenal. These inspectors, or "appraisers" as they were called then, were responsible for inspecting timbers offered, seeing that good wood was delivered, and reporting its value to the lords who formally contracted for it. They were also responsible for inspecting finished products." By today's standards they rated ISO 9000 qualification.

The arsenal made use of accounting principles keeping two journals and a ledger. It seems that the financial records were the basis of operating management. While finished goods were carefully inventoried and stored with complete inventory records, the raw material, the wood used in the construction, was not as carefully controlled. George (1972, p.41) describes the result:

> When a worker wanted a piece of wood—the chief raw material—he would search around through the piles of lumber until he found one to suit his need. This casual handling of the lumber stocks contrasted sharply with the orderly disposal of the finished products as previously discussed. Lane's study, however, indicated that this inefficiency attracted the attention of officials only after being expressed in terms of money lost. Thus, in 1564 an accountant testified that five hundred ducats a year were spent in finding wood and moving it around the Arsenal. Furthermore, whenever a ship was launched, it was necessary to clear the lumber out of the way. This activity required an expenditure of twelve hundred ducats each year. An accountant found that it cost three times as much to find a log as the log was worth.

The financial model was well known to the Venetians and was used as the basis for management reports and actions.

The same models for reporting were in use when the Industrial Revolution of the late 18th century required supervisors, managers, and executives to get information of production, inventory and other aspects of operations. Having the bookkeeping model available, they adopted this to their needs. And this model has survived to this day.

Requirements for Modern Management Reports

The management expert, Professor Peter Drucker feels that we lose important information when we look simply at what he calls the "treasury" aspect of reporting. Drucker (1995, p. 118) stated:

> But most needed—and totally lacking—are measurements to give us business control. Financial accounting, balance sheets, profit-and-loss statements, allocation of costs, and so forth are an X ray of the enterprise's skeleton. But much as the diseases we most commonly die from—heart disease, cancer, Parkinson's—do not show up in a skeletal X ray; a loss of market standing or a failure to innovate does not register in the accountant's figures until the damage has been done.

Axson (2003, p. 161) points out that "Effective management reporting is about delivering the right information to the right people at the right time." The writer would add in the right way. Reports can present a great deal of data and yet have no relevant information to run the business. Drucker (1995, p. 113) points out that "the challenges increasingly will be not technical; rather, they will be to convert data into usable information that is actually being used."

If the management report does not lead to action, it has limited usefulness. Unfortunately, many managers are faced with data overload. According to Axson (2003), "managers typically use less than 5 percent of the information contained in any report." He goes on to say,

> Management reporting has two purposes: Either it confirms to management that everything is on track and that no action is needed, or it points out the need for a potential change in plan to capture a new opportunity or correct a problem. Information that does not contribute to management's ability to do one of these two things is superfluous. The acid test of any piece of management information is to ask "So what? Who cares?" "So what?" tests the information for relevance to the organization; "Who cares?" identifies the people who can benefit from the information. If a piece of information does not pass both parts of the test, it is irrelevant. (p. 173)

Unfortunately many reports use what Drucker describes as the treasury-reporting model. This model is very useful for showing the history of financial transactions but less useful in handling operational management problems.

Enumerative versus Analytical Reports

The financial or treasury reporting model is primarily enumerative. It shows the current position and the changes (since the last period) of how the present point was reached. Management decisions require an analytic approach. Not only does the manager need to know the current position and how it was obtained but also needs to know if this is a normal situation or if special causes exist. If the data indicates a stable process exists, the manager needs to decide if that is a satisfactory state of affairs or not. If satisfactory, no special intervention is required. If changes are needed, the manager must examine the process that generated the data and make a fundamental change. The analytic model of managerial reporting helps the manager to see whether the changes made were effective or not.

If through the use of the analytic model of managerial reports, it is indicated that a special cause exists, the manager can see when this occurred. Such temporal information is often hidden in the financial model. The knowledge of when a drastic change in the operations—such as a special cause—began is often a great help in tracing down the special cause and rectifying it.

Another management issue difficult to solve with the financial or treasury model of report structure is that of variation. Quality practitioners have had to face these problems for many years and have a solution in the form of the Process Control Chart. This paper maintains that the use of Process Control Charts for Management Reports will give far more useful information to managers than the use of reports based on the financial model alone. This truly maximizes quality impact and delivers real and useable results.

Example One—Accounts Receivable

In a seven part article, Anthony Ash (1996) prepares a management report on aging of accounts receivables (A/R's). In a summary table, he shows 34 periods of sales from the most recent (period 1) to the oldest (period 34) he also shows the ledger balances and the aging for 1 month, 2 months, 3 months, 3+ months and total overdue. A reconstruction of his data for the Total Accounts Receivable to Ledger Balance is shown in Table 1.

Ash (1996, p.20) finds that "as can be seen there are wide variances and it is difficult to see any trend. He is observing variation and finds that a table does not give him a good overview of the process. His solution is to use something he calls "Moving Annual Total (MAT) on both the Ledger Balance and the Total Outstanding. He does not mention that, in effect, he is smoothing that data for both sources by using a 12-month Moving Average. That will indeed reduce the variation but not in a desirable way. It

Table 1 Total A/R Outstanding to Ledger Balance

Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Total A/R	1376	1011	945	574	1186	1164	1127	1177	1376	1020	1463	2013
Led Bal	5340	6818	7808	7336	5889	6304	6313	5808	5340	6910	7088	7796
% A/R	25.8%	14.8%	12.1%	7.8%	20.1%	18.5%	17.9%	20.3%	25.8%	14.8%	20.6%	25.8%

will hide fluctuations. Figure 1 shows the smoothing effect of using the MAT. The MAT is the smooth blue line compared to the original series for both the Total Outstanding and the Ledger Balance. The moving average is simply the MAT / 12.

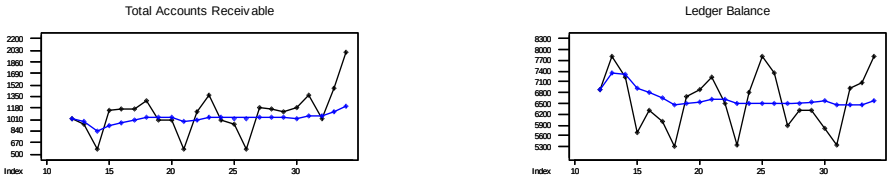

Figure 1 Impact of Moving Average

Table 2 Moving Annual Total (MAT)

Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
12 Month A/R	12460	12455	12454	12454	12492	12485	12455	12273	12652	12662	13547	14432
12 Month Bal	77971	77893	77891	77987	78175	78158	78484	78968	77603	77611	77458	78750
% A/R	16.0%	16.0%	16.0%	16.0%	16.0%	16.0%	15.9%	15.5%	16.3%	16.3%	17.5%	18.3%

When Ash then looks at the ratio shown in Table 2 he observes that the percentages are now far less variable than they were before. The reduction in variation is due to the smoothing and actually hides some problems by averaging out high and low values.

If one examines the individual values for Total A/R outstanding using a process chart for individuals, another picture emerges. As Figure 2 shows, the total A/R's outstanding were quite stable until the last period. One might speculate that the process of collecting A/R's is quite stable and independent of the ledger balances. Whatever company policy in dealing with collection and debt are in effect, they result in a constant amount of Accounts Receivable ranging between £405,000 and £1,808,000. Clearly, if the Total A/R of the current period is £2,018,000, it exceeds the normal upper limit and indicates a special cause.

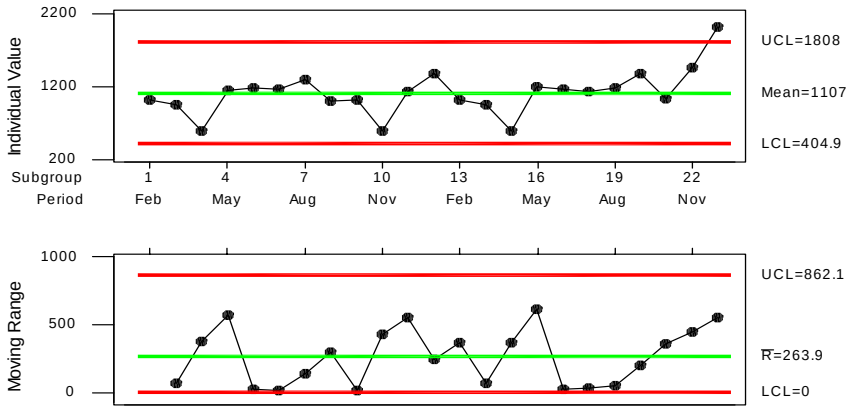

Figure 2 Process Chart of Total A/R Outstanding

An examination of the four classes of A/R's outstanding (One Month, Two Months, Three Months, and More Than Three Months) showed that the change occurred in two places. The One Month Outstanding account and the Three Month Plus account showed a special cause to exist in the most recent

month. While this was a unique special cause in the One Month account, the Three Month account had been building up to this for several months past. Such a pattern is difficult to see with tabular data but shows up readily when a Process Chart is used. Figure 3 below gives the picture for the four accounts.

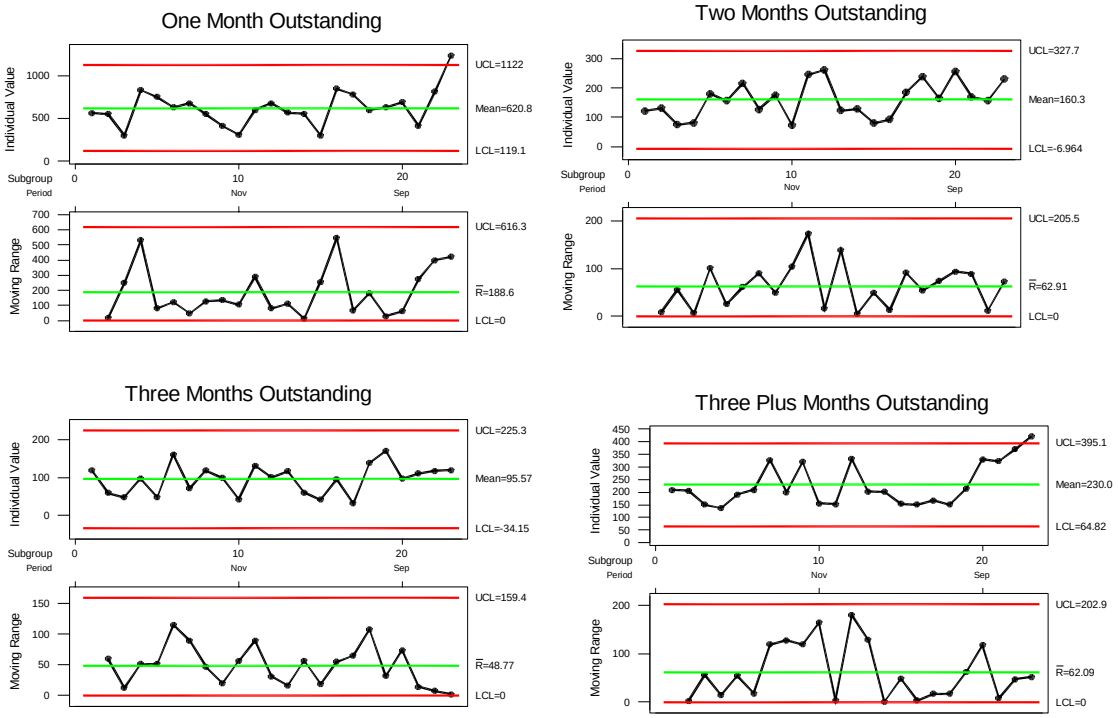

Figure 3 Process Chart of A/R's Outstanding by Time

Example 2—On-Time Performance

The Financial Model of Management Reports often shows less data than is displayed here. A usual display of data shows the current value, the value at some previous point in time—such as last month, a year ago—or some similar relationship. Managers are expected to base their decisions on the two or three points of data. The implicit assumption is that no variation exists in the process. This assumption is almost always not true.

Table 3. Example of report

On Time Perf	%
Yesterday Total:	95.70
Month to Date:Mon	95.35
Year to Date: Mon	92.69
AM Peak:Mon	97.95
PM Peak:Mon	94.74

Shown in Table 3 is an extract from a typical report. This report shows the performance indicator that management considers important and gives as a reference to this indicator summary data such as the average performance for the month to the date of the report and the average performance for the year to date. Of course, on the first day of the month the "Month to Date" figure is the same as the total figure. In effect this form of report also is a form of moving average. The on-time performance is affected by common and special causes of variation. The manager that must control this operation may or may not know whether there are special causes of variation—such as adverse weather conditions—present or if the variation is due to common causes. Figures that show period to date in effect average the data in an effort to remove variation. However that does not really help the operations manager to figure out which action to take. If the manager chooses the wrong option, he or she can tamper and make the situation worse.

Table 3 discloses an interesting difference in performance. One would expect the off peak performance to be as good or better than the peak performance since the system is not as stressed in that time. As a manager, one would expect the off peak performance to be as good as the average peak performance. Yet the average peak performance is (97.95 + 94.74) / 2 = 96.35 whereas the daily performance was only 95.35. This means that on time arrivals either were very poor during the off peak period or the volumes were extremely different.

Using a simulated example based on realistic data, we can see in Figure 4 that the "Month to Date" and "Year to Date" figures do not display as much as a Process Chart. As one can see, the period from day 10 to day 16, were all below the average. Clearly something happened in that seven-day period which remains hidden in the "Month to Date" average. Again, a Process Chart can quickly display areas of special cause (e.g. day 10 as well as the points following) and let the operations manager make better decisions.

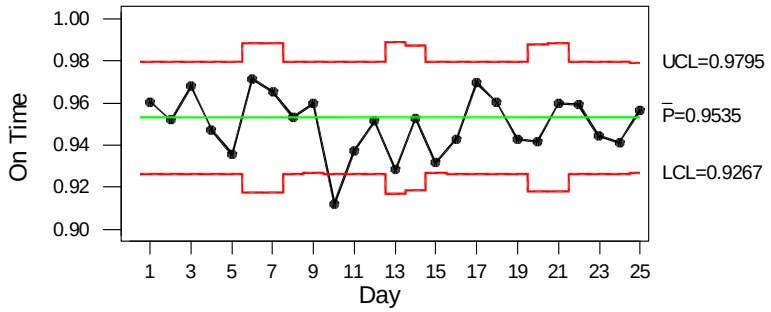

Figure 4. Simulated Example On Time Arrival

Example Three—Consolidated Net Income

Andersen (1983) in a study carried out on behalf of the National Association of Accountants (now the Institute of Management Accountants) said, "Management accountants must communicate and inter-

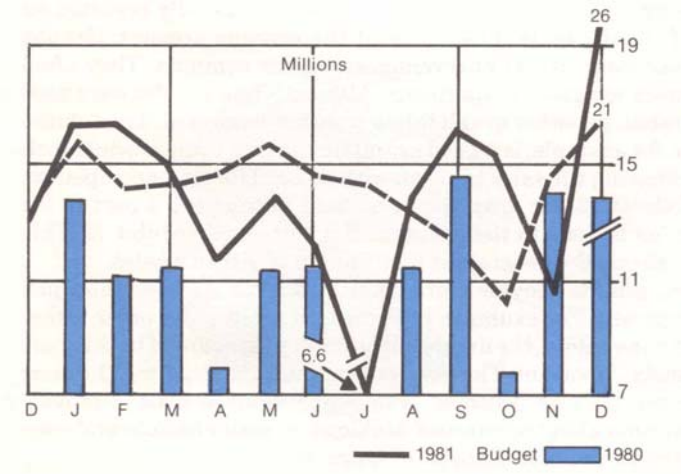

Figure 5. Example of Financial Chart for Consolidated Net Income (Reprint permission granted to W. J. Latzko by the Institute of Management Accountants formerly known as NAA.)

pret data to the users. Graphs are one means of accomplishing these tasks. They can be used to show results, indicate trends, and make comparisons." (p. 43)

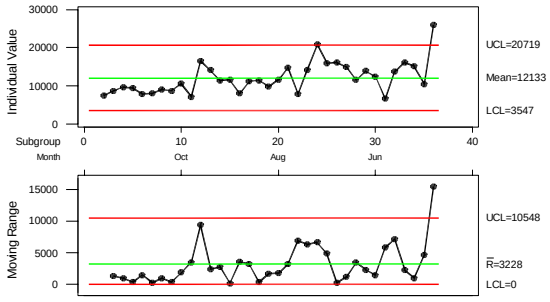

Figure 6. Consolidated Net Income

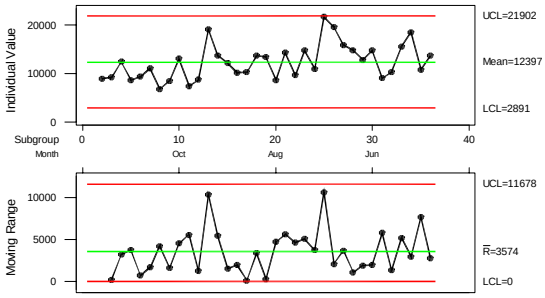

Figure 7. Deseasonalized Net Income

He was right in his basic concept. Although Andersen showed many examples of line charts such as Figure 5, he never used Process Chart to account for variation in the process. From Andersen's accompanying table, it was possible to construct a process chart. Reconstructing the three years of data as shown in Figure 6 shows quickly that there is seasonality in the data that is especially pronounced every December. By deseasonalizing the data one gets the result of Figure 7. From this one can see that the process is relatively stable.

There is a tendency on the part of many managers to superimpose two or more years on a single chart instead of treating the years as a process continuum. For example, Anderson places two years data into Figure 5. He also introduces a bar graph that represents the budget. In effect, he is looking at the relative performance on a month-by-month basis considering each month as an individual reporting period. The seasonality of the data remains hidden in Figure 5 and appears not to be reflected in the budget figures.

Example Four—A Typical Management Report

A government agency recorded the daily number of interviews scheduled and their disposition. Figure 8 shows the top portion of a typical weekly report. The rest of the report contained a breakdown giving the reason for each disposition of the various results. This report was so long that it was given to managers on legal sized paper.

The managers were expected to review the report and take "appropriate" action. Although the managers were excellent, this mass of data does not give the type of information that one needs to operate a department doing the type of work performed in this instance. The data

REV 1/01

WEEKLY SUMMARY REPORT: COMBINED **(X) Type**

Office **Xth FLOOR** Project Title: _____ ( ) Undercare **(X) Applicant**

WEEKENDING: 11/22

	PRIOR RESULTS	DATES 18-Nov MON	19-Nov TUES	20-Nov WED	21-Nov THURS	22-Nov FRI	WEEKLY TOTAL	WEEKLY YDT
INTERVIEWS BOOKED:	***45491***	***211***	***328***	***32***	***334***	***267***	***1172***	***46663***
Interviews Rescheduled	5454	32	53	3	50	58	***196***	***5650***
Actual Number Expected	40037	179	275	29	284	209	***976***	***41013***
Failure to Report	13616	58	95	0	95	56	***304***	***13920***
INTERVIEWS HELD:	26421	121	180	29	189	153	***672***	***27093***
INTERVIEW RESULTS:								
A	3913	20	38	10	52	26	***146***	***4059***
B	5670	57	76	10	73	76	***292***	***5962***
C	5854	30	38	8	44	39	***159***	***6013***
D	10984	14	28	1	20	12	***75***	***11059***
E	0	0	0	0	0	0	***0***	***0***
OTHER RESULTS:								
F	***1266***	***5***	***1***	***2***	***1***	***1***	***10***	***1276***
G	***5703***	***4***	***8***	***5***	***2***	***6***	***25***	***5728***
H	***3201***	***2***	***3***	***0***	***3***	***1***	***9***	***3210***

Figure 8. Example of a Management Report

is ok, even if excessive. However, to analyze a mass of data of this type is not only difficult but time consuming. This type of data report probably supports Axson's (2003) statement above that, "managers typically use less than 5 percent of the information contained in any report." Notice also that an attempt is made to give the manager a reference point in the last column, which shows "Weekly YDT [year to date]"numbers. Again such numbers hide variation by averaging the data. Even columns of percentages would not help to inform the manager of the state of affairs in their operation. A similar monthly summary report is given to senior management. It is not clear what they do with this.

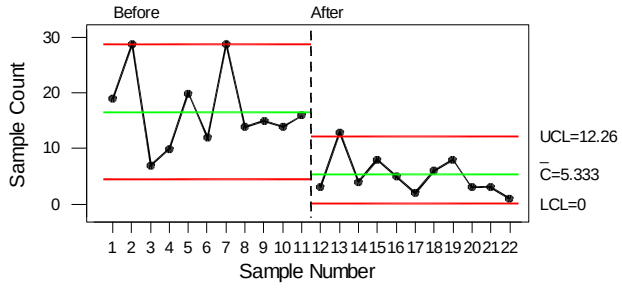

Figure 9. Process Chart of Data From Management

Extracting just one result, item G, and plotting the results with a Process Chart for the month of November (Figure 9) quickly disclosed that a process change had occurred. Investigation revealed that this change was due to a policy change. This change affected a number of other relationships as well. The impact of the policy change was easy to detect with a Process Chart but was hidden in the raw data of the "management report".

Conclusions

Drucker is looking for something other than an X-ray of the organization. The Process Control Chart can provide this. Most management reports are a presentation of historical data. While such data is useful, the Process Control Chart can convert such enumerative data into analytic information to help management make appropriate decisions in a timely manner. The ability of a Process Chart to detect change that is easily hidden among the mass of data allows it to enhance Management Reports.

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