Automatic measurement of Social Media Use

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ABSTRACT

Today Social Media is not only used for personal use but also by politicians to get more votes. A lot of research is done in the field of Social Media but most of the research focuses on the extraction of information from the data stream of Social Media networks, while there is less focus on research of effects of Social Media use by specific persons. Most of the tools available today for analyzing Social Media are therefore designed for the extraction of information. The Social Media Indicator (SMI) is a model to give an indication of Social Media usage and could be used to analyze the effects of Social Media usage. Because the SMI is measured by hand, mistakes could be made easily during the measuring. By automating the measuring of the SMI, research in this field can be done faster and more accurate. This also means that the SMI needs to be altered, because not all the indicators currently used by the SMI are available in an automated way. This paper describes how and which information can be measured for the SMI and which information is not available through the API’s from Social Networks. The Social Networks looked at are the same as currently used in SMI. These Social Networks are Facebook, Twitter, LinkedIn, YouTube and blogs. Most of the current indicators used by the current SMI are available using the API’s provided by these Social Media Networks. A prototype implementation is built for measuring a new SMI that includes indicators that could be measured automatically.

Keywords
Social Media, Statistics, SMI, Participation

1. INTRODUCTION

Social Media are communication platforms on the internet. With its increasing popularity it has become a common way to interact with each other. Nowadays Social Media is not only used for personal messages but it is also very interesting for marketing purposes. Another example of usage is politicians to get a better relation with their political supporters. Currently there is just minimal research done on how to measure the use of Social Media in a automatic way.

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Most of the research, done in context of Social Media, is about the information which can be extracted from the social networks behind them. Another way of looking at Social Media is collecting statistics about the use of Social Media by a given person. There are several models created to measure the use of Social Media.[6] These models all have their own strengths and weaknesses but the main disadvantage is that they are poorly defined.

None of the current models has become an accepted framework. One of the used models to measure Social Media engagement is the SMI (Social Media Indicator).[5] The SMI is based on the Macintosh participation ladder. The Macintosh participation ladder is a three-step ladder model describing participation.

1. e-Enabling
2. e-Engaging
3. e-Empowering

The Macintosh participation ladder don’t further describe how to measure these different steps. The SMI fills this gap by specifying indicators to measure them. Macintosh did not specify what e-Empowering means and this step has been left out of the SMI.

The SMI describes a way to measure the use of Social Media for a given person. By counting different indicators the SMI gives a value that describes how much a person uses Social Media. By measuring in a structured way it is possible to compare the Social Media use of different persons. The indicators can be split up in two different categories. The first category contains the indicators which describe the contribution of own content a person makes to a Social Network. This can be things like writing a blog post, uploading a video or tweeting. The second category contains the indicators that describe how much a given person interacts with other people. All the indicators about the replies received from other people are in this category. With this information it is possible to do research on the influence of Social Media usage. The SMI consists of several indicators which need to be measured for a specific period. After these indicators are measured these indicators are summed up which gives the SMI value for a given person. Although this framework gives a good indication of the use of Social Media it also has its limitations. Only some well-known Social Media networks are measured by the given indicators which can give a distorted view of the use of Social Media if someone uses a less common Social Media network. The indicators used by the SMI are listed in table 1. The indicators are divided by their Social Network and split up in the categories contribution and interaction.

<table>
<thead>
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<th>e-Enabling</th>
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<tr>
<td>1</td>
<td>e-Engaging</td>
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<tr>
<td>2</td>
<td>e-Empowering</td>
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The indicators are listed in table 1. The indicators are divided by their Social Network and split up in the categories contribution and interaction.
Table 1. Social Media Indicator

<table>
<thead>
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<th>Platform</th>
<th>Questions</th>
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<td>Twitter</td>
<td>How many tweets?</td>
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<td></td>
<td>How many followers?</td>
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<td></td>
<td>How many retweets? (latest 200 tweets)</td>
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<td>How many replies? (latest 200 tweets)</td>
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<td></td>
<td>How many following?</td>
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<td>Facebook</td>
<td>How many friends?</td>
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<td>How many likes?</td>
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<td>Youtube</td>
<td>How many videos are posted?</td>
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<td>How many viewers?</td>
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<td>How many comments?</td>
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<td>LinkedIn</td>
<td>How many connections</td>
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<td></td>
<td>How many recommendations</td>
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With the use of the SMI there can be searched for relations between the use of social media and its effect. For example the SMI has been used to measure the effects of Social Media on elections. There has been found a positive relation between the number of votes a politician received and the politicians Social Media usage. A disadvantage of measuring the SMI is that it has to be done manually as there exists no tool to measure it which makes it a time consuming process.

1.1 Problem statement

To measure the SMI there is a need for a tool that can easily compute the SMI for multiple persons. At the moment all the measuring is done by hand which makes it sensitive for errors in the measurements. By using an automated way to measure the SMI the results can be more accurate. Most tools available today are built for only analyzing a small number of Social Networks while they cannot provide the required data. Some of the data is easily available through the use of an API (Application Programming Interface) given by the different Social Networks. These API’s can be used by an application to request data from the Social Network. Other indicators may be unavailable through the API because of privacy issues which can make it impossible to automatically gather these indicators. Although most of the indicators are well defined and describe an indicator provided by a specific platform, the blogs are an exception. Blogs are provided by different platforms and there is no common API available for them which makes it hard to support measuring all available blogs. The SMI is still under development therefore some of the measurements can still be changed and the required data gathered needs to be changeable.

There are already some tools available for analyzing Social Media. But to be able to measure the SMI they need support for a wide range of Social Media networks. While Twitter and Facebook are widely supported systems, YouTube is mostly an uninteresting platform for Social Media analyzing, because it doesn’t provide a lot of textual information to be analyzed. Blogs are also a problem because there exists a lot of different blog software and they all need to be supported by the analyzing software to be able to fairly compare the SMI between different people. At last it is uncertain if the available tools are able to measure all the information needed by the SMI. Some information is available through an API but some is not directly accessible because they are usually not necessary. Maybe other problems arise when measuring the SMI in an automated way. Therefore we have to look what is needed for measuring the SMI in an automated way.

1.2 Research Questions

Based upon the problem statement the following research question arises. How should a system be designed to be able to measure the SMI? Therefore I will answer the following questions.

1. Which shortcomings do current Social Media Analyzing tools have for measuring the SMI?
2. How can the different indicators of the SMI be retrieved?
3. How should the component to retrieve specific indicators be designed?

In the next chapter will be explained how to get answers to these questions. In the third chapter there will be a short overview of the current available Social Media Analyzing tools and will be looked if they can be used for measuring the SMI. In the fourth chapter we look at the different platforms and answer the second question and a little bit of the last question. In the fifth chapter there will be a short overview of the design of the developed prototype. In the sixth chapter we discuss the shortcomings and possibilities to overcome them. In the last chapter there is a conclusion and an answer on the main question if it is possible to measure the SMI in an automated way.

2. METHOD OF RESEARCH

To answer the first question we need to systematically look through current tooling and see what they do exactly. Examples of tooling for Social Media analytics are Radian6, Klout, Teezir and Whorules.nl. I will look at how far they come with measuring the SMI and what their strengths and weaknesses are.

To answer the second and third questions there is an application designed to measure the SMI in an automated way. The evaluation done for answering the first question will help to enhance the requirements for this application. To design this application I will make use of the Design Science process[7]. This means I will follow a step by step design process.

At this time the most important requirements are support for retrieving the SMI for different people and export them to a suitable format for further research. For retrieving the SMI measurements the tool needs to support a wide range of different Social Media networks like Facebook, Twitter and LinkedIn. It also needs to be able to count the number of blog posts and the number of comments on different blog systems.

During the design I will also start developing the proof of concept. The development will be done in iterations. During each iteration a specific indicator, used in the SMI, will be added to the proof of concept. Therefore we look at the documentation of the Social Media platform how this information can be accessed and at what conditions. Then we make an implementation and see if it all works and test if there are no missing conditions and the measuring has been done well. At the end we look at the performance of the implementation to see where it could be enhanced and which new indicators could be extracted from the information we gather for the implemented indicator.

An iteration will contain the following steps.

1. Choose a specific SMI indicator.
2. Find out how the indicator can be measured and which requirements it needs.

3. Add this indicator to the proof of concept.

4. Test the new added component to the application.

5. Evaluate the used techniques, complexity and limitations.

3. SOCIAL MEDIA TOOLS

There are several Social Media Tools available today, but they often don’t look at specific persons. By looking shortly at Radian6, Klout, Teezir and Whorules.nl you can see that they are designed to get insight in what is said about a brand or company. Radian6 and Teezir can give you all kind of statistics. For example: how often specific words has been said and how much of the post are positive or negative. This can be used to check the influence your actions had but don’t tell anything about the Social Media use of a person we try to measure. Whorules.nl is a simplified tool that gives just an overview of what is talked about a single entity. With Radian6 and Teezir you can also get an overview of all the posts the tools used for the analysis. These tools are therefore unsuited for measuring the SMI.

Klout is the only exception and is more oriented towards persons. Although they go a step further than the SMI by trying to measure the influence of a person. This means you get a low Klout score if your Social Media use doesn’t influence other people. The exact calculation’s done by Klout are kept secret so it’s uncertain what they exactly calculate. To do all this calculation they also need more access to your accounts. This means the people to measure need to cooperate. This makes this Social Media tool unsuitable for a replacement of the SMI or to measure the SMI.

4. PLATFORMS

To get access to the required information from the different platforms I make use of the Application Programming Interface (API) provided by the different platforms. An API is a documented interface that gives you the ability to request data and perform actions. All the evaluated platforms make use of a REpresentational State Transfer (REST) API. RESTfull Web Services reuse the HTTP protocol to define operations on the Web. This API’s are stateless and the requested data or the action to be performed is given by the used URL. By reusing the HTTP protocol the implementation is a simplified approach to request data and perform actions. All the evaluated APIs are designed to be used in a browser environment which is suitable for a console application. Therefore the login procedure is currently not ready for an end-user. Another problem is that we can’t provide the number of friends or you should scrape the Facebook webpage of a user. But this is not a viable option because it’s an ugly way and the Facebook pages change too often to make it work on the long term.

The other indicators needed for the SMI can all be provided by the Feed of a specific user. This Feed provides all kinds of posts of a specific user and also things like changes to the relations which isn’t the case for the SMI indicators. But the biggest shortcoming is that only the logged in user can be used in the filter. These limitations are good for the privacy of the Facebook users but make this API useless for gathering statistics of other users.

To get access to these APIs you have to request an API token which you could request on the Facebook website by letting a person logging in. You could also get access without logging in as a specific user but then you can’t access all the data. Some user data is only available if that specific user logged in into the application. The first API they provide is the Graph API. With this API you can access information from a graph with in the root all kind of different data like persons, pages or applications. All these objects provide relations to other objects which you can request with the Graph API. These relations provide the needed information like friends and the news feed. An extension to the Graph API is the FQL (Facebook Query Language) where you can use a SQL like query language to query for specific information. Although the FQL would be a perfect candidate to measure the indicators there are some drawbacks. Not all of the columns are indexed and can be used to query. This means you can only use it to find likes on other pages or anything else that is accessible from the Facebook website itself. It could only come in handy if you want to add extra criteria to the relations which isn’t the case for the SMI indicators. But the biggest shortcoming is that only the logged in user can be used in the filter. These limitations are good for the privacy of the Facebook users but make this API useless for gathering statistics of other users.

There are two relations in the Graph API which are needed for the SMI, namely the friends and the feed relation from a specific user. The friend list is needed to count the number of friends. Because of the privacy of its users, Facebook provides this list only to the current logged in user and friends of the currently logged in user that also use the application. There are currently no other ways to get the number of friends or you should scrape the Facebook webpage of a user. But this is not a viable option because it’s an ugly way and the Facebook pages change too often to make it work on the long term.

The use of the API is not very difficult. The only problem is providing a login to the user, because the API is designed to be used in a browser environment which is a problem for a console application. Therefore the login procedure is currently not ready for an end-user. Another problem is that we can’t provide the number of friends because the persons needed to analyze are not the users of this application. But we can provide the number of likes which is needed for the current SMI. The current implementation of the API could also measure the number of comments and the number of posts. These data is measured from a specified time period so early adaptors of Facebook don’t have an advantage. This also limits the data size because old data is not requested. The number
of request per person depends on the number of posts because the Facebook API is using paging. The number of posts you can access in one request is therefore limited and you need extra requests to get more data.

The number of comments and likes on posts of other persons could also be good indicators for the SMI but currently can’t be measured because of privacy limitations. A new addition to Facebook named subscription is currently available in the API. With subscriptions you can subscribe to users in the same way you can on Twitter. This lowers the hurdle to use Facebook as a platform to inform interested parties without being friends.

4.2 Twitter

Twitter is a simple Social Media Network without the complexity of a full suited Social Network as Facebook. First it was only a medium where you can send short text messages to all your followers. They added some extra functionality to control the message flow better. You can now resend messages by retweeting them and send replies to specific messages. This extra metadata can be used for the SMI, but this is of limited value because not all users use these new features.

The API of Twitter gives access to almost all data unless a user has a private account. The API of Twitter is easy to use, because you don’t need to authenticate to request the required information and because users have only one privacy option so you don’t need to make all kind of exceptions if data is unavailable.

With the Rest API of Twitter you can access all kind of different data for a user. The data they provided come with a lot of metadata which lower the number of needed API calls. Some functions can also be used to access information of multiple users in a single call. Most of the needed data can be found by the lookup function which gave the number of followers, following and the total number of tweets. You can receive a maximum of 100 profiles with one call to the lookup function.

The SMI also has two indicators about the number of retweets and replies in the latest 200 tweets. Because of the working of Twitter the replies has a totally other meaning than the likes indicator in Facebook. Instead of the number of replies you get from other users it means in this case the replies you gave to other users. The SMI isn’t always very clear and often the indicators are interpreted on the simplest way. For the number of replies this is very unclear because you can as well measure the number of tweets a person has retweeted as how many times the tweets of a person are retweeted.

To measure the number of tweets and replies you have to get the latest 200 tweets. This restriction seems awkward but in this case it is very useful because this is also the maximum number of tweets you can receive in one API call. Although this limitation has only been added because it would consume to much time to count the retweets and replies in all tweets. In the metadata of this tweets you can find if it’s a retweet. In the early days of Twitter the retweet wasn’t part of the Twitter functionality and to let people know if someone repost a post from someone else they put RT in the front of the tweet. Because this behavior was widely used the API also put RT in front of native retweets. This means you can count the number of retweets by simply check if a tweet starts with RT. Twitter also provides a number of how many times a tweet has been retweeted. In contrast to the number of retweets done by a person this counter don’t count the number of non-native retweets. Because of this limitation this counter is not perfect measured and makes it less usable.

As with retweets Twitter now a days also provide a more native way of retweets so you can check if it’s indeed a reply or just a tweet to a specific person. This functionality is not always used. To get a better measure you can count the number of tweets which are for a specific person. This can be done in Twitter by mentioning another Twitter user at the start of a tweet . Currently this indicator is measured by counting all persons mentioned in the last 200 tweets. Not only replies but also mentions are in this way counted as replies. This means also that multiple mentions count as multiple replies. If you do this not only replies but also personal messages are counted as replies. You cannot get a list of replies to a specific person because this data is only made available for the current logged in user. There is no other data available which could maybe used as indicators for the SMI.

A problem for getting lots of data from Twitter is the rate limit. This means that you can only do 150 API calls per IP per hour. With every request you get back the number of API calls you are still permit to do and when the next reset will occur. With this data you know when you have to wait before you can make another call. Although you have this limit it hasn’t to be always a problem because you can get all the information of a person in one call. This means you only have to wait if you have 150 or more users for which you want to measure the SMI. This limit can be raised by using authenticated API calls for which the limit is raised to 350 requests per hour. Because we need one call for the tweets and one per 100 users for the profile information we can do 346 users/hour with authentication and 148 users/hour without authentication. To request the data for at least 1000 users we need 2 hours with authentication and 6 hours without authentication.

4.3 LinkedIn

LinkedIn is a business related Social Network where you can provide all your work related information. It has also the possibility to post messages. But this is less interesting for this research because LinkedIn is for your professional network and messages should be therefore businesses related. Currently only the number of connections and the number of recommendations you have received from other users is used in the SMI.

LinkedIn provides a API[3] to provide you with the information from the social network site. To be able to use this API you need an Application Key and let a user login to your application. This login is done on a website which will give you a pincode needed by the application. This data is used for the rate limiting that is been done by LinkedIn. The data needed by the current SMI is all provided by the public profile. Because this public profile is only rate limited for the application and not the logged in user this limit is not a problem. At this moment you can make 100k request per day which is more than enough to measure the SMI for a few hundred people.

The number of connections of a LinkedIn user is freely accessible but has a limitation. You cannot get the number of connections if it’s number is more than 500. The only thing you can get if someone shows with 500 connections is if the number is capped or not. With this extra information you can get a distinction between 500 connections or more than 500 connections. The best value for more than 500 connections would be the average number of connections for people with more than 500 connections. This value is not only difficult to calculate but would give
a lot of people a too high SMI value. The only thing you can sure about is that someone with more than 500 connections must have at least 501 connections.

There isn’t much countable information which could be interesting for the SMI. Most information available on LinkedIn is profile information. The only other countable information which could be used for the SMI is the messages send with LinkedIn. But this message functionality is currently not widely used by the LinkedIn users.

4.4 YouTube

YouTube is not a typical Social Network. It is a video sharing website but because of the possibility to subscribe to users and post comments it has a lot in common with a Social Network. YouTube users are also able to rate videos with the use of likes and dislikes. The interaction possibilities on the website and the use of video’s to tell your message make it an important platform.

The API[2] provided by YouTube gives a lot of information. The API split almost all kind of information in different kind of feeds which you could open with a regular feed reader. These feeds are just a list of links with at least a title and a description but could be extended with all kind of metadata. There are feeds provided for the comments, subscribers, posted videos and many more. For the user profile there is a exception because it is just a single item.

The data about the user profile already gives most of the information required by the SMI. They contain the statistics of the current user. These statistics contain the number of total views and the number of subscribers.

The YouTube API also lists the links to other feeds that are related to a specific item. Because these links contain a number to indicate the length of such a feed you can use this number for example to count the number of uploads. This extra information makes it possible to get the indicators with the use of a just a few API calls.

The information about the posted videos is provided by the video feed. The only thing needed to count the total number of comments is the number of comments for each different video. There are also some extra statistics about these videos which could be good candidates for the SMI. These statistics are currently only available by using a test server from YouTube for the API calls. These extra statistics provide information about the number of likes and dislikes a video received. The number of dislikes would give an indication of the interaction you get but it also indicates your message is not well received. The influence of using such an indicator is unknown which makes it not a good indicator.

4.5 Blog

Blogs are an older technology to tell your opinion on the internet. Although blogs are older it is still widely used and is split up in many different applications that all have their own API’s. There are not only different API’s, the API’s are also designed to be used by the blogger himself to add new posts or manage the comments. These API’s are therefore behind a login and not available to us.

Most blogs however have support for feeds which provide a list of the last blog posts. Because the feeds provides only a list of the last posts you can’t use them to get the total number of blog posts. The only way to count would be to regular check the feeds. This means you need to do this in a given period of time in which you want to measure. These checks need to be done on a regular base because if there are too many new blog posts you could miss one or more.

Some blogs also provide a feed with all the comments which means you could also count the number of comments. There are a few drawbacks however. There can be a lot more comments than blog posts and in the case of a very popular blog you would probably miss a few comments even if you check them regular.

The last problem is the identification of those feeds. There is no automatic way to distinguish a feed with blog posts from a feed with comments. In the case of some blogs the comment feed is on a per post base and with some other on a per blog base. Only in the last case this would not be a problem as you could configure the comment feed manually.

5. APPLICATION DESIGN

The prototype application has been developed in Java. Java provides a HTTP API and there are libraries available for the required authorization code of LinkedIn. Also other programming languages would be a good choice but because I had already experience with this language and the language doesn’t have major drawbacks for this application I chose for Java. The application can be provided with a CSV encoded list of all the persons you want to measure and their corresponding profiles on the different platforms. After the application has requested all the required information it will export a CSV file with all the measured persons and the value of the indicators. This CSV file can then be imported in a spreadsheet or other application for further analyses.

To make it easy to remove, change or add new Social Media platforms the application is split up in different backends. Each of this backend contains a Connector object which connects to the platform and does things like authentication. Also every backend contains a Person object to collect the data for a specific person. To make it possible to do rate limiting the connector contains a list of all the users of the specific platform and decides when to lookup the information. The connector can make a call to get information of multiple people to speed up the process. This can be done on Twitter where you can get the profile information of multiple people in one call.

The Persons collect all the information provided by a Social Network. This information is, after all the information is gathered, combined with the information from other Social Networks. The mapping between these Persons is done by the application which received a list with id’s, profiles and url’s to identify a person on an given platform. The application makes a connection to all the platforms and adds the Person to these connections. Then all the connections are run in parallel to speed up the process without doing multiple calls to the same Social Network. After all the information has been gathered the information is exported.

The class diagram of the application prototype can be found in figure 1. The application SMIt will setup all the connections and creates the Persons using the given list. These persons are added to the Connection’s which will be started to gather the information. This information will be gathered from the different Person’s and then exported for further analyzing.

6. DISCUSSION

Current Social Media analyzing tools focus on keywords instead of persons which make them unsuitable for the
usage of measuring the SMI. To be able to retrieve the required indicators of the SMI there is need for an application that can make use of the API’s of the different platforms to measure the SMI indicators. Although most of the indicators used by the SMI can be measured there are some limitations. You cannot measure the number of friends with Facebook and the platform and their corresponding API design influence how specific indicators can be measured. Some networks like Facebook and Youtube can only give the number of comments and likes you get from other persons while Twitter can only give the number of mentions of other persons. Most of these limitations are the same as if you would measure the indicators manually. Without this limitation a more consistent SMI could be created.

6.1 SMI

Currently the SMI is based on which information is available or easily countable by persons on the websites of a Social Network and would give an indication of the use of Social Media. Because the counting always had to be done manually, not all the potential indicators have been used. Some good indicators could have been left out. In the case of Facebook there is also an indicator, the number of friends, which could be counted manually, but not automated. While trying to implement the indicators needed for the SMI sometimes there is also information available which is currently not used but could give an indication of Social Media use. The SMI is not perfect and can be improved by adding the available indicators. By automating the measuring there is also time for using more indicators, because the indicators don’t have to be counted manually.

For the implemented prototype there is used a new list of indicators which is based on all the available information trough the API. The indicators used by the application are listed in the table below. The indicators are divided by their Social Network and split up in the categories contribution and interaction.

6.2 Application

The application is designed to gather all the required information in a single run. This make the design a lot easier but this method has some limitations. In case of the blogs you need an application that runs for a period of time and frequently measures the information. With running the application for a longer period of time you could also measure the change in Social Media usage in time. You could still do this by running the application regular, but it would be more efficient if the application has access to earlier measurements because then it could skip the already analyzed messages.

The current application is console based while it could be needed to login to a Social Network. This login can only be done with a web browser which is not available from the console. The integration would therefore be better if the application would become a web application so that the user can login without having to copy-paste url’s and access codes.

7. CONCLUSION

The measuring of the SMI can be automated. Therefore we need other analyzing tools than the tools currently available. Although there are some possibilities to get an indication of Social Media usage through Klout it isn’t suitable for research purposes because of its lack of implementation details. With the build prototype all the indicators can be measured except for the number of friends on Facebook and anything related to Blogs.

With the use of the available API’s of the Social Media platforms you can get most of the information needed for the SMI in its current form. By making the counting automated, there are possibilities to gather more information to calculate the SMI than currently used. Although some information is not available because the website and API design of some Social Networks can’t give you access to all the information you want. There is also a limitation because of some rate limiting but it is still much faster than counting it manually.

To be able to fully automate the measuring of the SMI the SMI should be changed to only include accessible indicators. Although you would miss a few indicators there could also be added a few new indicators. With the founded indicators during this research I created a new list of indicators to give a measurement of Social Media usage. This new list is my proposal for a better SMI which is well-suited for research purposes because of its lack of implementation details. With the build prototype all the indicators can be measured except for the number of friends on Facebook and anything related to Blogs.

8. REFERENCES

Table 2. Proposed Social Media Indicator

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<td>How many times are they watched?</td>
</tr>
<tr>
<td></td>
<td>How many subscribers?</td>
</tr>
<tr>
<td>LinkedIn</td>
<td>How many connections</td>
</tr>
<tr>
<td></td>
<td>How many recommendations</td>
</tr>
</tbody>
</table>
[1] Facebook graph api documentation.


