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Digital Transformation to Increase Procurement Value Creation

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Abstract

For the last few years the purchasing function has embarked on its Purchasing Digital Transformation (PDT), today with process digitization and tomorrow with Data Analytics and Artificial Intelligence, what leads CPOs to redefine their organizations. Do they have to continue to invest in maturity development or only in the PDT? This paper provides a framework to companies allowing them to measure the ROI (Return on Investment) of three main options: PDT with workforce reduction at iso-maturity, PDT at iso-workforce with maturity improvement, and PDT with new skills acquisition. The options are analyzed, and the findings compared and discussed.

Key words

Digitization, Efficiency, Effectiveness, ROI, Maturity, Performance

Introduction

The first wave of PDT is here with mature products (S2C or P2P suites), delivered by publishers to companies for their Procurement process digitization. Thus it is now time for any company to invest in such tools, but of course after measuring their ROI. The problem is then to gather all the necessary elements for this ROI measurement, whatever the company Purchasing maturity level, its size or its business sector. After a description of the research background, and its objective, we will present a methodology based on two kinds of academic models combined with two heuristic models, which together measure the value created by the PDT. In a second step we will gather the different elements enabling us to calculate the ROI of three options : PDT with workforce reduction at iso-maturity, PDT at iso-workforce with maturity improvement, and PDT with new skills acquisition for future Data Analytics. Lastly, the findings of each option will be discussed and compared in order to provide a decision framework for companies and CPOs.

Key words

Digitization, Effectiveness, Efficiency, Maturity, ROI.

Research description

This PSM research is a continuation of work started in 1998 on purchasing performance management by developing its maturity. This work is based on the development of concepts and models based on twenty years of experience and feedback as CTO and then CPO in a Hi-Tech International Company. These concepts and models now formalized in university teaching and in a book (Potage, 2016) make it possible to analyze the impact of PDT in PSM and, as in this paper, to measure its ROI according to different strategies and options.

- **Problem background**

  The decade following 2010 saw the mission statement of the Purchasing function continuously evolve towards increased value creation: less prevalence of the cost reduction approach, more risk management, more SRM (Supplier Relationship Management), and more co-innovation management with suppliers. Hence a permanent quest for maturity.
  The end of that decade saw at least the advent of the PDT. As a first step, companies were therefore finally able to digitize their end-to-end purchasing process, thanks to a range of

digital tools that were now mature and competitive, pending the arrival of other digital tools associated with Data Analytics and Artificial Intelligence (AI), which came later in a second wave.
As a phenomenon, the PDT begins to be analyzed by scholars around the Procurement 4.0 topic with papers either survey oriented, such as (Bienhauss, 2017), or pilot study oriented, leading to present the transition from actual PSM to « PSM 4.0 » as a journey (Pellengahr, K. Schulte, A. Richard, J. Berg, M., 2016), (Henke, M. Feldmann, C., 2016).
In order to support firms to launch their PDT, a lot of Consulting firms such as (Daher, M. et al., 2017) for Deloitte, (Nowosel, K. et al., 2015) for Accenture, (Geissbauer, R. et al, 2017) for PwC or (Wyman, O., 2017) for Oliver Wyman, produced recently either dedicated reports or white papers in that matter, aiming to show in what 4.0 technologies are a historical opportunity for PSM in terms of effectiveness, leading to reshape the current organizations.

The objective of the first PDT wave was to improve Procurement function efficiency by reducing the workforce devoted to administrative processes thanks to automation and digital procurement platforms directly used by the specifiers. A study over 414 practioners (Bienhauss, 2017) gave findings indicating that digitisation of procurement process « can yield several benefits including: supporting daily business and administrative tasks ». CEOs and CFOs are naturally tempted to choose this option, in order to achieve a quick win in efficiency. But unfortunately this option does not improve the function's effectiveness, which remains the same before and after the PDT. This is the reason why there is a second option, which is to reinvest the buyers' time now freed up by training them in new practices to achieve better purchasing maturity. It is then interesting to know if the ROI of this second option is always better than the first one. Facing the future of the Procurement function there is also a third option which is similar to the second one, developing maturity but also preparing buyers for new skills and practices in Procurement Data Analytics and AI (Artificial Intelligence) applications, the second wave of the PDT. How to choose the best option with appropriate decision support tools is the general purpose of this research.

- **Problem definition**

In order to detail out and compare the three strategic options and take the investment decision, it is then necessary to be able to calculate the ROI of each option by using appropriate models of SRM and PMM (Purchasing Maturity Model), and by running scenarios in a precise company context, for example an medium one among the SME category (Small and Medium Enterprise).

- **Research objectives**

The research was organized in six stages corresponding to the six following key questions:
Q1: What kinds of models to select in order to measure efficiency and effectiveness of the Purchasing function in companies, whatever their business sector and their maturity?
Q2: What kind of data to gather in order to calculate the ROI of the PDT in a precise company context?
Q3: How to measure the efficiency of the Procurement function after its PDT?
Q4: What is the ROI of the PDT at iso-maturity when we reduce the workforce in Purchasing Departments (first option)?
Q5: What could be the ROI of the PDT if we reinvest the freed-up time in a short term maturity improvement (second option)?
Q6: What could be the ROI of the PDT if we reinvest the freed-up time in medium-term maturity development, with investment in Data Analytics and AI (third option)?

- **Research methodology**

In the first and second options we choose to measure the Procurement savings performance, by using two models proposed in the same paper in 2011 (Potage, 2011): the SRM CTG model for categorizing the supplier panel, and PMM PIMM (Purchasing Integrated Maturity Model) for the economic value created according to the maturity level of a Company (Potage, 2017b). In order to measure the ROI of the PDT, we choose a concrete context such as the virtual company ZyCo, a Medium-Sized Enterprise (MSE), to run the scenarios of the three options. For the third option, we conducted interviews of three CPOs in large companies (Potage, Calvi, 2021b), and one in a large public organization (Potage, Philippart, 2021c). Each of these organizations had already embarked on their PDT.

Selection of four models for the research

In order to avoid a lot of citations about previous papers concerning the CTG and PIMM models, this section presents their essentials applied to the research context.

- **CTG: a meta-business model for supplier panel categorization**

A standard approach to companies' stakes in purchasing is to consider amounts of money spent per supplier and their division in A, B, C categories after a Pareto ranking. But this economic approach is an observation of the result of a customer–supplier relationship, not of the relationship itself. This is the reason why we proposed a meta-business model for purchasing, based on the different kinds of customer–supplier relationships (Potage, 2011).
A symbolic representation of this model is given in Figure 1, showing a new way to split the supplier panel of a company. With the CTG model, three types of business purchasing and SRM may be identified in the regular purchases: the first is the Competitiveness type, driven by priority given to price, quality and on-time delivery performances; the second is the Trust type, driven by early supplier involvement in products design, and continuous improvement plans with key or strategic suppliers; and the third, the Growth type, is driven by the research of complementary expertise and co-innovation.

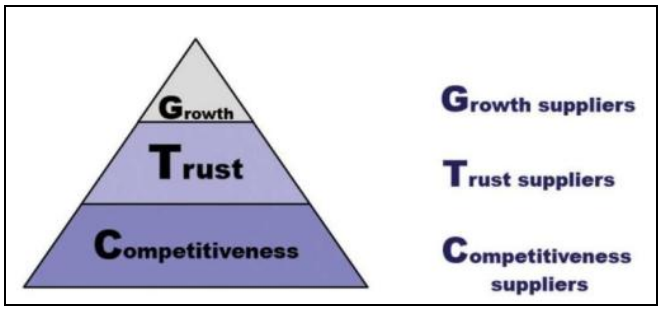

Figure 1: The CTG model representation.

This identification step leads immediately to another one: the list of suppliers in each type. In general and in big companies, we can observe some thousands for the Competitiveness type, some hundreds for the Trust type and some tens for the Growth type. A different representation of the purchases is then possible, in which we may have, for example, for ZyCo : 50, 40, and 10% in value respectively for each type, which is a very different representation compared to the regular ABC breakdown often proposed in Purchasing manuals and used by CPOs and buyers. An example of what is the Trust type is largely described by Mosey when applied in the construction sector (Mosey, 2019).

- **PIMM : a meta-Purchasing maturity model for Companies, bridging the gap between maturity and value creation**

The PIMM model is a different model compared to the other PMMs, which are generally oriented towards controlling the Purchasing process. PIMM simply groups the purchasing practices required by CTG category, thus enabling maturity assessment in each category (Potage, 2017). The more complex this relation is, from the Competitiveness type to the Growth type, the higher the maturity level must be.
Applying such a strategy, the three SRM modes have been used to define five PIMM sets of practices: sets number 1 and 2 are dedicated to the Competitiveness mode, sets number 3 and 4 are dedicated to the Trust mode, and set number 5 is dedicated to the Growth mode.
To facilitate the use of these two models by a company, a PIMM toolkit for CPOs was published at IPSERA 2017 (Potage, 2017a).
The Procurement mission statement having moved to more value creation, the PIMM model made it possible to establish for the first time the link between the development of purchasing maturity and the associated value creation. This demonstration was published in a French book in 2016 (Potage, 2016), which received an award in 2017 ("Prix des Plumes des Achats") and was commended in the Journal "Logistique et Management" (Potage, 2017b).

- **A Gross savings heuristic model based on industrial feedback in a big company**

The proof of concept of this model is described in (Potage, 2003) and summarized below. Thanks to the PIMM's vertical architecture, practices in sets 1 and 2 correspond to basic and fundamental practices in purchasing (the cost reduction approach). Such practices were introduced in a large group via a huge improvement program called "Pour des Achats Compétitifs chez Thomson-CSF (PACT)". For seven years, from 1993 to 2000, buyers were trained at a Corporate Campus, and the PACT method became mandatory in each of the 80 units, whatever their business. This program was led by the corporate CPO. To measure purchasing savings a precise metric and a "thermometer" were defined with consultants. The savings of each unit were reported each month to the CPO, and an assessment letter sent each quarter to the CEO of the business units. On the strength of more than 5,000 measurement points, the result of such huge heuristics was the following: the mean value of gross savings due to practices of sets 1 and 2 under control (maturity at 100%) is typically 5% per year.
Concerning PIMM practices of sets 3 and 4, another company program, "PACT en CONception, (COMPACT)", was conducted for five years from 1995 to 2000, aiming to create "engineer project buyers" tasked with implementing upstream purchasing practices in company projects, including the early involvement of suppliers. As for PACT, a reporting process to the CPO spanning 1,000 projects demonstrated a purchasing gross saving at a mean value of 12%, within a dynamic range from 5 to 15%.
Because in parallel the Purchasing maturity of each unit was also measured, we could assume that gross savings are proportional to the maturity, according to a simple equation for each CTG mode:

Gross savings % (in Competitiveness mode) = 5% x M (Percentage of PIMM maturity in the Competitive mode)
Gross savings % (in Trust mode) = 12% x M (Percentage of PIMM maturity in the Trust mode)

These equations are illustrated with the abacus of the Figure 2 for each mode of the CTG model, assuming that gross savings are proportional to the maturity index.

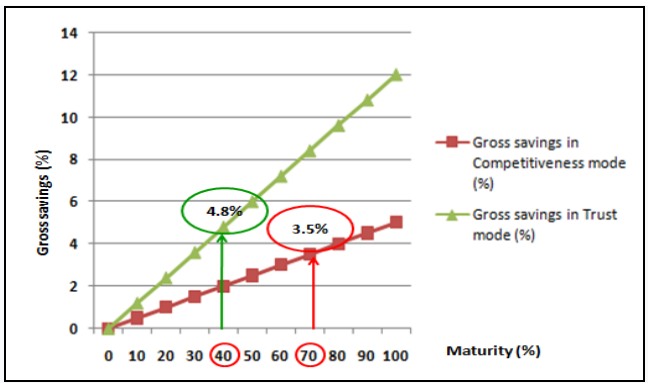

Figure 2: Gross purchasing savings as a function of company PIMM maturity percentage in CTG Competitive and Trust categories

For example if ZyCo is being assessed at maturity 70% in the Competitiveness mode and only 40% in the Trust mode (points indicated in Figure 2), and if the amounts of purchases in these modes are 50 M€ and 40 M€ respectively, then the gross savings are (3.5% of 50 M€ + 4.8% of 40 M€) = (1.75 M€ +1.92 M€) = 3.67 M€, i.e. only 4% against the total purchases.

- **A Cost of Procurement function (CPF) heuristic model based on industrial feedback in a big company**

Still in the same group as CPO, we could measure precisely once per year the cost of the function, in each department, from 2000 to 2005, through the annual budget exercise of each BU. This CPF was defined as the following percentage: [annual cost of the purchasing department/ amounts of negotiated purchases by the department]. This ratio was initially created in order to define and benchmark the size of the different purchasing departments (number of buyers). The results of these statistics and measurements: 1) we must distinguish the nature of the business activity, and thus 2) the CPF for the best-in-class units was at 2% in their Information Technology (IT)/Services activity (i.e. no manufacturing), and at 4% in their Products/Systems activity (manufacturing plants in the BUs).
Thanks to this second heuristic feedback we are now able to obtain the net savings before PDT with this simple equation:

Net savings % (before PDT) = Gross savings (function of maturity M) – CPF (before PDT and function of the business sector)

Gathering data and tools to estimate the net savings before and after the PDT

In order to prepare the ROI calculation three elements must be gathered: 1) the cost of acquisition and installation of the PDT tools, 2) the additional purchasing performance obtained after the tools roll out, and 3) the translation of this additional performance in economic value.

- **First element: the cost of acquiring digital tools such as the S2C and P2P suites**

According to our PDT market analysis, the products available are mature and several publishers are to be found in the magic quadrant (Morsinkhof, 2018). For a turnkey solution we observed annual prices that vary between a few tens of thousands of euros for small SMEs, and several hundred thousands of euros for large SMEs or large groups.

- **Second element: the estimation of the efficiency improvement by the PDT**

This materializes mainly through a substantial time saving for buyers in terms of their process, standing at a level of 30% according to several studies (Daher, 2017), (Wyman, 2017), published last years by consulting firms and based on large corpus of buyers. The

impact of such a value (30%) has already analysed in previous surveys (Potage, 2019a, 2019b, 2021a). According to a first-order calculation, the PDT therefore reduces the cost of the function for the company by these same 30%. Then the two CPF at 2% or 4% according to the business sector become respectively 1.4% and 2.8%.

- **Third element: the estimation of the effectiveness improvement by the PDT**

To do this calculation we built simple abacus drawings presented above which enable us to estimate the gross and net savings, whatever the business sector of the company and whatever its maturity level.

The abacus providing the net savings for each type of SRM is represented in Figures 3 and 4 when the Company's business is IT & Services-oriented, and in Figures 5 & 6 when its business is Products & Systems-oriented.

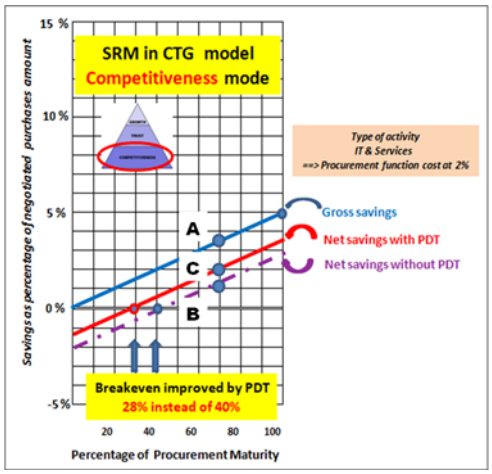

Figure 3: Net purchasing savings in the Competitiveness mode according to the percentage of maturity for an IT & Services oriented activity before and after the PDT

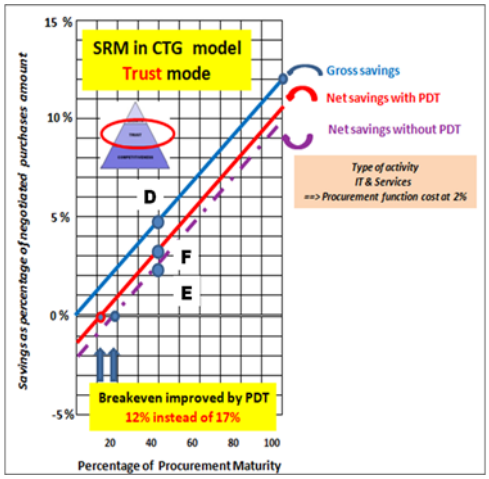

Figure 4: Net purchasing savings in the Trust mode according to the percentage of maturity for an IT & Services oriented activity before and after the PDT

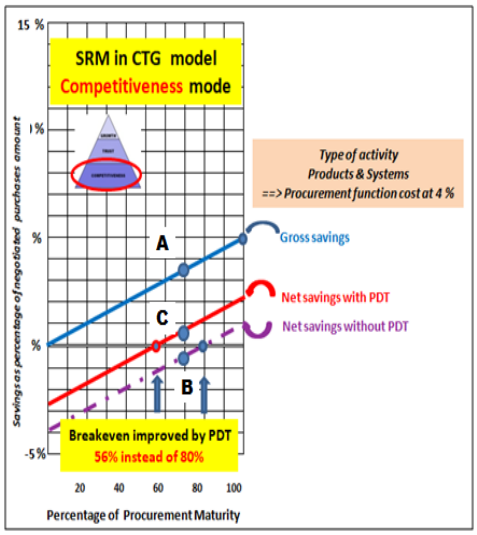

Figure 5: Net purchasing savings in the Competitiveness mode according to the percentage of maturity for a Products & Systems oriented activity before and after the PDT

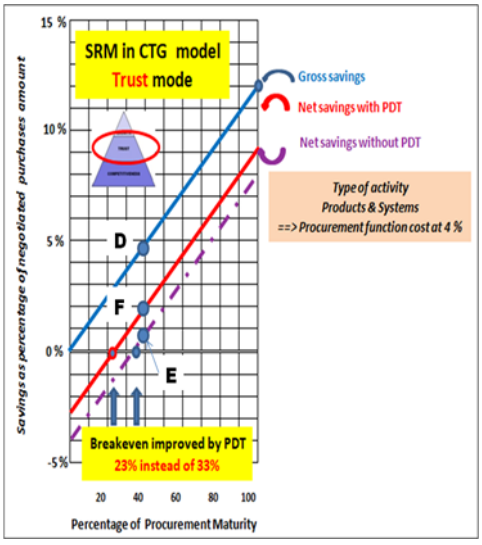

Figure 6: Net purchasing savings in the Trust mode according to the percentage of maturity for a Products & Systems oriented activity before and after the PDT

Thanks to this abacus tool box let's take an example with ZyCo having a business in IT & Services and a PIMM maturity assessed at 70 % in the Competitiveness mode and at only 40% in the Trust mode. Then in the Competitiveness mode, the gross savings are at 3.5% (point A in Figure 3), the net savings before PDT are at 1.5% (Point B) and the net savings after PDT are increased, at 2.1% (Point C).
Similarly, in the Trust mode, the gross savings are at 4.8% (point D in Figure 4), the net savings before PDT are at 2.8% (Point E) and the net savings after PDT are increased, at 3.4% (Point F).
If ZyCo were involved in a Products & Systems-oriented business with the same PIMM maturity levels for the CTG modes, we should obtain with the abacus in Figure 5 the new points A at 3.5%, B at -0.5%, and C at 0.7% for the Competitiveness mode, and in Figure 6, the new points D at 4.8%, E at 0.8%, and F at 2% for the Trust mode.

- **First findings observed in the abacuses figures : a breakeven improvement with PDT for the Purchasing function**

The four abacuses highlight a significant improvement of the maturity breakeven whatever the CTG mode and the company activity, as summarized in Table 1.

Maturity breakeven improvement with the PDT	IT & Services activity	Product & Systems activity
Business in the Competitiveness mode	28% vs 40%	56% vs 80%
Business in the Trust mode	12% vs 17%	23% vs 33%

Table 1: Breakeven improvement with the PDT

This observation is ambiguous because it may encourage CEOs and CPOs not to develop the purchasing maturity of their buyers.

In fact, what we observe here is a misleading improvement: after the PDT, the maturity remains the same and everything remains to be done from this point of view. Are there other options which enable us to benefit from the PDT and also enable us to improve maturity? If the answer is yes, only an ROI calculation will enable us to compare and choose among these options, and the abacus presented here will be used to calculate the ROI in each savings business case.

Calculation of the PDT ROI at iso-maturity by reducing the human resources workforce in Purchasing Departments (first option)

In this option the CPO aims to increase the net savings only by reducing FTEs in the Purchasing function.

- **ZyCo PDT business case target at three years according to first option**

ZyCo annual turnover is at 200 M€ and purchases represent 50% of this turnover, i.e. a portfolio of 100 M€. The cost of the Purchasing Department, made up of twenty buyers, represents 2% of this amount (IT & Services activity).
Estimating the purchasing maturity of the buyers at roughly 50%, the CPO can refine this estimate using the PIMM maturity matrix (Potage, 2016) or (Potage, 2017a, 2017b). For this, he estimates the distribution of his purchasing portfolio by type of SRM mode at 50%

in Competitiveness mode (50 M€), 40% in Project / Collaborative Trust mode (40 M€), and 10% in Co-Innovation Growth mode (10 M€), as indicated in Figure 7.

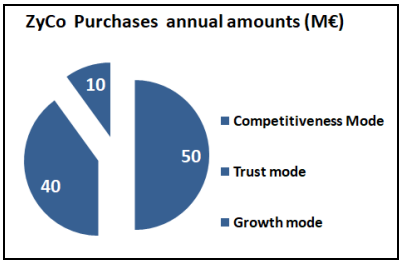

Figure 7: ZyCo purchases annual amounts per CTG mode

The maturity of ZyCo buyers assessed with the PIMM matrix is respectively 70% in Competitiveness mode, 40% in Projects / Collaborative mode (despite efforts, upstream purchasing practices are still not acquired!), and finally 10% in Co-Innovation mode (ZyCo buyers are indeed discovering this oxymoron: purchases and co-innovation).
In the end and thanks to the abacus in Figures 3 and 4 we observe a ZyCo GROSS savings amount at only 3.5% (point A in Figure 2) for the Competitiveness purchases and 4.8% (point D in Figure 3) for the Trust purchases.
As the CPF stands at 2% of the portfolio (ZyCo being involved in IT & Services), the NET purchasing savings are then 1.5% (point B in Figure 3) for the Competitiveness mode and 2.8% (Point E in Figure 3) for the Trust mode.
After a roll-out of the new digital tools and a downsizing of the FTE (Full Time Equivalent) workforce, the reduction in the cost of the function will be 30% as indicated above, and the NET savings become 2.1% (point C in Figure 3) for the Competitiveness mode and 3.4% (point F in Figure 3) for the Trust mode.
According to this first option, the CPO transforms his/her purchasing process "as it is", no more. In the Competitiveness mode, net savings before and after PDT are 0.75 M€ and 1.05 M€ respectively.
It is then easy to calculate the net savings for each mode (Competitiveness and Trust) before and after PDT, as indicated in Table 2.

ZyCo PDT Business case 1st Option	Before PDT	After PDT	PDT effect
Net annual savings (M€) in Competitiveness mode	**0,75**	**1,05**	**40%**
Net annual savings (M€) in Trust mode	**1,12**	**1,36**	**21%**
Total (M€)	**1,87**	**2,41**	**29%**

Table 2: Comparison of ZyCo annual savings before and after its PDT with the first option, in IT & Services activity

- **ROI calculation over three years**

With a workforce reduction at 10% per year it is easy to calculate the annual net savings over 3 years (total 6.69 M€); and assuming a total investment in digital tools at 0.6 M€ (0.2 M€ per year), the ROI stands at 80% as indicated in Table 3.

ROI calculation	Year 0	Year 1	Year 2	Year 3	Total over 3 years
Total net savings (M€)	1,87	2,05	2,23	2,41	6,69
Cost of digital tools (M€)		0,20	0,20	0,20	0,60
ROI %					80%

Table 3: ZyCo PDT ROI over three years
with the first option at iso-maturity and reduced workforce in IT & Services activity

Not to mention that to achieve this ROI, the CPO has to cut back 30% of the buyer workforce (i.e. 6 FTEs!). "All that for this!" the CFO will probably say!

Fortunately there is in fact a much better way of proceeding, and this is the whole challenge of the second option, which will consist of using the time freed up by the buyers (who stay in place) to enable them to acquire and master new practices and thus substantially develop company maturity.

- **Findings of the first option**

With a negative ROI at the beginning, the final result is finally not so impressive.

Calculation of the PDT ROI by reinvestment of the freed time in maturity development (second option)

In this option the CPO will use the "freed up" time to develop maturity by working better on purchasing strategy, risk management, drafting framework contracts and optimizing SRM.

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- **ZyCo PDT business case target at three years according to second option**

Let's assume that the target fixed by the CPO is: maturity at 100% in the Competitiveness mode and 60% in the Trust mode. This development can be realized via an ambitious and robust progress plan, as the PIMM assessment singled out some bad shortcomings. Let's see the promise of these new potential savings that can be achieved according to this SMART objective. According to our abacus, the GROSS gains then become (100% x 5%) = 5% in Competitiveness mode and (60% x 12%) = 7.2% in Project / Collaborative mode. The NET savings with PDT are then respectively for these two modes (5% - 2%) = 3% and (7.2% - 2%) = 5.2%. Here we begin to see the leverage effect of the development of maturity.
Compared to the economic value of these two modes in the ZyCo purchases portfolio, i.e. 50 M€ and 40 M€ respectively, the NET savings after PDT are then (1.50 M€ + 2.08 M€) = **3.58 M€** to be compared with the 2.41 M€ of the first option, as indicated in Table 4.

ZyCo PDT Business case 2nd Option	Before PDT	After PDT	PDT effect
Net annual savings (M€) in Competitiveness mode	0,75	1,50	100%
Net annual savings (M€) in Trust mode	1,12	2,08	86%
Total (M€)	1,87	3,58	91%

Table 4: Comparison of ZyCo annual savings
before and after its PDT with the second option in IT & Services activity

- **ROI calculation over three years**

With a maturity improvement at 80%, 90%, 100% over the three years in the Competitive mode and 50%, 55%, 60% in the Trust mode, it is easy to calculate the annual net savings over 3 years (total 9.27 M€), with a total investment in digital tools at 0.6 M€, thus an ROI at 510% as indicated in Table 5.

ROI calculation	Year 0	Year 1	Year 2	Year 3	Total
Total savings (M€)	1,87	2,60	3,09	3,58	9,27
Cost of digital tools (M€)		0,20	0,20	0,20	0,60
ROI %					510%

Table 5: ZyCo PDT ROI over three years
with the second option at iso-workforce and maturity development in IT & Services activity

- **Findings of the second option**

Over 3 years (after PDT), the total net savings stand at 9.27 M€, to be compared to the 6.69M€ of the first option, with ROI at 510% instead of 80%, as summarized in Table 6.

ZyCo business PDT business case	1 st option	2nd option
Total net savings over 3 years (M€)	6,69	9,27
ROI over 3 years	80%	510%

Table 6: ROI over three years comparison
according to the option

This second option, "development of purchasing maturity thanks to the PDT" proves here to be six times more profitable than the first option. Beyond the economic perspective, there is also the CSR (Corporate Social Responsability) dimension which is taken into account: the jobs of ZyCo buyers are maintained and their skills improved.

- **Discussion about the CPF (Cost of the Procurement function) effect on findings**

What would happen to our findings if Zyco were involved in a Product & Systems business sector, with a CPF at 4%? With the same input data for the PDT business case, and a CPF at 4% instead of 2%, we obtain Tables 7 and 8 for the first option and Tables 9 and 10 for the second option.

ZyCo PDT Business case 2nd Option	Before PDT	After PDT	PDT effect
Net annual savings (M€) in Competitiveness mode	- 0,25	0,35	140%
Net annual savings (M€)	0,32	0,80	150%
Total (M€)	0,07	1,15	1543%

Table 7: Comparison of ZyCo annual savings
before and after its PDT with the first option in Products & Systems activity

ROI calculation	Year 0	Year 1	Year 2	Year 3	Total
Total savings	0,07	0,43	0,79	1,15	2,37
Cost of digital tools		0,20	0,20	0,20	0,60
ROI					260%

Table 8: ZyCo PDT ROI over three years

with the first option
at iso-maturity and reduced workforce in Products & Systems activity

ZyCo PDT Business case 2nd Option	Before PDT	After PDT	PDT effect
Net annual savings (M€) in Competitiveness mode	- 0,25	0,50	200%
Net annual savings (M€)	0,32	1,28	300%
Total (M€)	0,07	1,78	2443%

Table 9: Comparison of ZyCo annual savings
before and after its PDT with the second option in Products & Systems activity

ROI calculation	Year 0	Year 1	Year 2	Year 3	Total
Total savings	0,07	0,80	1,29	1,78	3,87
Cost of digital tools		0,20	0,20	0,20	0,60
ROI					510%

Table 10: ZyCo PDT ROI over three years
with the second option
at iso-workforce and maturity development in Products & Systems activity

- **Findings in ROI comparison between 1st and 2nd options**

Using Tables 1 to 4 it is easy to consolidate Table 11, giving the PDT ROI according to each option for two kinds of business sector.

Zy Co activity	ROI 1st Option at worforce reduced and iso-maturity	ROI 2nd Option at iso-worforce and maturity development
IT & Services	80%	510%
Products & Systems	260%	510%

Table 11: ROI comparisons between 1st and 2nd options

Whatever the business sector, the second option is undeniably the better one, even when the CPF is at 4% in Products & Systems activity.

Preparing the future of Procurement with the third option

If the first option is intended to improve the efficiency of the Purchasing function and the second, to reuse the time freed up to develop the maturity of this function and thus its effectiveness for better value creation, the third option is to add a second objective: that of preparing the function to extract the value embedded in the purchasing data. This presupposes new practices, new tools and therefore new skills, which must be integrated into the PMMs (Purchasing Maturity Models) and therefore into the PIMM model. The main steps in that conquest are described below.

- **Create the company's Purchasing Data Lake**

Until now, purchasing data were scattered, both in buyers' PCs and in ERP systems, and in any case not organized in a global and structured way. Starting to organize and fill this Data Lake is a complex task, as shown in Figure 8, according to two criteria: the origin of the data (internal vs external) and their accessibility for the company.

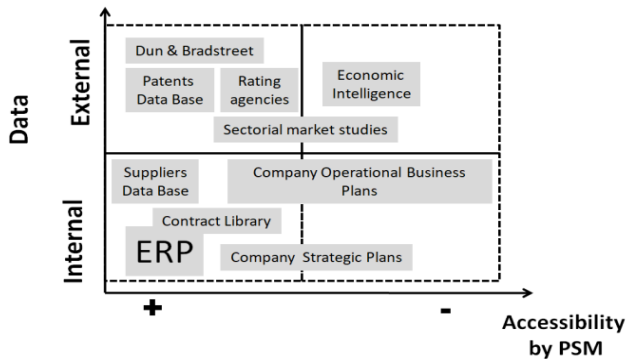

Figure 8: Typical structure of a company Purchasing Data Lake

If purchasing data are stored in an organized way and are easily accessible, it then becomes possible to exploit their value - some authors consider them to be the new oil of purchasing.

- **Proceed to Data Analytics thanks to the company's data lake**

Procurement data analytics is the process of collecting and analyzing procurement data to give the company business insights and promote effective decision-making in Purchasing and Procurement - such as Make or Buy decisions, Partnership decisions, or Supplier selection. Many different kinds of analyses may be carried out in spending, changes in spending, TCO, categories, business plans of BUs, TRL (Technology Readiness Level) risks, markets, suppliers' previous bids, sustainability and corporate social responsibility (CSR), and CO2 neutrality, hence making it possible to improve forecasting, quality and risk management, as well as criteria for selecting suppliers. This inventory can be represented as in Table 12, organized according to upstream vs downstream considerations.

UPSTREAM Data Anaytics Areas
Customers demand
General spend
Spend by Category
Markets
Risk exposure
Regular Competitors performance
New incomers
Previous suppliers bids
Previous supplier performance
Suppliers Merge & Avquisition

DOWNSTREAM Data Anaytics Areas
Previous contracts
Terms & Conditions
Payment terms
Invoice compliance
Previous savings per supplier
Previous suppliers disputes
Concretized risks
Suppliers bankruptcies

Table 12: Sources inventory for Procurement Data Analytics

An example of the Data Analytics process as used by Category Managers is the creation of spend cubes according to three dimensions (categories, suppliers, BUs).

- **Extract the value embedded in the Procurement Data Lake**

Thanks to the different angles of Data Analytics, new sources of value creation become accessible, such as Predictive Procurement, new savings, cash flow improvements with better payment terms and conditions or better innovation capture with new suppliers. All these new opportunities lead to a better company Balanced Score Card, such as the one proposed in Figure 9.

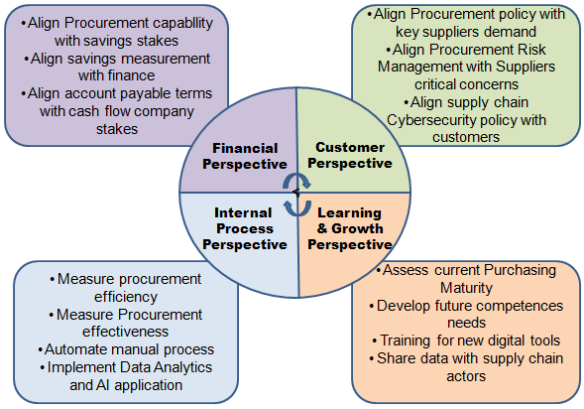

Figure 9: Balanced Scorecard for Digital Procurement proposed by the author

- **Begin to use AI potential**

Beyond Data Analytics, AI is starting to be used case by case according to the stakes, and the maturity of this new technology applied to the Purchasing Data and Process. Such opportunities can only be described in a precise context. So with the same objective of saving time in the administrative process, let's give an example cited by BCG Consultants (Schuh et al., 2022): AI is used to send automatic e-mails to the thousand suppliers of the tail spend asking them for a mandatory offer at -10%. Here, the time saved by buyers is quite impressive.

- **Create value by sharing procurement data between actors of the same supply chain**

To illustrate this approach let's take the example of Airbus' "Skywise" initiative. "Skywise" is a platform that brings together data shared by Airbus (manufacturer), its customers (airlines) and suppliers, who represent 70% of the added value chain. In two years, and since the launch of the platform in 2017, Airbus has convinced more than 90 airlines representing 60% of the market, and 15 suppliers to "free their data", for a total of 18,000 users sharing data on more than 8,000 planes, including Boeing planes. In total, a customer-supplier share of 10 Terabytes. This is for the creation of value in predictive maintenance, reduction of fuel consumption, fleet availability, and optimization of spare parts warranty: the savings are in double digits and thus boost the service activity of the aircraft manufacturer. Airbus recently estimated the potential savings from data sharing in the aviation industry at 40 billion euros, achieved by removing "friction costs" caused by barriers between actors and categories of data. According to the Airbus CDO Marc Fontaine, "the digital transformation is ultimately nothing more than the re-creation of the continuity of information lost during the various IT evolutions carried out in silos".
This example can easily be extrapolated to other business sectors, such as Automotive, or Construction with BIM (Building Information Modelling), depending on their own digital maturity.

- **Monitor the Cybersecurity risk**

Since purchasing data have value, they are therefore vulnerable from a cybersecurity point of view. No company is safe from a third party loss of data or aggressive breach. Therefore new and complex responsibilities immediately appear for CPOs, such as Cybersecurity awareness and Third-party risk management. As explained by G.C. Rasner (Rasner, 2022), CPOs have to be able to understand the fundamentals of third-party risk management, conduct appropriate due diligence in that area, initiate audits and close vendor risk management, secure supply chain data transmission with or without the

Cloud, and more generally monitor the supplier side cybersecurity risk for their company. A huge task, to be carried out via a cross-functional approach with CDOs and CIOs.
Of course, Encryption and Blockchain techniques are the main techniques to be used according to the company stakes in SRM.

- **Develop skills and competencies in Procurement Data Science**

Creating value with Procurement Data implies the development of new skills and competencies in Purchasing organizations, which are not there today. As investigated by a research team of the University of Twente (Delke, Buchholz, Schiele, 2022a, 2022b), new skills must be urgently acquired in Purchasing departments, such as those of Data Analysts, Master Data Managers, Process Automation Managers, Supplier Onboarding Managers, and AI Programmers. According to our feedback, we can further add Cybersecurity and Third-Party Risk Manager and Data Value Manager skills at the supply-chain scale. According to their business sectors, companies will have to anticipate their needs in that arena, at the appropriate pace.

- **Upgrade the PMM used by the company**

A natural approach would be to implement a new E-Procurement Maturity Model, based on interviews and literature, such as suggested by Delke, Buchholz, Schiele (Delke, Buchholz, Schiele, 2022). Their recommendation is to implement the classical architecture in Maturity models proposed by the Carnegie Mellon University, which is based on five levels: 1) Initial, 2) Managed, 3) Defined, 4) Quantitatively Managed, and 5) Optimized.
This has the disadvantage of having an additional maturity model for the Purchasing function. A second approach would be to integrate the new skills and tools of the PDT into each set of requirements and practices of the PMM already used, such as PIMM, by supplementing the Key Performance Areas of this model with a new one: Data Analytics Skills and Tools.

- **Third option findings**

Because Data Analytics are becoming mature, with a high potential of value creation, and because threats in supply-chain Cybersecurity are already with us, it is a matter of urgency to integrate the appropriate skills and competencies into Purchasing organizations. This option cannot wait and is finally the best. Instead of buyers job suppression (option 1), the freed-up time due to the PDT may be reinvested in a short term maturity improvement plan (option 2) and also in development of new skills in Company Data analytics, AI, Cybersecurity … thus preparing the era of value creation with Procurement Data.

Findings synthesis and conclusions

The progressive analysis of Procurement value creation thanks to its digital transformation according to three options may be summarized in this final Table 13 - here we see again that the third option is the best, with an excellent compromise between ROI against short-term maturity development and medium-term maturity development including the new skills brought in by the PDT.

Key Figures	Enabler	1st Option	2nd option	3rd option
Value creation with PDT enablers	Buyers time freed up	FTEs suppression	No FTEs suppression	No FTEs suppression
	Maturity assessment and development plan	No	Yes	Yes
	New digital techniques & skills development (Data Analytics, AI)	No	No	Yes
Net savings	Before PDT against Purchasing Total Amounts	1,87 M€	1,87 M€	1,87 M€
	After PDT against Purchasing Total Amounts	2,41 M€	3,58 M€	3,58 M€
PDT Cost of tools	According to market analysis and MSE status	0,20 M€	0,20 M€	0,20 M€
PDT ROI	If Activity purely IT & Services	80%	510%	510%
	If Activity purely Products & Systems	260%	510%	510%

Table 13: Summary for PDT decision makers

Contribution to scholars

Thanks to the CTG and PIMM academic models previously published, and by adding to them two heuristic models resulting from a large CPO feedback, one for the savings model per CTG supplier relationship mode, and a second for the Cost of Procurement Function per type of business sector activity, it is now possible to calculate the ROI of digital solutions before investment and to select the best scenario creating value with Purchasing maturity increase and 4.0 new skills development for buyers.

Contribution to practitioners

Irrespective of the company size (MNC, MSE, SME) and business sector, the four abacuses provided in this paper enable CEOs and CPOs to do a quick estimation of the ROI before investing in PDT tools and rolling them out. Because some PDT solutions such as Data Analytics and AI are quite disruptive, new skills and competencies to be acquired are identified and listed in the paper. The tools provided in this paper may help CPOs in the reshaping of their organizations.

Tracks for research ahead

Because the PDT substantially impacts the value creation capability of Procurement, and due to the disruptive effect of Data Analytics and AI, an urgent track is to upgrade current PMMs, starting with the PIMM model.
If data is the new oil of purchases, measuring the value of this data according to the companies business sectors is a second track.
A third track concerns the new skills to develop in PSM organizations when Data Analytics and AI must be used in the day to day Procurement Process.
At least and because the Procurement function must be aware about Cybersecurity in its SRM, studies in common rules and protocols definition seem to be necessary and urgent.

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