Developing a platform for contribution and sharing of Key Performance Indicators

Philip van Til
p.d.vantil@student.utwente.nl

ABSTRACT
It is important for companies to know and use the right key performance indicators (KPIs). However, most companies are struggling to select the proper KPIs that are really key for their business performance. Furthermore it is costly and time consuming to select the specific KPIs for each individual employee. For this problem a KPI reference model is developed. This model created the possibility to classify KPIs based on business type of the company and the functional role of an employee. The main problem that arises is the way to get access to knowledge of the classifications of their KPIs.

Therefore a crowdsourcing application will be developed by using the KPI reference model. With this prototype application it will become possible for companies to contribute to the model by classifying their KPIs. With this application the KPI reference model will be used for the first time. This will give insight in the accuracy of the model. Additionally the prototype creates a repository of KPIs classified in a new manner. This can be used as an inspiration for companies to select their KPIs. But also for researchers to gain a deeper insight in how KPIs are related with business types and functional roles. Furthermore this research will give a proof-of-concept of the application of crowdsourcing by putting it into practice.

Keywords
KPIs, Key Performance Indicators, crowdsourcing, crowdwisdom, motivation, performance management.

1. INTRODUCTION
Key performance indicators (KPIs) are used to measure performance of a company [3, 4]. A single KPI measures one aspect of business performance for example profit or sales. These KPIs are measured in a certain timeframe like every week or month. The outcomes of the KPIs in each timeframe can be compared to previous values or with company goals. The negative or positive differences form important information for decision making [3].

Because KPIs supply information for decision making it is crucial to set the right KPIs. Otherwise decisions will be made on information that is not key for the performance of the company. Many executives have a hard time in the selection of the KPIs that yield them the clearest picture of their business [3].

Currently mid and high level executives have access to the results of KPIs. But it can be valuable to also give other employees access to performance data. But at this moment this is not feasible due to money and time constraints. [13]

Jasper Stoop [13] developed a KPI reference model to categorize and classify KPIs in a new manner. In the first place a KPI is classified based on the business type of a company. This includes the marketing, customer and product type. Secondly a KPI is being classified based on the functional role of the person who is using it. In figure 1 depicts a simple overview of the KPI reference model.

![Figure 1. KPI reference model](image)

The model gives the opportunity to look for KPIs by knowing the business type; functional role or both. This will make it easier for companies to select proper KPIs for their employees.

2. PROBLEM STATEMENT
The way of classifying KPIs by looking for relationships between a KPI, business type and functional role is new. Research about these relationships has not been done yet. The information about these associations can be found in companies using KPIs.

The main problem that is faced here is: how to elicit the KPI classification information from companies. How do we get companies in a position that they are able and willing to provide and share this information.

In this thesis the concept crowdsourcing offers the basis of the solution for this problem. Together with the problem statement the following two research questions are identified:

1. How can crowdsourcing be a solution to gain KPI information from companies?
2. What are critical success factors for an implementation of a crowdsourcing application?

3. APPROACH
The approach in this thesis starts with a literature study. In this study articles are searched in the fields of KPIs, performance measurement, crowdsourcing and motivation. Based on this information it can be investigated how crowdsourcing can contribute to the problem of gathering KPI information. Furthermore a working prototype will be developed. The prototype is based the KPI reference model. From the literature research some requirements for the prototype will be acquired.

Section 4 describes background information about KPIs and the KPI reference model. Section 5 introduces the crowdsourcing...
4. THE CONCEPT OF KPIs

KPIs have been used to measure performance of companies for centuries [3]. So KPIs are certainly not a new phenomenon but still they are widely used in today’s business world. However, companies still have trouble in building, managing and maintaining KPIs [3]. It seems hard for executives to set proper KPIs that represent the goals of the company.

Companies always set goals which they plan to reach in a couple of years. For example: a company has a goal to see an increase of productivity of 50% in the next three years. The company will not reach this goal if it lays back and only checks in the end if the increase in productivity meets the desired increase. Executives need information from time to time about the amount of productivity. Based on the progress in productivity, decisions can be made to steer the company in the right direction and to finish with a reached goal. KPIs can provide this directional information. Basically a KPI splits the timeline in smaller chunks of a specific size. This way KPIs help the management to define and track progress towards desired goals and serve as a guide to achieve goals [3].

It is important to set meaningful KPIs [3]. In the first place the management makes decisions based on the outcomes of the measurement data. Even if the gathered performance data is correct, wrong decisions can be made because the used KPIs are not really key for the business. Secondly when performance indicators were introduced there was a phrase: “What gets measured, gets done” [12]. Naturally the phrase is pointing to the implications of the things not being measured. It is important here to include all elements integral to what is being measured [12].

The most accepted type of KPIs are those that can be physically measured [4]. Revenue is measured in dollars and sales in units. Besides these quantitative performance indicators, qualitative performance indicators also exist. These are less accepted because they are more difficult to measure. Employee satisfaction or motivation are examples of qualitative performance indicators.

4.1 Dashboards

Dashboards helps an organization to measure, monitor and business performance more effectively [5]. Dashboards are a visual display tools to present performance data and compare it with business goals. In common, only mid or high level executives have access to dashboards. But it can be valuable to also give employees access to performance data. At this moment this is too expensive and time consuming to select useful KPIs for each employee. Since, in general each individual needs different performance data to complete the tasks assigned to them. This means that every individual needs a dashboard specifically tailored to his information needs.

4.2 KPI reference model

A reference model is “… an information model used for supporting the construction of other models” [15]. This KPI reference model should support the construction of dashboards. In this model KPIs are categorized based on certain properties. The aim of this model is to support the development for a dashboard design for every employee [13].

Companies differ widely from one another and so is the use of KPIs. One of the categories in which the model classifies KPIs is the type of business the company conducts. The business type is acquired in three different ways: the type of customer, the multiplicity of the customer and the type of product. Furthermore it is known that inside a company the use of KPIs and thus dashboard design differs from employee to employee. Therefore the model also classifies KPIs based on the functional role of the person using it.

The result of using this KPI reference model is a KPI repository. This repository will contain KPIs and their relationships with business types and functional roles using them. This information can be used to select and find proper KPIs for existing or new businesses. Also the information can be used to provide a dashboard layout for every employee of a company. This becomes possible because the KPI reference model links a KPI with a functional role of an employee.

5. THE CONCEPT OF CROWDSOURCING

Howe [6] gives the following definition for crowdsourcing:

“Simply defined, crowdsourcing represents the act of a company or institution taking a function once performed by employees and outsourcing it to an undefined (and generally large) network of people in the form of an open call. This can take the form of peer-production (when the job is performed collaboratively), but is also often undertaken by sole individuals. The crucial prerequisite is the use of the open call format and the large network of potential laborers.”

In other words it is taking a job normally performed by your own employees and ‘give’ it to a random group of people and let them work on it. In general the Internet is used as the network for it. The company posts the job online and individuals can take the job. Often people are getting an award in the form of money or recognition.

For instance Threadless.com is a good example of a crowdsourced application. Threadless is a web-based t-shirt company. The idea of the company is to crowdsource the designing of the t-shirts through an online competition. Basically visitors applying for the competition have to make a design for a t-shirt and submit it. All the designs of the competitors are shown on the website and can be rated by the visitors themselves. Eventually the best contributions are taking into real production by Threadless and the winners will be awarded with money prizes. Normally a company has to hire or rent a professional designer who are much more expensive then the winning prize money for the best contributions. Furthermore the designs taking into production have a great potential if not for sure to become a success. This is known because many visitors have liked it based on the ratings. [2]

Besides Threadless there are numerous examples of other well running crowdsource applications. For instance iStockPhoto or InnoCentive have also full-time crowdsource operations running.

What have these several applications in common? They all provide some sort of problem. And instead of looking for a solution themselves they let a crowd of random individuals...
solve it. Treadless needs designs for t-shirts, iStockphoto requires amateur photos and InnoCentive wants answers for difficult R&D challenges. The crowd responds on these problems and often gets in return a wide range of different rewards.

5.1 Crowd wisdom
It is interesting that many random people excel at sometimes high complexity problems when traditional problem solving teams cannot. James Surowiecki [14] has written a book titled: The Wisdom of Crowds. In this book he describes that the level of success of a solution is dependent on a large body of solvers.

After all, think about what happens if you ask a hundred people to run a 100-meter race, and then average their times. The average time will not be better than the time of the fastest runners. It will be worse. It will be a mediocre time. But ask a hundred people to answer a question or solve a problem, and the average answer will often be at least as good as the answer of the smartest member. With most things, the average is mediocrity. With decision making, it’s often excellence.

You could say it’s as if we’ve been programmed to be collectively smart.

If you give a problem to be solved to a group of people, probably everybody knows or recognizes something with respect to the problem. Everyone has something to contribute as a part of the whole solution. However probably no one knows the complete solution all by himself. Wisdom of crowds is not about averaging solutions but aggregating them [2].

Solving problems entails two high-level tasks: 1) generating solutions, which include framing the problem and establishing a set of working assumptions about it and 2) evaluating the different alternatives generated in the first step [1].

It is important to have the right balance in the group between diversity and expertise [1]. Often when we try to solve a problem by ourselves or with a small selected and known group we are facing the self-serving bias. We try to find information that confirms our assumptions. And we try to maintain believes even when there is evidence that proves otherwise (belief perseverance).

These are just two common traps that can lead us off track when we are making important decisions. Crowdwisdom can help us to mineralize the effect of those biases [1]. Therefore it is needed to contact a large group of individuals. “With enough eyeballs, all bugs are shallow” is a common saying in the open-source community [1]. It describes the fact that when there are enough developers working on a project every mistake will be revealed.

The amount of diversity needed in a group of problem solvers differs from problem to problem. However no amount of diversity can help if all the participants are completely not aware of the issues. An organization needs to choose wisely which people are suitable to involve in the decision making process. Decisions might require a selected set of skills or knowledge that only some people outside the company have [2].

5.2 Where is it used for?
Crowdsourcing can be used for many different purposes. When there is a need of involving others outside your network it is ideal. Previously Treadless, iStockPhoto and InnoCentive where mentioned.

Another example is Wikipedia. The content on the website comes from contributors worldwide. Battle of Concepts is a Dutch crowdsourcing application. Companies or the government can post here certain questions. The crowd exists only of students or young professionals up to 30 years of age.

Another type of using Crowdsourcing is made by Amazon: the Mechanical Turk. Anyone can post here tasks to be completed together with a specified price. The idea of the system is to let humans perform simple tasks that would be extremely difficult (if not impossible) for computers. Tasks can be like: identifying objects on a picture, find relevant information or to do natural language processing. The reward for the person who is performing the small task is a few dollar cents. [9]

In all the examples of crowdsourcing the application makes use of a crowd of people to generate the desired content. The type of award given to the contributors is different and can be like prizes or recognition.

5.3 Motivation
The main question that is raised here is why people share knowledge in online communities. Often everyone has access to the information and often you do not even reveal your true identity. What drives individuals to post free advice on the internet? And besides the group that shares a lot, another group rarely or never shares anything.

What motivates people to share their knowledge or advice for free on the internet? Sometimes it can be money but generally that is not the case (e.g. YouTube or Wikipedia). Contributors upload massive amounts of content without getting payment whatsoever.

What are motives to share valuable knowledge or advice? Motives are activated by certain incentives. Those can be either intrinsic or extrinsic. Intrinsic incentives arise from inner motives, Inner motives are for instance feelings of competence, satisfaction or fulfillment. Those cannot be influenced from the outside but extrinsic motives can. [10]

Four motives can be distinguished. Direct compensation is a motivation where the best participants earn a price in the form of money, medals or trophies. Secondly motives can be social motives. This includes the reactions of other people for instance friends, family or the audience. Motivation grows if others around you confirm the importance of participation. Self-marketing is a third motive. Participation can be an opportunity to demonstrate capabilities and skills. Forth and last: the learning motive. When taking part in some sort of crowdsourcing idea you can learn from experts in the field of even other people participating. [11]

Also it is shown that attention is a valued resource – even such a value that people often forsake financial gain to obtain it [7]. In the world of academia, attention is often its main currency [8]. In all articles the work of other people is cited in a way that original writers get credit and attention. And also in online communities status and recognition is important [10]. This is also researched in 2008 based on a large dataset from YouTube. Researchers found that the amount of videos uploaded has a strong positive dependence on attention. Contrary this means that lack of attention results in a decrease of video uploads [8].

6. REQUIREMENTS
For the prototype a list of requirements is specified. These requirements will give a scope for the development process of the prototype. Both functional and user requirements are
specified. These will describe the functions of the software and the how the user can interact with the system.

1. Functional requirements

1.1 The system should implement the KPI reference model

1.2 The system should have a registration function

1.3 The system should have a member area where users can browse and lookup KPIs

1.4 The system should have a function to detect potential false registrations

2. User requirements

2.1 The user should be able to provide company information and KPI usage in the registration process

2.2 The user should be able to browse through KPIs

2.3 The user should be able to view detailed information about KPIs and their usage in industries and business types

7. OTHER SOLUTIONS

Basic functionality of other possible solutions should be close to the requirements described in section 6. Important is that the other solutions classify KPIs in some way and a browse function is present.

KPI Library is a web application that provides the functionality. KPI Library calls itself: “the largest online community for Enterprise Performance Management professionals”. It is a community, that wants to provide tools for Performance Management professionals that successfully want to implement Performance Management. The application has a database with over 2,000 KPIs with benchmarks and ratings. Furthermore questions can be asked to the community and professional advice can be acquired. KPIs can be browsed by industry or process they are related to. Each KPI can be rated or commented by the visitor. Also new KPIs can be posted on the website.

Another web application called smartKPIs.com provides a database with hundreds of KPIs. The advanced search functions work with categorization of KPIs in functional area and industry. Also more filters are available to find the appropriate KPIs. SmartKPIs.com aims to provide an online repository of high quality documented Key Performance Indicators (KPIs) accessible to the public to use and contribute to their continuous development.

Although KPI Library and smartKPIs.com provides some of the required functionality it is not enough to be a solution to the problem. The root of this thesis is to classify KPIs by business type and functional role. For this relationship between KPIs and business types is needed. KPI Library and smartKPIs.com have another focus. KPI Library focuses more on the origin of a community about performance management. And the classification of KPIs is not foremost aspect of the application. SmartKPIs.com is more like a large public database of KPIs with some classifying applied. But both options does not give the opportunity to link business and KPIs together and do not require KPI usage data from companies.

Furthermore a main purpose of the prototype is to gain KPI relationship data from the users. Without it no information can be shown to the members. This is an important part of the prototype. The two solutions mentioned in this section do not have such functionality.

8. PROTOTYPE DESIGN

The KPI reference model forms the basis of the prototype. This model contains more functionality then is needed to satisfy the requirements. Only the needed parts of the model will be used in the prototype. A high level picture of the used model is shown in figure 2.

![Figure 2. Prototype model](image)

The center of the model is the user, the registrant. The user works for a certain company. A company relates with an industry and a business type. Furthermore the user has a functional role that he performs in a department of the company. The user makes use of specific KPIs in his dashboard. The rating entity connects a user with a KPI. A KPI have to be rated on how important it is for business performance and how often it is used. The average of those ratings forms the KPI rating of the user for that KPI. Logically only those KPIs the user is using can be rated.

The original KPI reference model did not contain the industry entity shown in figure 2. The original model describes a company by its type of marketing, customer and product. The type of industry tells as well something about the company. The type of industry immediately draws a picture about the business the company is in involved. The industry entity is added because of two reasons: it gives a better understanding who is registering and it is a third classification besides business type and functional role. The correctness of the original KPI reference model must still be evaluated. Further research is needed for the original classifications. Now a third classification can be applied to the future research and might give interesting results in classifying KPIs.

In the research of the original KPI reference model a three point rating scale was used in taken surveys. Users could rate KPI as either as very important; somewhat important or not important. In the prototype is chosen to use the 5-point Likert scale. This is a widely used and known scale in surveys. A 5-point scale is chosen because it will give more differentiation in the ratings of KPIs. Furthermore it will give more accurate ratings. On the websites the rating of a KPI is shown visually in 0 to 5 colored stars and in numeric form.

8.1 Crowdsourcing

The prototype will be a crowdsourcing application. This is because of two reasons. In the first place the KPIs need to be classified. That can only be done by the individual employees of various companies. The needed wisdom resides within the companies: the crowd. The crowd has to provide their information to the system. Secondly the gathered information is
used for personal gain. The aggregated ratings are valuable for companies. Because the ratings are information about how important and how much KPIs are used and in which industry or type of business. In the case of this prototype this information is offered back to the crowd. This description of the prototype agrees with examples of crowdsourcing applications described in section 5. This prototype application uses the crowd for something and it will obtain value. The value is generated from aggregating the different KPI ratings.

It is important to motivate people to register at the prototype application as seen in section 5.3. A motivation type applied to this prototype is the learning motive. From the information companies can learn more about the usage of KPIs. They can compare their KPIs with other companies in their field of industry or business. All this possibly results in improving dashboard design of employees. This motive is implemented in the prototype by protecting the aggregated information from anonymous access. Only after providing the KPI information a company is given access. The prospect of getting access to the information will be used as bait.

The registration process takes the registrant through a series of six steps. It is divided into different steps to make the sign-up procedure more clear and easier to understand. The steps are presented in table 1.

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Industry and department</td>
</tr>
<tr>
<td>2</td>
<td>Functional role</td>
</tr>
<tr>
<td>3</td>
<td>Marketing type, customer type and product type</td>
</tr>
<tr>
<td>4</td>
<td>Rate of common KPIs</td>
</tr>
<tr>
<td>5</td>
<td>Rate of other KPIs</td>
</tr>
<tr>
<td>6</td>
<td>Username and email address</td>
</tr>
</tbody>
</table>

In the first two steps questions about industry, department and functional role need to be answered. The user can choose the industry that applies to his business from a list. Department and functional role can either be picked from a list or a custom one can be entered.

The third step is about the business type of the company. The business type consists of three subtypes: marketing type, customer type and product type. Each subtype has two possible options. Marketing type is either business-to-business or business-to-customer. Customer type has as either the value of one-to-one or one-to-many. And product type can be either service (intangible products) or non-service (tangible products).

Step four shows common used KPIs. A total of 88 KPIs are used in the prototype and 39 are selected as common. These 39 common used KPIs are obtained from the thesis of Jasper Stoop. Each of these KPIs can be rated by the user on a 5-point scale. By default KPIs are selected as not used.

At step five the user has the possibility to rate the remaining 49 KPIs. The user can search for KPIs by submitting a keyword or by looking down the list of all KPIs at once. The rating of KPIs is split into two steps to make it more user friendly. One list of all the KPIs would not be a nice prospect for the registrant. Because of this only the common KPIs are presented in a list. When the user reaches step 5 he has the possibly to rate more or continue to step 6 right away.

After step 5 is finished the data is stored in the database and can be used from now on by registered members. At the last step the registrant has the possibility to provide a username and email address. The password will be send to this address to check if the email address is valid. With the username and password the user has access to the aggregated information.

Research in the field of crowdsourcing with the Mechanical Turk [9] shows the importance of checking the integrity of the submitted data. People are going to try to beat the system to gain access to reward for free. In the case of the Mechanical Turk it is quick earning money. In the case of this prototype it is gaining free access to the secured area. It is a possibility to postpone the registration until the data is checked by an administrator. This gives assurance that only correct data will enter the system. However this is time consuming and user unfriendly.

Important is to let the registrants explicitly know that all the data will be checked. This will discourage people from trying to enter fake data but will not avoid it completely from happening. It is useful to have multiple options in place to detect false registrations [9]. For instance checking the ratings of the KPIs is a possibility. If no ratings are provided; all KPIs have the same rating or very few have been rated the registration can be flagged as possible a fake one. However this is still somewhat vague and does not cover the integrity of the data completely. What worked with the Mechanical Turk should work with this prototype: measure the time elapsed to complete the registration process. This can be taken as far as needed, for instance measure the duration of one step or between rating individual KPIs. For the prototype the intervals between steps is measured and stored in the user account. The time difference between the steps can be checked by the system administrator. For this prototype it possible to access these intervals manually.

### 8.2 Browse KPIs

Once logged in with the given credentials the user has access to search for and browse through all the KPIs. The prototype gives the possibility to browse KPIs by industry, business type or keyword. Once the user clicked on a single KPI, additional information about the KPI is given. This includes a brief description; what for the KPI is used and a formula when possible. Also the ratings applied to the KPI are shown. For each industry-business type relation the rating for that combination is shown in a graphic and numeric way.

The prototype gives one view on the ratings as described above. There can be thought of more views and drilldown options. However those are out of scope of the development of this prototype. For example an interesting view would be to view all the KPIs that have some relationship with your industry, business type or functional role.

### 9. VERIFICATION

A working prototype was made available for the public on the internet. Through online forums and communities about KPIs people were invited to visited the prototype application. Ten people have completed the registration process. Investigating the integrity of the data showed that only two registrations were actually valid. Based on these two legitimate registrations no conclusions can be drawn about relationships of KPI usage with company industry or business type. However the time difference needed for a user to complete the registration process can still be of interest.

It could quickly been seen whether or not a registration was valid. Some registrations had exactly rated all the 39 KPIs
available at step 4. Some of those registrations all KPIs had the same rating. Other registrations just had a series of KPIs rated in precise the same order as displayed at step 4. Furthermore only common KPIs where rated by the users. Other KPIs available at step 5 where not rated at all. In table 2 the ten registrations are shown, ordered by time spend to rate one KPI.

<table>
<thead>
<tr>
<th>#</th>
<th>Duration/KPI (sec)</th>
<th>Rated KPIs</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.2</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>4.5</td>
<td>39</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>4.6</td>
<td>39</td>
<td>Same rating</td>
</tr>
<tr>
<td>4</td>
<td>5.0</td>
<td>39</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>6.1</td>
<td>39</td>
<td>Same rating</td>
</tr>
<tr>
<td>6</td>
<td>6.1</td>
<td>8</td>
<td>Continuous</td>
</tr>
<tr>
<td>7</td>
<td>12.1</td>
<td>14</td>
<td>Continuous</td>
</tr>
<tr>
<td>8</td>
<td>40.0</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>50.8</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>200.0</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Obviously it can be said that registration numbers 2 to 5 are invalid. All 39 KPIs in these registrations have been rated by the user. Even two of those registrations all KPIs rated the same. Those registrations also give a rough estimate of the duration taken for each KPI, concerning fake registrations. Registration number 6 and 7 have an ordered list of rated KPIs and based on this fact can be considered as false. Also the duration per KPI of number 6 lies in line with the previous described registrations. The registrations 2 to 7 have a high chance of being invalid because it is nearly impossible that a company uses exactly the 39 KPIs from step 4. Also an continuous list of KPIs is not likely. Furthermore the time spend to rate one KPI is little and implies that the user rated the KPIs quickly. Registration number 1 and 10 are two extremes and logically can be marked as possibly invalid. The remaining registrations with number 8 and 9 are interesting, because they differ of the others. The registration data of these ratings is looking correct. Also the time needed for rating one KPI is plausible in compare with others. However no hard conclusions can be drawn from these registrations. Ten registrations are not many and cannot be representative. Yet it still gives a small insight of looking into the time needed for a registration to be complete. With more registrations, more accurate duration times can be acquired. This will give the opportunity to find out what time on average give either an invalid or valid registration for this particular application. This could lead to the automation of detecting invalid registrations.

10. CONCLUSIONS
The KPI reference model needs data to be of any use. The data needed is the relationship of KPIs with business types and functional roles. This information can be found in companies. Actually the wisdom needed for the KPI reference model is present in the all companies: the crowd. The idea behind crowdsourcing is to take a job and outsource it to a group of unknown individuals in the form of an open call. The crowd has the opportunity to act on the request. Crowdsourcing is a suitable solution for gaining KPI information out of companies. In the case of this paper we need the crowd to supply information; the crowd is the companies that can provide their KPI information. Furthermore the aggregated data obtained from the companies is valuable, because the prototype aggregates the data. And this will give insight in how KPIs are related to industries, business types and functional roles.

In many online communities people are sharing their advices and knowledge. Crowdsourcing is no different. Behind this phenomenon there is often a drive that motivates people to share, even if there is no reward in the form of money. It is important when implementing a crowdsourcing application to think of how you are going to motivate visitors to share their information using your application.

It is important to build in checks to monitor the submitted data of your crowdsourcing application. This is especially important when data is gathered at large scale or the reward is of great value. People will try to enter false data to get the reward for free. It is important to let contributors know the data will be checked for integrity. Real checks can exist of measuring the time needed for the user to fill-in the form. When it is done very fast it has a great potential of being a fake. It is strongly recommended to include cross check questions.

At last a right mix of people is needed to get the best solutions or results. For some purposes it might be needed to select specific groups of people. A mix of people will generate many different solutions. By aggregating the solutions the outcome is more often better then when only accessing professionals.

11. FURTHER WORK
When the KPI reference model is put into practice, the acquired data potentially provides new information about KPIs in general. But also interdependencies between KPIs, businesses and functional roles will become available. Research is needed to find out patterns in these relationships.

For a crowdsourcing application it is important to check the quality of data entered by the crowd. Further research is needed to find out ways to enhance and standardize this examination of the data.

12. REFERENCES


