

Identifying Interesting Packages: a Spend Analysis Tool

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ABSTRACT:

Regarding the three stages of a spend analysis (gathering, refining and analysis) a tool is developed in order to systematically undertake the analysis step. Based on 9 ranking indicators purchasing packages are compared in order to identify the packages that show possibilities for improvement. Each ranking indicator considers a different characteristic of a purchasing package. The ranking indicators are based on a combination of three sources: literature, available data from this case study and contact with procurement personnel. The resulting tool is promising and appears to identify points of interest within a spend analysis. This tool is recommended as a twofold tool: policy making and spend assessment. Different possibilities for further improvement of the tool are acknowledged. The Dutch Tax and Customs Administration is the commissioner of this thesis and served as both a case study and a source of information.

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Keywords

Tool, spend analysis, purchasing, procurement, public procurement, Belastingdienst, Dutch Tax and Customs Administration, case study

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1. INTRODUCTION

Procurement is a crucial part of each organisation, it makes up approximately 70% of turnover across all sectors (Telgen, 1999). A spend analysis is a tool used to gain an overview of procurement and to improve the purchasing operations of an organisation. The idea behind a spend analysis is to analyse data on expenditure by bundling it in packages that can then be analysed. For example, the package office supplies would show how office supplies are being bought, giving information such as who bought what for whom, where, when and at what price.

Many tools and frameworks have been developed in order to conduct a spend analysis. These can broadly be described in three steps: gathering, refining and interpretation (Harrison M. , 2012).

The gathering step consists of collecting all the data concerning the spending of an organisation. This would consist of invoices and accounts payable combined into a single data set.

In order to make the data useful, refining is needed. This would be the standardization of the data by gathering everything in the same format and identifying potential overlap. Overlap could occur when the name of a company is not spelled consistently. In this case it would be advisable to unify all spelling versions for one company. The data is combined in different spend packages. These are packages formed from all the spending done for a certain commodity. This with the goal of creating an overview of how different things are bought. For example, all invoices regarding the purchase of food would be combined in a package named "catering", while all invoices for the raw materials needed for the core activities of the company would be combined in the package "raw materials". These two packages should be separated as it is likely that the way of procuring both differs (Kraljic, 1983). In the refining stage there is also a part recoding of data. When certain spend is categorized wrongly or as various/other it is often re-categorized in order to fall within one of the spend packages.

The last step is the interpretation. The different packages are analysed in order to see which ones would be likely candidates for improvement of the buying process. An example of this could be finding out that a certain department buys office supplies "off contract" (also known as maverick buying). When this is identified it can be countered, which would improve the buying process (Karjalainen & van Raaij, 2011). The problem in this interpretation step is that the process is experience based; there are no clear guidelines on how to conduct this step (Telgen, 2003).

This study will focus on the interpretation step of a spend analysis. All the existing tools and frameworks are aimed at creating an overview of the different purchasing packages, their characteristics (such as value and number of suppliers) and how to obtain support within a company in order to perform a spend analysis (Kirit Pandit & Marmanis, 2008). The gathering and the refining steps are included, but not the interpretation step. In this paper a tool shall be developed in order to identify interesting packages that result from a spend analysis. This shall be done in cooperation with the Dutch Tax and Customs Administration (Dutch: de Belastingdienst). They will provide the data of the first two steps of the spend analysis process (gathering and refining) as a support for the construction of the tool. Therefore the tool, while having a more universal aim, will be tailor made for the Dutch Tax and Customs Administration.

2. INITIAL ANALYSIS

While using only a few (~10) packages may create a clear overview, it has not been found useful, mainly due to the lack of specificity of each package. Therefore it is preferable to use approximately 70 packages (Cicchetti, 2013). How to use these packages is an art in which many consultants have specialized (Bravo Solutions) and which has many different possibilities (Harrison M. , 2012). While consultancy firms have specialists to perform the analysing step, there is no standardized tool widely available that any procurement department could use to assess their own individual spend data. This indicates the complexity and need for a tool regarding the spend analysis.

The improvement of the buying process which would follow from a spend analysis can have significant effect. An example of this is a case where by streamlining the buying process its costs have been reduced by 5% which has led to an increase in return on investment of 20% (Telgen, Lennartz, & van der Krift, 1999). This shows that there are clear benefits to a spend analysis.

The Dutch Tax and Customs Administration is used as a case study for this tool. Currently the situation is a neutral zone (Bridges & Mitchell, 2000), meaning that changes are being made to how procurement is done. At the moment a digital tool is being constructed in order to easily assess spend analysis data. In this tool 62 different packages are in place, but are (at this moment) only scarcely used. For this tool the main aspects currently used are the following:

- The risk of default, which uses the MORE classification, in order to rate the likelihood of defaulting (going bankrupt) of companies. Also whether and how its classification changes are taken into account.
- Dependency of the suppliers on the Dutch Tax and Customs Administration. The dependency is based on the percentage of the total turnover of a supplier that originated at the Dutch Tax and Customs Administration.
- The legal status of current suppliers, whether they are still active or have defaulted. This is used to assess the choice of suppliers and to learn from choices that went wrong.
- An overview of the biggest spenders per department and the biggest suppliers.

It is important to note that the exact use of this tool is still changing and being adjusted. Interesting to note is that all the previously mentioned aspects used are focused on the suppliers and not the package level.

3. ELABORATION

3.1 Research goal

Designing a tool to identify the most interesting purchasing packages based on spend analysis data.

3.2 Key concepts

Department: here a department within an organisation is meant. While this concept may vary depending on the organisation, examples would be: the human resources department, the financing department, or the marketing department. It could also be different ministries for a government, or different geographical locations for an international organisation. The main attribute is that the departments are distinct "units" within the organisation that act as internal clients for procurement purposes.

DTCA: Abbreviation for the Dutch Tax and Customs Administration (in Dutch: de Belastingdienst).

Framework contract: A contract which defines certain aspects in the present and others in the future. Often used for medium to long term purchasing.

GUO: Global Ultimate Owner: it is the legal entity that is the end owner of a certain corporation. Example: firm A is owned by firm B. Firm B and C are owned by firm D. In this case all firms are eventually owned by firm D, which would be the GUO.

Interesting purchasing package: a purchasing package is considered interesting when there are possibilities to improve the packet. An example of improving the procurement process could be streamlining the buying process (Telgen & Cobben-Mulder, 2005).

Purchase: Everything for which you receive an invoice is a purchase (Telgen, 1994).

Purchasing package: a package that combines all purchasing done according to a certain definition (often the same commodity). An example of this could be office supplies or energy. The focus of this tool is on purchasing packages. This choice is based on two factors. Firstly, literature supports a package focus (Kirit Pandit & Marmanis, 2008). Secondly a package focus has a more universal application, this because it can be applied to different organisations regardless of the exact definition and number of packages.

RI: abbreviation for Ranking Indicator; these are defined variables used to create the tool and to rank the purchasing packages.

Spend analysis: An analysis of all spending (purchasing) done by an organization over a certain period of time (usually 12 months). It often has the goals to identify where the company can more efficiently purchase a certain commodity, helping in negotiations and/or internal alignment. This is in accordance with the principle that organizations should buy different commodities in different ways (Kraljic, 1983).

Supplier: a company supplying a certain commodity to the DTCA. For each supplier the DTCA is the customer.

3.3 Academic relevance

Using standardized ways of doing research is crucial (Bryman & Bell, 2015). When doing research regarding procurement it could be useful to compare the spend data of different organisations. Such a comparison could be aimed at observing the effects of different procurement strategies, or how different economic circumstances affect the procurement process. To compare the data in a standardized manner, a tool would be needed. The literature research done for this paper has not found any such tool. Therefore the tool developed here could be a solution.

3.4 Practical relevance

Procurement is a large part of any organisation. It is on average 70% of turnover for companies (Telgen, 1999) and between 40% and 50% for governments (Knight, Harland, Telgen, Thai, Callender, & McKen, 2007). Therefore analysing and identifying possibilities for improvement has great potential. The DTCA observed that there is no tool to analyse the data that a spend analysis generates. It can be assumed that the problem also exists within other organisations. This tool would be a practical solution by identifying areas for improvement.

Around the world different governments have started to publish their spend data (sometimes only partially). Two

examples of this are the United Kingdom (UK government) and the Commonwealth of Australia (Australian Institute of Health and Welfare). The Dutch government is also increasingly following an open data policy (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties). These efforts are part of a trend of open data and transparency. This trend has started to become prominent in the last 50 years (Braman, 2006). As an extension of this it has been observed that governments increasingly use IT and e-government, making data (such as spend data) digitally available (Bertot, Jaeger, & Grimes, 2010). The tool could be used with these sources of data in order to help assess governmental spending. Additionally it could increase citizen participation, which is generally believed to be beneficial (Irvin & Stansbury, 2004) and supported by the Dutch government (Rijksoverheid).

This tool shall be tailor made for the practical need of the DTCA, but shall aim at being applicable to most types of organisation.

4. METHODOLOGY

The goal of a spend analysis is to see how different commodities are bought, and to identify opportunities for improvement. The purchasing process has multiple steps (such as defining what needs to be bought or supplier selection) (Van Weele, 2005). A spend analysis could investigate performance related to these steps. This would bring focus to any improvement efforts. The basis for a spend analysis is the concept that different commodities should be bought in different ways (Kraljic, 1983).

On the subject of purchasing and spend analysis prof. dr. Telgen has done extensive research. He has written the most used definition of purchasing (Telgen, 1994). His Telgen-box visualizes/analyses framework contract compliance (Telgen & Cobben-Mulder, 2005). This could be interpreted as a way of identifying how interesting a purchasing package is according to framework contract compliance.

Literature does exist on how to perform (gathering and refining) a spend analysis (such as (Kirit Pandit & Marmanis, 2008) (Roberts, 2003)) but less on how to use the resulting information. In order to create a spend analysis, purchasing data is grouped into purchasing packages. This data consists of the invoices an organisation has of its purchases. Depending on the organisation invoices can contain different information. The information that should always be available in an invoice is: value of the purchase, who the supplier is, for which department the purchase was done, a contract and/or invoice identification number, and an identifier of which package the invoice is assigned to or some kind of description of the product/service purchased. Additional information may be available depending on the organisation and/or the software used.

Data grouped by packages give information on how commodities in a certain area are bought. They have many characteristics such as the number of suppliers, value of items purchased and purchasing frequency. It does not directly indicate which packages are interesting and which are not.

In order to create a tool it is important to have a clear approach. The tool is based on three sources of information: literature, available data from the case study, and contact with procurement personnel. A practical framework has been made in order to clarify this process (see figure 1).

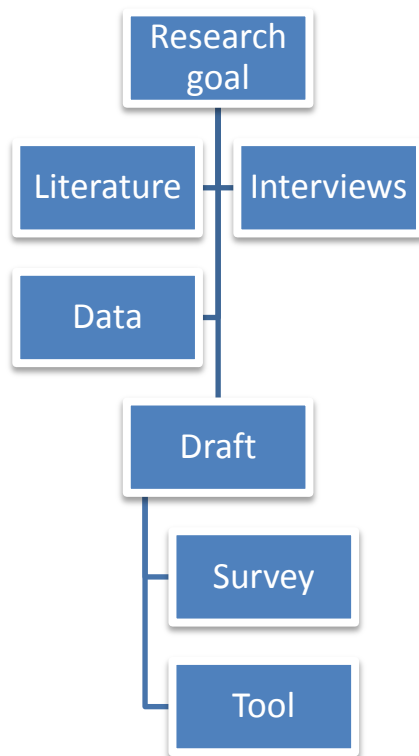


Figure 1: Practical framework

The start of the practical framework is the research goal, which has been defined in combination with the DTCA. The goal is: *Designing a tool to identify the most interesting purchasing packages based on spend analysis data*. The practical framework incorporates information from multiple sources. This approach is aimed at creating a tool that bridges the gap between theory and practice, while remaining useful for organisations.

When examining the different packages in a spend analysis it becomes clear that certain aspects can indicate whether a package is interesting or not. These aspects will form the basis of the tool and will be called ranking indicators (RI).

Literature was the basis for most ranking indicators (RI) and the tool as a whole. Here an exploratory literature search has been done following certain guidelines (Wijnhoven, 2014). Using these guidelines it is important to note that it turned out non-systematic research yielded better results than systematic research. This is probably due to the lack of scientific literature related to the spend analysis. This increased the reliance on grey literature (as opposed to published literature). Consultancy firms have their own frameworks, tools and methods regarding the spend analysis that are more or less available. This has shown to be useful in combination with published literature (Benzies, Premji, Hayden, & Serrett, 2006).

Informal interviews have been held with different procurement personnel in order to complement the literature research. The interviews are also used to assess the practicality of the possible RIs identified by literature. As mentioned in the initial analysis, procurement at the DTCA is in a neutral zone (a change). In changing times, interviews can be of great use to extract information concerning the current changes within the organisation (Schoenberger, 1991).

In order to assess the feasibility of the RIs that came up from both literature and the interviews the data was taken into

account. Using the DTCA data as a case it was possible to understand what data is used and is available in practice. Hence both the available data and the data actually used by procurement personnel was taken into account in order to create the tool.

Combining these three sources of information a draft of the tool was made. This draft was tested via a survey. This survey was made for this paper and has a dual aim: what would procurement personnel want to see from a spend analysis tool and what is the reaction to the draft tool. The survey was made available to procurement personnel (DTCA procurement wide, +/- 15 people) that operate on the package level. It was a voluntary survey that aimed at gaining a practical perspective on the possibilities of a spend analysis tool. This has been done using guidelines from literature (Fowler, 2013). The survey is found in appendix A. The results of the survey were used to refine the draft into a tool.

5. RESULTS

The tool consists of different aspects, called ranking indicators (RI). The RI direct the user towards interesting packages and the characteristics of a package that show most improvement possibilities. Which RIs to use depends on the strategy of an organisation and on the availability of the complementary data.

This framework will rank the packages according to two scales: an absolute scale and a relative scale.

- The absolute scale is defined from 0 to 1 for each RI. They can be used to compare packages. The RI with the highest score would be the most interesting package, while the lowest score would be the least interesting.
- The relative scale knows 5 categories: A, B, C, D and E. A package in category A of a certain RI has a score that is in the lowest 20% of all packages. A package in category E has a score that is in the top 20% of all packages. This means that for the 62 packages used by the DTCA the 12 (which is 20%) packages scoring E are seen as the most interesting packages in relation to each other.

A few things are important to note regarding the RIs:

- Some of the RIs in this tool use supplier level information (such as supplier default risk), while other RIs use package level characteristics. This tool will combine both.
- While the focus should lie on the highest scores, as they indicate the most interesting packages, it is important to note the following. Some RIs can be brought to 0, while others cannot. For example, for the spending value: one cannot reduce all spending to 0 and assume things are well. When this needs to be taken into account for a certain RI this will be mentioned.
- For some RIs data is needed that is not (only) available in regular spend data. Therefore the RIs will be divided into three categories: RIs that only need spend data, RIs that require complementary internal data and RIs that require complementary external data. By internal and external data is meant data that is internal or external to the organisation. Combining different sources of data makes it possible to gain a wider perspective on the spend analysis.
- The RIs of the tool have a pick and choose basis. Each organisation can decide for themselves which

RIs to use and which to skip. It would be advised to examine each RI and decide whether or not it is applicable (or practically attainable) to the specific case. An example for this would be an organisation that does not have access to external data will not (be able to) use RIs that need external data.

For each RI there will be a description on how to use it and what it is based on (published literature, grey literature or practice). Where possible there will be advice on possibilities of improvement when a RI score is high.

5.1 Ranking indicators, spend data only

5.1.1 Spend value

Spend value is the amount of money spent for a certain package.

Use

The score of a package on this RI is linked to the value of the package compared to the others. This is done in five categories: A, B, C, D, and E. The 20% of packages that have the highest spend are linked to category E, the 20% of the lowest value packages are linked to category A. As shown in table 1.

Example: A certain package is in the top 20% of values, therefore receives a score of 1.

Table 1: Categories of the spend value RI

Category	A	B	C	D	E
Score	0	0.25	0.5	0.75	1

Basis

Packages that have a higher value are regarded as more important. The value of spending is one of the crucial aspects of each spend (Telgen, 2003). If something can be improved in a package this will have the most effect in the package with the greatest value.

Possible improvement

The amount of spending is not a negative factor. If other aspects of the purchasing process are improved this factor can be reduced. The spend value score of a package is relative to the spending of the other packages. Therefore changes are expected to be minimal.

5.1.2 Number of Suppliers

This regards the number of suppliers for each package. It compares a perceived optimal amount of suppliers to the actual number of suppliers. What the optimal amount would be depends on the organisation and on the different packages.

Use

Beforehand for every package an optimal number of suppliers must be defined. Then the actual number of suppliers should be compared to this optimum. This RI is a one sided test, with a score of 1 if the amount of suppliers is higher than the optimum, and 0 if it is equal or lower than the optimum.

Example: The optimal number of suppliers is determined to be 4 for package A. The actual amount of suppliers is 5, the score will be 1.

It is important to note the following: in order to keep out of consideration the small suppliers (suppliers that represent a small spend value) the optimal amount of suppliers should be regarding 90% of the spend. This would mean that only the biggest suppliers that make up 90% of the spend are taken into

account for this RI. The 90% margin is chosen arbitrarily and practical use will show whether this should be adjusted.

Basis

Having an excess of suppliers indicates low bundling of procurement. This has as consequences that some of the work must be done more times than necessary (such as multiple contracts) and the organisation possibly misses an economies of scale advantage.

The basis for how many suppliers are seen as optimal would depend on multiple factors such as the package specifics, geographical or strategic reasons. These would differ from one package to another and from one organisation to another.

Example: Company A has two locations in two different countries. For the package energy they would want one supplier. Depending on the countries this can be geographically impossible, leading to an optimum of 2 instead of one.

Possible improvement

Advised would be:

- Bundle spend in order to achieve a lower amount of suppliers.
- If it is not possible to lower the amount of suppliers re-evaluate the basis for the optimum.
- Take into account the different contracts with the different suppliers before leaving one of them. It might be the case that the smallest supplier is the easiest to leave (due to size) but offers the best price-value ratio. Here it might be interesting to leave a larger supplier for more favourable purchasing rates.

5.1.3 Departmental cooperation

Departmental cooperation regards whether different departments have different suppliers within the same package. Suppliers that supply only one department can indicate low departmental cooperation. Departmental cooperation is when all departments of an organisation use the same supplier with the same (framework) contract.

Use

A matrix should be made with the suppliers and the departments (within the same package). The matrix should show whether or not a supplier supplies to a department. An example of such a matrix would be table 2.

Table 2: Example of a supplier x department matrix

Supplier	Department 1	Department 2	Department ...
A	Yes	Yes	Yes
B	No	Yes	Yes
...	Yes	No	No

Each supplier should be looked at to determine whether they reach a certain threshold of cooperation. This threshold would occur if a supplier supplies 75% of departments. If the supplier does not meet the threshold requirement its value in spend should be used for the score. The score would consist of the summed up values of all the suppliers that do not meet the threshold divided by the total value of the package.

Example: Package A has 3 suppliers. One of them supplies to more than 75% of departments, the other two do not. The two that do not represent a spend value of 47% of the spending done within this package. This would lead to a score of 0.47.

Important to note is the following:

- This RI is most useful in combination with the number of suppliers RI. This is further explained in the possible improvements part of this RI.
- If a department does not have any spending within a package it should be left out of consideration.
- If a certain supplier only supplies to a few departments for valid reasons it is advised to keep it out of consideration for this RI in the future. For this complementary internal data would be required. It is, for example, possible that only one department needs a certain product or service within a package.
- The 75% margin is chosen arbitrarily and should be changed in order to meet the needs for each individual organisation. Practice will show whether this percentage should be changed. This margin might also be different depending on the package.
- In order to take into account GUOs it could be interesting to make two such matrices, one with the suppliers themselves, and one with the GUOs. These are expected to give different scores, and would give more insight into the procurement process.

Basis

In an ideal situation all departments buy the same commodity at the same supplier using the same contract. If many organisations supply to only a few departments it can indicate that each department has a different supplier for the same product. This is seen as inefficient as an overall framework contract could improve the procurement process (Wittig, 2003). Bundling spend together can lead to a higher purchasing power, which is seen as a positive change, such as gaining a leverage position (Kraljic, 1983).

Possible improvement

A high score for this RI indicates that different departments of the organisation have different suppliers. It would be recommended to investigate whether this is beneficial or whether it would be better to bundle spend into fewer suppliers.

A low score for this RI indicates that most departments use the same suppliers. While this is seen as positive, there is one situation in which this could be a “false positive” score. This occurs when each department has their own contract with the same supplier. This is not considered beneficial despite yielding a low RI score. Therefore with a low score it should still be investigated whether all departments have the same contract.

5.1.4 Number of invoices

The relative amount of invoices originating from a certain package.

Use

The score of a package on this RI is linked to the amount of invoices in the package compared to the others. This is done in five categories: A, B, C, D, and E. The 20% of packages that have the most invoices are linked to category E, the 20% of the lowest amount of invoices packages are linked to category A. As shown in table 3.

Example: A certain package is in the top 20% of the number of invoices, linking it to category E. Therefore receives a score of 1.

Table 3: Categories for number of invoices RI

Category	A	B	C	D	E
Score	0	0.25	0.5	0.75	1

Basis

The use of an extensive amount of invoices indicates that there is room for improvement (Telgen, 1999).

Possible improvement

Streamlining invoices would be recommended (Telgen, 1999). This could be done using framework contracts for the suppliers (Telgen, 2003). It would be advised to have one invoice per month per supplier which would contain an overview of the expenses made.

5.2 Ranking Indicators, complementary internal data required

5.2.1 Framework contract compliance

Framework contract compliance is the percentage of purchasing (in value) done in a certain package that is done using a framework contract. Depending on the administrative way of creating the spend data, complementary internal data (regarding the framework contracts) may be necessary.

Use

The score of a package on this RI is an inverse linear relationship between the percentage of spending on contract compliant purchasing (0%-100%) with the score (0-1).

Example: Package A spends 60% of total spending according to framework contracts, this leads to a score of 0.4.

Basis

Using framework contracts is an effective way of purchasing. In the few cases that it is not, it regards low value purchases (Telgen & Cobben-Mulder, 2005). Overall framework contracts have many benefits and work well within the European economic environment, hence these are strongly recommended (Wallace, Yukins, & Matechak, 2005). It can be said that framework contracts are an improvement of the purchasing operation (Wittig, 2003). In an ideal situation (almost all purchasing is done through framework contracts) the value of the money spent in a non-framework contractual manner would be negligible giving a score near 0.

Possible improvement

When a package has low use of framework contracts it is advised to find out where the non-compliant spending is and consolidating it in order to improve this spending towards framework contracts (Telgen, Lennartz, & van der Krift, 1999). It is possible that this spending occurs because different departments all purchase the same commodity but do not see the total value of that commodity spending. Pointing this out would be a great help in gaining support for the switch to framework contracts (Telgen & Cobben-Mulder, 2005).

5.2.2 Spend goal compliance

Spend goal compliance is the measure in which (framework) contracts have kept to the assigned budgets. Over spending is the amount of money spent more than previously accounted for, and underspending the amount of money spent less than previously accounted for.

Contracts that have a spending within a 5% margin of their original spend goal are seen as having no overspend or underspend. This is because a small amount of uncertainty with the prediction of the spend goal is to be expected. The 5% error margin is chosen arbitrarily. Practice will show whether fine tuning is necessary.

Depending on the administrative way of creating the spend data, complementary internal data (regarding the spend goal) may be necessary. While it would be possible to add the spend goal to the spend data, it is not common practice with the DTCA, and assumed not to be common practice overall. This means that complementary internal data would be required.

Use

This RI can be used in two ways, one for overspend, and one for underspend. The overspend RI only takes into account contracts with overspend and the underspend RI only takes into account underspend. In both cases the average percentage of spend off budget is the score. The percentage of contracts (by value) that have over or underspent can also be used as an RI.

The aim is to have multiple percentages to give the following information:

- Percentage of spend done with contracts that have overspending.
- Percentage of spend done with contracts that have underspending.
- Average overspend for contracts that have overspending (in %).
- Average underspend for contracts that have underspending (in %).

For every percent the score is 0.01, this means that if 30% of contracts have overspending the score would be 0.3.

When looking at a total ranking, it would be advised to average the four scores into one. This would still give an indication of possible improvement while not disturbing the total ranking. If this would not be done the over/underspend score would appear four times.

Basis

Making goals for the spending on a certain contract is important in planning. The spend analysis can show whether or not there is a structural problem with the composing of goal values (Minahan & Degnan, 2004).

Possible improvement

If the percentage of contracts that have overspending is high it indicates a structural problem with either the creation of goal values (making up how much is expected to be spent) or the guarding of the value (making sure the spending keeps within the budget). The average percentage of contracts that have overspend would show how widespread overspend is, while the average overspend would show the average size of the overspend. The same concept applies for underspend. Depending on the situation different conclusions can be drawn. Here two examples:

- The percentage of contracts that have underspending is 40%, the average underspend is 20% and the overspend percentages are both near 0. This would indicate that the spending goals are generally set higher than necessary, leading to the organisation not fully using the resources at their disposal.
- The percentages regarding underspend are near 0, the amount of contracts that overspend is also near 0, but the average amount of overspend is 40%. This

would show that generally speaking the goal spend is properly made and followed, but when spend rises above the 5% tolerance gap it rises to 40% on average. Here a case to case evaluation would be advised for every contract that experiences overspending.

It is important to note that the absence of over/underspend does not necessarily imply that spending is done correctly. Only if framework contract compliance is high and there is no/low over/underspending, it is possible to state that the amount of spend is (almost) equal to the goal set for it.

5.3 Ranking indicators, complementary external data required

5.3.1 Supplier risk

The risks of suppliers is defined as the risk of defaulting according to the MORE classification. For this RI external complementary data is needed.

Use

Each supplier is categorised, the average of that is scored taking into account the value of these suppliers represent. Since 10 categories exist (AAA, AA, A, BBB, BB, [...]) there will be a linear relation between the categories and the score (0-1). Table 4 shows the score per category.

Table 4: RI supplier risk scoring

Category	AAA	AA	A	BBB	BB
Score	0	0.1	0.2	0.3	0.4
Category	B	CCC	CC	C	D
Score	0.5	0.6	0.7	0.8	1

While the first steps in categories are of equal size the last step is slightly larger (0.2 instead of 0.1), this is to increase the importance of spending done in the highest risk class.

Example: Package A spends 100€ in total, of which 10€ to AAA companies, 20€ to BBB companies and 70€ to B companies. The score would be determined as follows: $0.10 \cdot 0$ (10% of spending is done with AAA companies, this is linked to a score of 0) $+ 0.20 \cdot 0.3 + 0.70 \cdot 0.5 = 0.41$. The score for this RI would be 0.41, which would be rounded down to classification BB on average.

Basis

Defaulting of suppliers has a negative impact on its customers. Therefore it is important for procurement personnel to take into account suppliers that are close to defaulting as there are a multitude of courses of action possible in order to avoid (or being influenced by) defaulting (Wagner, Bode, & Koziol, 2009).

The measurement used for assessing default risk is the MORE rating (Ciprian, 2014). This rating is used because of its relatively high transparency and the use of multiple sources of data. It is important to note that the MORE rating evaluates companies per country and relative to each other.

For measuring default risk a multitude of methods exist. The MORE rating is chosen because the DTCA favours it. Other organisations may prefer using a different measurement method. Even with a different method this RI can still be used. It only requires adapting the categories to the different methodology.

Possible improvement

In order to improve the situation of the package a few approaches are possible. One of them would be to strengthen the bond with the supplier and to help them with a new supplier strategy (Wagner, 2006). An example of this could be the extensive transfer of knowledge (Modi & Mabert, 2007). Another option would be to move away from defaulting suppliers towards healthier ones.

It is important to note that a certain supplier can be close to defaulting while its GUO is still very strong. In such a case it is advised to investigate whether and how the GUO could make guarantees for the supplier.

5.3.2 *Dependency*

The dependency is indicated by the percentage of total turnover of a company that originates from the DTCA. If this percentage is low (approaching 0%) it indicates that the DTCA is not a major customer. If it is high (5% and above) the DTCA is a major customer. For this RI external complementary data is needed.

Use

The dependency knows four categories, each category is linked to a score as follows:

- A: 0%-2.5% dependency is a score of 0
- B: 2.5%-5% dependency is a score of 0.3
- C: 5%-10% dependency is a score of 0.6
- D: 10% and above is a score of 1

These scores are averaged per euro spend in that package in order to get an average score.

While the first steps in categories are of equal size the last step is slightly larger (0.4 instead of 0.3). In order to increase the importance of spending done in the highest risk class.

Example: total spend for a certain package is 100€; 20€ spent on suppliers of class A, 40€ spent on suppliers of class B and 40€ spend on suppliers of class C. The averaging of the score leads to the following calculation: $0.20 \cdot 0$ (20% class A) + $0.40 \cdot 0.3$ (40% class B) + $0.40 \cdot 0.6$ (40% class C) = 0.36. The score would be 0.36 for package A.

Basis

Empirical evidence has shown that suppliers who are greatly dependent on the government as a client are less competitive and less innovative (Cohen & Malloy, 2014), which is generally considered negative. This is due to the fact that competition and innovation leads to improvement of products and services (Cohen & Malloy, 2014).

Possible improvement

It is important to note that a certain supplier can have high dependency while its GUO has very low dependency. In such a case it is advised to investigate whether and how the GUO can guarantee the supplier.

5.3.3 *Legal status*

Legal status regards whether a supplier is still an active company or whether it has defaulted (gone bankrupt) in the recent (last year) past. For this RI external complementary data is needed.

Use

The percentage of spending attributed to suppliers that have defaulted relative to total spending of the package (0%-100%) has a linear relationship with the score (0-1).

Example: Package A spends 1% of its spending on suppliers that have defaulted, this leads to a score of 0.01

Basis

Defaulted suppliers have a negative effect on the customer (Wagner, Bode, & Koziol, 2009). Therefore it is important to see where things went wrong in the past in order to prevent it from happening again in the future.

Possible improvement

This is mainly an approach with hindsight that is aimed at comprehending what might have gone wrong in order to learn and prevent similar situations in future. It is recommended to take note of which other RIs were high for the supplier prior to defaulting. This should help in identifying what did and what did not go wrong.

5.4 Overall ranking

In order to assess where most improvements can be made it is advised to firstly find the package with the overall highest score, and then to examine within that package which RIs are highest. An overall ranking can use simple addition. Multiple other methods for an overall ranking of factors exist (Hwang & Yoon, 2012). This paper will only regard four related to an addition method.

5.4.1 *Simple addition*

The easiest way of creating an overall ranking is to add up all the scores of the RIs used per package. The packages with the highest total score are indicated as the most interesting.

5.4.2 *Weighted addition*

Each organisation is different and has different priorities. Therefore it is advised to use a weight for each RI depending on the perceived importance of each RI. This would imply that, for example, if an organisation perceives the RIs that use only spend data as important and the RIs that use external data as less significant; it could use the following weight system:

- scores with only spend data gain a weight of 2,
- scores using complementary internal data gain a weight of 1,
- scores using external data gain a weight of 0.5

5.4.3 *Threshold addition*

It is also possible to use a threshold addition method. This would mean that RIs below a certain value will not be taken into account. RIs above this threshold would be used as equally prominent. This way only areas where the highest possibilities for improvement would become clear. Multiple tiers of threshold are possible.

Example: Two tier threshold; $(0-0.5]=0$; $(0.5-1]=1$.

Table 5: Threshold addition example

Package	A	B	C
RI 1 score	0.2	0.7	0.4
RI 1 threshold score	0	1	0
RI 2 score	0.3	0.1	0.4
RI 2 threshold score	0	0	0
Total RI score	0.5	0.8	0.8
Total threshold score	0	1	0

Using only 2 RIs and 3 packages the example is shown in table 5. It is possible to see that package A is the less interesting, both according to simple addition and the threshold addition. While both packages B and C have the same value according to simple addition, according to the threshold method B is more interesting than C. This is because

B has one significant high score. Using this method the package with the most high possible improvement areas becomes clear.

This method is advised when the resources for improvement are very limited and they would need to be put to work on as few areas as possible with as much promise for improvement as possible.

5.4.4 Weighted Change addition

It would be possible to add or subtract the amount of change over the course of two consecutive spend analyses. This would amplify the change undergone by each package.

Example: Package A scores 0.35 in the last spend analysis and scores 0.41 in the current spend analysis. The difference in score is 0.06, since this is a negative change this would be added to the score, making the final score 0.47. Which makes this package more interesting.

$$\text{Weighted change score}_t = 2 \times \text{score}_t - \text{score}_{t-1}$$

This would especially be useful for identifying packages that have an increase in supplier risk or dependency. This method would result in making packages that show increasing improvement possibilities more interesting and packages that show a decreasing amount of improvement possibilities less interesting.

This method can be used in combination with other methods as desired.

5.5 Overview RI

In table 6, is an overview provided of each RI containing what each data value would correspond to in terms of score. Table 7 gives an overview of each RI and mathematical formulas used to calculate the score.

Table 6: Overview of RI

RI	Data value	Score
Spend value	Categories from A to E	0-1
Amount of suppliers	Under/over the optimum	0-1
Departmental cooperation	Spend done with suppliers with low departmental cooperation	0-1
Number of invoices	Categories from A to E	0-1
Framework contracts	100%-0% compliance	0-1
Spend goal compliance	0%-100% over/underspend	0-1
Supplier risk	Categories from AAA to D	0-1
Dependency	Categories A to D	0-1
Legal status	0%-100% defaulted spend	0-1

Table 7: RI formulas

RI	Formula for score
Spend value	$\text{Score per category}$
Number of suppliers	$\text{suppliers} > \text{or} \leq \text{optimum}$
Departmental cooperation	$\frac{\text{Low cooperation suppliers spend}}{\text{Total package spend}}$
Number of invoices	$\text{Score per category}$
Framework contracts	$1 - \frac{\text{Spending framework contract}}{\text{Total spend value package}}$
Spend goal compliance	$\frac{\text{Spend done over/underspend}}{\text{Total spend package}}$
Supplier risk	$\sum \frac{\text{Spend package} \times \text{category score}}{\text{Total spend value package}}$
Dependency	$\sum \frac{\text{Spend packages} \times \text{category score}}{\text{Total spend value package}}$
Legal status	$\frac{\text{Value spend defaulted}}{\text{Total spend package}}$

5.6 Survey and interview results

Overall the results of the interviews (prior to the development of the tool) and the survey (after the development of the tool) were in agreement with each other. All agree that more can and should be done with regards to a spend analysis. Especially regarding an overview of the data per RI and indicating which RI to focus on for improvement is regarded as beneficial. The advisory role of the tool is also seen as constructive. The main demand that has come up is a trend aspect, identifying occurring trends. It would be valuable to use the tool over multiple years in order to investigate possible trends. Some have also pointed out that forecasting could bring even more benefits to a spend analysis tool. While these ideas are seen as good and worth investigating they are left outside of the scope of this paper. For the exact survey see appendix A (the survey is in Dutch).

5.7 Case application

Overall governmental organisations have to follow different procurement rules and laws. These are specifically regarding public procurement. While this is outside of the scope of this study a few comments will be made regarding the possible use of spend data. The main issue is regarding the tender process (Aanbestedingswet, 2012), which is set by law. For this purpose it would be useful to flag any supplier that has a contract for longer than 4 years as interesting, this because the guidelines are to re-tender every 4 years (Piano). If a supplier has been chosen for more than 8 years in a row it should be flagged as interesting, this because the guidelines are to promote competition. With only one supplier this guideline might be ignored (Janssen, 2001).

In order to test the tool in practice it has been applied on a data set that has been made available. This concerns two sets of data, DTCA wide and Kingdom wide. This test has shown promising results, clearly showing which packages perform better or worse on the different RIs. Putting all the RIs per package in one table gave an overview of the situation. By using a threshold method it was possible to identify which packages were more interesting and which aspect shows most

possibilities for improvement. While the results were promising, meaning that the tool successfully identified interesting packages, they will not be published in this paper for two reasons. Firstly confidentiality, the data used contains confidential information of economic value, additionally the results of such application of the tool is considered confidential, it gives insight into the working of the organisation. The second reason is the quality of the data used. Due to a problem in the form of the data made available, presumed to be an error in the data refining step, the data is assumed to be fundamentally flawed. This makes the use of the data as an example limited.

5.8 Example of practical application

Here the tool was applied to data that has its basis in the DTCA database but that has been edited for confidentiality reasons. The data itself has no meaning anymore, it is purely used as an example of how the results of a practical application might look. For practical reasons only 4 packages shall be shown, these are of approximately equal spend value. Only 6 RIs shall be shown, per RI an average shall be calculated (column with ~). The most interesting scores are marked in colour, red for the more interesting scores, and green for the least interesting scores.

Table 8: Example of tool application

RI\Package	1	2	3	4	~
Spend value	0.25	0.25	0.25	0.25	0.25
Number of invoices	0.25	0.5	0	0.25	0.25
Framework contracts	0.14	0.53	0.03	0.23	0.23
Supplier risk	0.39	0.40	0.36	0.38	0.38
Dependency	0.62	0.66	0.72	0.65	0.66
Legal status	0.03	0.05	0.04	0.08	0.05
Total score (simple addition)	1.68	2.39	1.40	1.84	1.83

From the results in table 8 the following can be concluded:

- Package 2 is the most interesting, mostly focusing on the number of invoices and the contract framework compliance. These two may very well be connected. It could be possible that a high amount of unregulated spending is done, which would lead to both a high number of invoice score and a high framework contract score.
- Regarding dependency, it is clear that there is room for improvement over all packages, on average it accounts for 36% of the total score (0.66/1.83). This could indicate that in the current procurement process dependency is not taken into account.

- When observing the legal status RI it is interesting that package 4 scores much higher than average. This may be due to difficult economic circumstances within the market of that particular commodity market.
- Package 3 has a significantly lower invoice score than the other packages. It may be interesting to see what processes occur in that package and see if those can also be applied to the other packages.

Looking at only 4 packages and 6 RIs, already a suggestion can be made for improvement. According to the informal interviews made with procurement personnel such an overview of the current situation is deemed useful. Below in table 9, the same information is presented in the relative scale. Since only 4 packages are used category E will be disregarded.

Table 9: Example of tool application with relative scoring

RI\Package	1	2	3	4	~
Spend value	D	D	D	D	0.25
Number of invoices	B	D	A	B	0.25
Framework contracts	B	D	A	C	0.23
Supplier risk	C	D	A	B	0.38
Dependency	B	C	D	A	0.66
Legal status	A	C	B	D	0.05
Total score (simple addition)	B	D	A	C	1.83

6. DISCUSSION

A pitfall for the use of this tool could be information asymmetry. If the managers of the different packages experience asymmetry of information it could inhibit the workings of the tool (van Weert & Thijssen, 2015). This is something any organisation using this tool should take into account. When applying this to the DTCA it becomes clear that there is no asymmetry of information (van Weert & Thijssen, 2015), meaning this pitfall is not applicable in this case.

A challenge that was encountered using the data of the DTCA was the unavailable data. This was mainly regarding the external data RIs. The reason this happened is probably the lack of available published corporate data. This data is used in order to determine, for example, the default risk and the dependency of a supplier. After investigating what type of companies these were it has become clear that these are mostly smaller firms that do not have a legal obligation (in the Netherlands) to publish corporate data. The DTCA does not see them as strategic partners. Therefore the unavailability of their data is seen as acceptable. In other circumstances it may not be applicable to dismiss this concern. The validity and reliability of this data could not be verified.

Depending on the organisation applying this tool it is possible, and recommended, to change certain RIs or add certain RIs that are available or deemed important to that specific organisation.

The tool combines data from both the package level as well as the supplier level. The author is of the opinion that using supplier data can be useful in rating packages as a whole. This because it can identify a faulty process that is structurally occurring. For example if the supplier default risk is extremely high in a package this might indicate that procurement personnel do not use this as a measuring tool, or it might show an aspect to keep in mind for future policy making.

Regarding the data used (partially) as basis for this tool, which is provided by the DTCA, no assessment can be made regarding validity and reliability. Different sets of data were used (DTCA related and Kingdom wide). Due to the scope of this research no time was available for the assessment of the data collection methods. It is known that different departments have different ways of collecting data regarding spend, which would indicate that there is a need to evaluate the reliability and validity of the used data.

7. RECOMMENDATIONS

This paper recommends a wider research into the tool as a whole. This should be aimed at extending the tool by adding more aspects and expanding on the possible improvements per RI. More aspects might be regarding additional links between other spend data and external data (such as growth), or regarding links between what corporate strategy would be, combined with what RIs should be used. It could also be aimed at refining the different RIs and scores, or at creating different weighted systems for an overall ranking.

7.1 Theoretical

It would be recommended to use this tool to analyse and assess the spending of multiple firms in order to evaluate whether or not this tool could be used as a standardized comparison tool. If so it could be used to compare a multitude of corporations in order to assess different procurement strategies and how those affect organisational spend.

It would also be recommend to investigate links and cross overs between the different RIs. While the connection between the number of suppliers and the departmental cooperation is explained in this study (see next paragraph) it would also be interesting to find links between other RIs, and find a basis to support those links. Ideas for specific links are:

- Number of invoices and framework contract compliance
- Dependency, supplier risk and legal status
- Number of suppliers and spend value.

Combining this RI with the number of suppliers RI is advised to find possible improvement situations. There are four combinations possible: both RIs are high, one is high the other low, and both are low. Subsequently all four options will be examined and advice will be given.

- Both RIs are high, this would indicate that the package has more suppliers than deemed necessary and each department has a different supplier. It would be advisable in this case to bundle spending from the different suppliers into a few.
- The number of suppliers score is high, the cooperation score is low. This would mean that the package uses too many suppliers, but most spending is done with only one supplier. In order to lower the amount of suppliers it is recommended to bundle the

spending of the excess suppliers. This spending could then be redistributed over the other suppliers or be used as a bargaining position for negotiations with new suppliers.

- A low number of suppliers score with a high cooperation score. This implies that overall the number of suppliers is seen as optimal, but each supplier only supplies to a few departments. This might be expected (if this is how the optimum is chosen). An example could be the energy package for an organisation that operates in four countries could chose an optimum of four suppliers (one per country). While the number of suppliers score would be low, each supplier only supplies to departments within their geographical area. This would generate a high cooperation score.
- Both scores are low. This would mean that the amount of suppliers for this package is seen as optimal and suppliers supply to most departments. In this situation it would be advised to investigate whether all departments use the same contracts with those suppliers.

7.2 Practical

For the number of suppliers RI another scoring method has been discussed during the development of the tool. The new scoring would be: the percentage of spending done with the smallest suppliers that are in excess (compared to the optimum), with a linear relation to the score. Example: The optimal number of suppliers is determined to be 4 for package A, the actual amount of suppliers is 5. The smallest supplier of the five (the one in excess) represents 13% of spending, leading to a score of 0.13.

With this method if the number of suppliers is good for almost all spending this would give a lower score, which would be in accordance with there being less possibilities for improvement. The drawback is that a significant part of the costs that can be saved could be located with the administration of the suppliers. If this is the case it does not matter how much is spent with excess suppliers, but how many there are. Use in practice and comparison of different data sets should show whether or not this could be a better method for scoring for this RI.

Regarding the RI departmental cooperation, another scoring system has come up during the development of the tool. This would be a correlation between the two axes of the matrix. In an ideal situation, all suppliers supply to all departments (see top table 8), this would result in a correlation of 0. While each department having a different supplier (see bottom table 8) would result in a correlation of 1. Here the score could be the same as the correlation. Practice and applying both the method of the tool and this one as a comparison could show if this would be a better scoring method.

Table 10: Examples of matrix supplier-department with correlation 0 (top half) and correlation 1 (bottom half).

Supplier	Depart. 1	Depart. 2	Depart. 3
1	Yes	Yes	Yes
2	Yes	Yes	Yes
3	Yes	Yes	Yes
Supplier	Depart. 1	Depart. 2	Depart. 3
1	Yes	No	No
2	No	Yes	No
3	No	No	Yes

Resulting from the survey the request has come to also add a forecasting aspect to each RI. While this falls outside of the scope of this project it would be an interesting future research subject. An example of future research would be comparing the forecasting of the tool to forecasting done by experts and to reality. This would give insight into the validity and reliability of these forecasting methods.

In order to assess the validity of the tool developed it is recommended to use a data set and ask different experts to identify interesting packages and explain why they find these interesting. Comparing the findings of these experts with the findings of this tool would give an indication of the validity of the tool. Also it would be advised to compare the RI scores of different organisations and investigate whether correlations and/or a causal effect exist.

8. CONCLUSION

This tool is recommended as a twofold tool: policy making and spend assessment.

As a policy making tool, different RIs can indicate interesting packages and advise what course to take and which policy improvements to make.

As an assessment tool it can show whether certain policy choices have effects on spending and if so how. This can also help procurement personnel in practice to know what to take into account and which aspects to focus on.

For each organisation that uses this tool it is recommended to set their own goals per RI that are in accordance with their strategy.

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