1.1 Solutions tailored to the situation at ASML

Having gathered information from various sources about the use of BI tools at ASML and the reasons why people use tools in a certain way, it's possible to propose solutions to increase adoption or to augment the use of BI tools in general.

Given the data from the survey and interviews, issues can be divided into a number of sections which can be linked to the theoretical frame that is explained in chapter 10.1.

1.1.1 Clustering information with a BI and Data Analytics portal

A BI portal in SharePoint will help to:

- Make accurate information searchable and available in one location for users and prospecting users.
- Have a base line of communication that provides the foundation of a community and provides a means of reaching it when needed.
- Facilitate management buy-in by providing transparency on the benefits of BI.

During the interviews several people indicated they had trouble finding the correct information. The author, while setting up his virtual workspace and applying for a software license, experienced the same issue.

To new employees starting at ASML, finding the right information about BI tools is quite the ordeal. Searching the myASML site gives sometimes irrelevant or outdated information. Finding the correct place to apply for a license is a challenge and it seems everything hinges on either accidentally contacting the right key-user who can help you or knows someone who can help you, or having someone who guides you in the process of setting up your workspace from the start.

Finding the right key-user is a problem mentioned by one interviewee as well. He stated: "So I started writing emails, but I guess I reached the wrong people, since I got no replies or I got replies saying "I'm not the person you need"." (Appendices 4, Interview 3).

The solution to this problem is to make one portal that clusters information and links to all the different resources and provides, similar to data sources, 'one version of the truth'. Ideally it would be divided into different sections to address each subdivision of the BDA portfolio, meaning analytics, data science and reporting. In every section categories should be made addressing each of the available tools and providing useful information about the procedures to apply for a license, the various levels of licenses and what they can be used for, a list of key users per BI tool per department and links to the different BI tool community sites, if they exist. By doing so, it will provide a reference for experienced users and a quick startup guide for new BI users.

The portal could also be used to distribute news about BI in general and about new developments, in order to keep the community interested. A general FAQ and some general information about where BI fits in the overall picture could provide some context for starting users.

The portal could however contain a lot more information than discussed above.

Working on clustering information will facilitate working on advocacy as mentioned in Protiviti's Fra²me Methodology (see 10.1.1, p. 68). Having a good BI portal will provide good name recognition and branding of the BI tools. People will understand it's relevancy and the positive promotion, combined with building a good social BI community, will in turn lower the threshold for new people or management to start using BI tools.

To cultivate management interest for using BI, the ADKAR model can be used conjoint with the BI portal. ADKAR uses five goals in order to facilitate change. The first two apply to the BI portal, them being Awareness and Desire (Prosci, 2018).

This first keyword captures the awareness a business user or manager has for the need for change. Do they know there is something better, do they know BI exists and can be used for easier reporting, etc. To build awareness, early communication of the coming change can be used.

When there's enough awareness and the user or manager understands the concept and benefit of the change, desire will follow. The user wants to change and is motivated to change. If desire is missing, questions like "what's in it for me?" will be asked. If this occurs, high level management motivation and management intervention through a one-on-one conversation can uncover the underlying objections or motivation for not willing to participate in the change (Prosci, 2018).

1.1.2 Classroom-based and video education

Appropriate training can provide:

- A steady base for new users to start learning and how to use the BI tool, thus providing a first success experience and boosting user confidence.
- A reference guide for experienced users to learn new advanced topics, find help quickly and help to maintain a good workflow.

One of the most recurring answers both in the survey and in the interviews was the need for more education. Users have trouble finding the correct training material and when they do, they do not like it or perceive it as insufficient. Results from the survey indicate that users prefer an instructor-led classroom. A classroom approach was chosen for two reasons. One because having an instructor provides the option to ask questions if something is unclear and to receive an answer reasonably fast. Also a classroom often provides an activity based training, which seems of great importance to users, since they prefer to learn new content while doing an exercise or follow a tutorial instead of just following a PowerPoint or reading a text. Organizing such classrooms at regular times could however be difficult to realize for different user groups from various departments, due to time and resource restrictions.

To counter this, the author proposes making video tutorials in the style of online training websites. As an example Udemy.com is proposed, mostly because the author is accustomed to using this learning platform, but also since users participating in the interviews confirmed this as being a good example.

The reason why Udemy is so well received as a learning platform is explained in the interviews: "I use Udemy for my courses in school as well and it's quite good. The nice thing about Udemy is, and this is why people love it I think, the structure. First you get an general overview and then different topics are addressed as separate modules." (Appendices 4, Interview 3).

Having this modular setup is indeed one of the strengths of these online course platforms, since it works well for the users as well as for the company. For the users the videos are small enough to watch in between the regular daily work. Also if a user wants to find a specific piece of content in a video, a limited amount of time has to be spent for browsing in small videos instead of spending an hour or more looking in lengthy tutorial videos. Furthermore the small videos define just one piece of content within a general topic, which gives users a good overview of the progress they're making and what they are learning.

Figure ***Error! No text of specified style in document.****-1: Modular setup of the Udemy course "Machine Learning A-Z™: Hands-on Python & R" (© Udemy, 2018 ; Eremenko, 2018)*

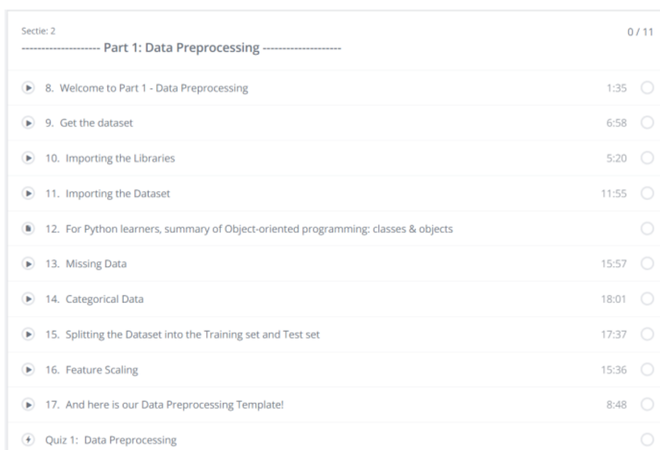


Figure ***Error! No text of specified style in document.****-2: Structured setup of Part 1 of the Udemy course "Machine Learning A-Z™: Hands-on Python & R" (© Udemy, 2018 ; Eremenko, 2018)*

For a company this method works very good since courses can be created and adjusted to audiences pretty fast. Certain modules or advanced topics can be omitted for BI consumers, while other 'basic' topics can be left out for advanced users. Also content can be easily updated, since only small pieces of content have to be altered if a new update or version is implemented.

Next users can start the course when the business requires it. Content can be consumed in one continuous training or the pace can be adjusted to the available time, due to its modularity. Since the videos are hosted on an online platform they're accessible throughout the network, however content cannot be downloaded or shared (a feature that cannot be guaranteed with a PowerPoint training on a SharePoint site), thus ensuring this training knowledge remains within ASML.

To tailor the content of the videos toward the needs of the end users, one could also opt for recording the solution of business cases instead of mere training videos. These business cases would give a hands-on insight in the use of the BI tool in a given department. ….

An added feature included in the video section of the Udemy site is the questions panel. Here users can ask questions about the video they're watching and possibly even link the timeframe where the question relates to. This enables the instructor to give to-the-point answers. Furthermore, since the course is cut into small sections, if a user is struggling with one video and he asks a question about it, he can continue the training with the next video. This feature not only enables the user to continuously progress, but also enables the course owner to cluster the questions and on a set time provide answers.

Although these training videos seem a good idea, users keep asking for classroom-based training in the interviews. The content of this training needs to be communicated very clearly, since some users already have a BI background and can get bored in the very basics of BI tool usage.

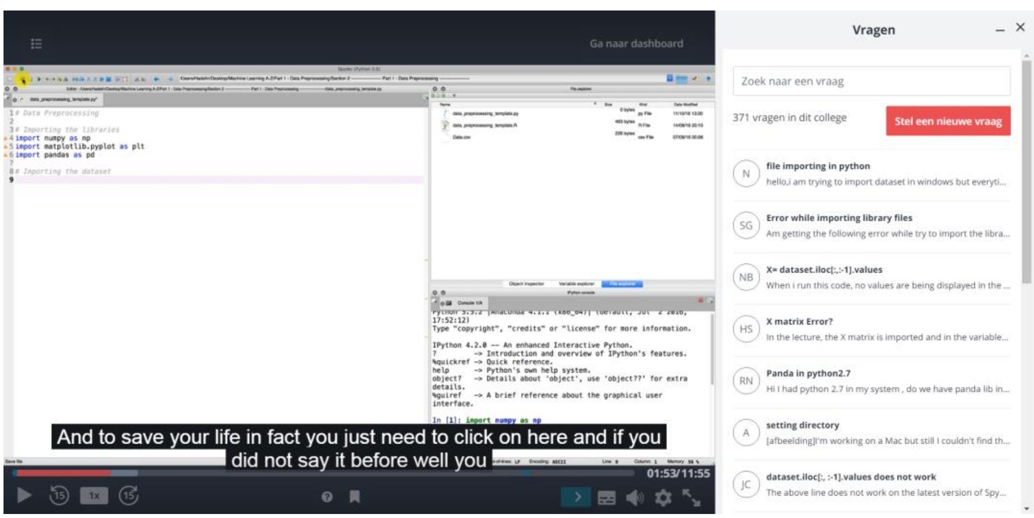


Figure ***Error! No text of specified style in document.****-3: Udemy training video window, with in the center the video content and to the right the question section for the given video. (© Udemy, 2018 ; Eremenko, 2018)*

To find a solution between high-impact user specific learning and general easy-access learning, one user proposes "I think a classroom-based training would definitely work for getting the basics correct. I think videos would work better for advanced topics, since when people hit a problem, they can use them for solving the issue themselves, watch a bit of video, get a quick answer and continue.” (Appendices 4, Interview 5).

Having this mix of training types could also help to divide the training among the different departments. The general section of the training could be provided by IT since it’s similar for all BI users at ASML. The advanced topics should be provided by key-users from various business units, since this content is more or less specified by how the tools are used within the different departments.

Paired to good training videos, users also requested a reference manual. This manual could be a wiki where people can search for answers. The content of this wiki could contain general information, but should primarily address “different information then the Spotfire website. It has to contain the specific information relevant to working with Spotfire at ASML” (Appendices 4, Interview 2).

Last users could utilize the learning videos on the Spotfire website to get more education. Using them as an additional information source could temporarily fill the training void that exists today, at least until more and better suited training material is available.

Linked to better training tools, users also indicate the time for training is often inadequate. Learning often starts with daily allotted time, but this time is often used for regular work tasks, whereas the training is pushed to a few free moments during the week. This results in users losing focus and the willingness to learn the new tool, ending in frustration or just abandoning the new software and reimplementing the old technology. This means that, in order to maintain a good learning curve for users, it requires a commitment from the business as well, meaning managers need to either lighten the workload to facilitate learning and practicing or users need a couple of dedicated days to start and finish the training as a full-length course.

Having adequate training is key for the third and fourth component of the ADKAR methodology for change management. Knowledge and Ability will facilitate change. Without proper knowledge people will struggle and will not have the ability to use the new software. This will result in frustration and users will stop using the new software (Prosci, 2018).

1.1.3 Finding help with a community site and meetups

A community site and meetups can provide:

- A reference base for starting users and experienced users where they can ask questions and find answers. This helps to alleviate pressure from key-users and colleagues to answer questions and provide help.

- A platform where people get to know each other and each other's competences and knowledge, and where they get stimulated and triggered into helping and participating in the community.

Linked to insufficient training, people also pointed out finding help sometimes can be a struggle. At the moment the most used way of finding help is asking a colleague, but as a user in one of the interviews pointed out colleagues get irritated or non-responsive sometimes due to workload or the amount of questions received. Although the response time is usually pretty fast, using colleagues as a knowledge base works counterproductive since these colleagues can't work on their own daily tasks. As one user stated in the interviews he therefore sometimes receives answers like "We would really like to help you, but we've had a lot of requests and we can't help you just now" (Appendices 4, Interview 3) from users and key-users.

To alleviate the pressure from these colleagues that receive a lot of questions a platform should be created where users can ask a question, and the community can answer. This model has been tried and tested as the Stack Overflow platform. Here millions of developers ask and contribute content, helping others and forming a community. The original poster can then mark one answer as best reply and people can upvote the comment, so other people with the same question can easily find and use older relevant content and pick a 'best' solution.

A module like that is already available within SharePoint today and can be implemented pretty easily. This module is called a Microsoft Community site and is part of the SharePoint collaboration solutions.

It is also possible to use Yammer as a community content sharing platform. A Yammer feed for Spotfire already exists and others are easily created. Yammer however is designed as a social network platform for Office 365 and not so much for collaboration, while the SharePoint community site is specifically designed to act like a Stack Overflow environment.

The Yammer community isn't very much alive either, with only 7 messages posted in the last year (Image 10-12). People admit they don't use Yammer in general, so they need to be persuaded to use it. To increase visibility, the feed can be embedded in existing SharePoint sites, but a SharePoint community site blends in more seamlessly as a whole.

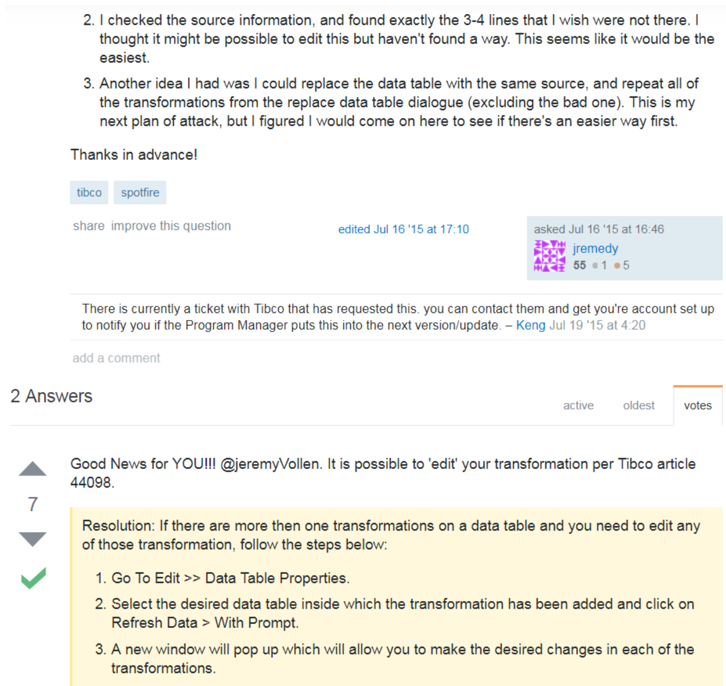


*Figure **Error! No text of specified style in document.**-4: Extract from Stack Overflow where an answer to a Spotfire question has been flagged as best answer (green check mark) and received 7 votes from other users (© Stackoverflow.com, 2018)*

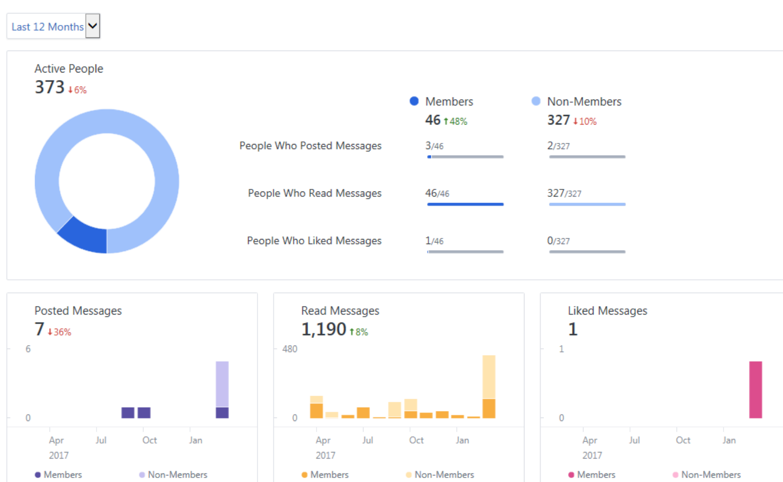


*Figure **Error! No text of specified style in document.**-5: Usage statistics of the Spotfire Yammer feed for the last 12 months*

Once this collaboration platform is set up, the key-users should be motivated to contribute, in order to generate a positive momentum. The end goal is however to make the entire community contribute and try and solve questions or give additional input. This community should be comprised of BI users, experts and key-users.

One last measure to get information to the community could be the organizing of two-weekly or monthly meetups. The content for these meetups could be, for instance, an issue a user has had and the solution for that issue or some new development within BI at ASML. The main goal is to spread knowledge and create a platform where there's room for discussing and sharing opinions. The big caveat however is to tune the content of these meetups to the various BI user groups. As one user at the interviews pointed out: "Sometimes it's difficult for the entire community, because a key-user has enough information or knowledge, but if you do it for the community you need to tone it down quite a bit." (Appendices 4, Interview 3).

It is therefore proposed to hold separate meetups per user group. Key-users on the one hand, are presumably more interested in technical solutions whereas report consumers would like more general information. Expert users are situated in between.

These meetups should be held every three months. Every quarterly cycle should contain a meetup for every user group. Assuming users are not interested in meetups of a higher usage level and are possibly interested in the meetups of a lower usage level, report consumers have one meetup every three months. Expert users can attend both their own meetup and the one meant for consumers and key-users can attend all three. This setup anticipates that a higher user level somewhat indicates a higher inclination to attend. Also if key-users and expert users attend the regular meetups for consumers, they can provide valuable insights in discussions and provide perspective and vice versa.

To secure involvement of the entire company, including the factories abroad, meetups can be streamed and recorded. This way people who can't attend a meetup can watch it later or watch it remotely.

Meetups and a community site will secure the last three components of the ADKAR framework for change management. Users can gain Knowledge and thus the Ability to use the new software by attending meetups and hearing people speak about problems. Also searching the community for answers will provide the help people indicate they need. When the skillset evolves, users can contribute to meetups and the community site, assuring Reinforcement and commitment to using BI tools (Prosci, 2018).

1.1.4 Workflow efficiency with templates, report lists and version control

Templates and a style guide can provide:

- A degree of standardization which will provide easier access to report users and alleviate the threshold to accepting reports in a BI solution.

- A companywide styling and easy to recognize reporting that is directly usable in presentations and publications.

Report lists can provide:

- A means to find and reuse reports instead of rebuilding them.

Version control can provide:

- The assurance of having the latest and most accurate reports currently available.
- The ability to revert changes if proven not effective or flawed in a quick and easy way.
- A single source of the truth.

A surprising amount of entries in the survey stated that they occasionally see reports that look similar to reports that have already been made, indicating a certain degree of redundancy. This redundancy means work time being used inefficient and some performance gain can be obtained by streamlining user workflow.

A first idea to optimize workflow could be the creation of a company-wide style guide to facilitate uniform reporting. This style guide would hold rules and regulations (e.g. color schemes, font styles, lay-out guidelines, etc.) that need to be applied to all reports made. This to make the reports more easily accessible for end-users and to create a general sense of recognition throughout all published reports.

This last feature can also be used to cope with an issue a user mentioned in one of the interviews. He stated that "If you rebuild it in a different BI tool, it's appearance changes and management isn't always too happy with that change." (Appendices 4, Interview 2). Having a preset style guide would make the change less obvious and thus make it easier for end users to find their way in various reports.

Based on the style guide, templates could be created that would help users to quickly build reports. These should have the "[…] proper formatting immediately so we can use it in presentations without the need for altering it." (Appendices 4, Interview 5). It appears before use reports are chopped up or visually altered to be able to use them in presentations. Having a template that immediately formats reports in a presentation ready styling, based on the style guide for reference, would make this alteration redundant.

To further optimize workflow a list should be created possibly per department that sums up the different reports in use and a brief description of the contents of the report. This would help people to find reports similar to the ones they need or want to make and thus avoid doing double work. Also the last current version should be added to this report in order to keep track of changes and to be sure users work with the latest version. This to facilitate new BI users to find their way quickly and to help experienced users to keep track of changes.

Building the report list can be partially automated. Since reports, for instance Spotfire dxp-files, contain xml and txt files, they can be crawled and indexed by intelligent software and compared to the existing list. If a report is not present in the existing list, the software can add it and update the list. Several AI tools, like for instance CLAIRE from Informatica, exist today, but using these advanced AI tools for this work seems overkill. A custom built tool in any programming language that can read specific fields in xml or txt files and that runs on preset times could be a better and less expensive solution. The only prerequisite however for this solution to work is that users have to fill in the metadata required to sort and validate the reports.

To facilitate version control, an on premise hosted git client could be used. Users could store their reports in the git repository and other users could pull the latest version before use to assure they have the correct report. To minimize the threshold for the business users to use git, a client like GitKraken or SourceTree could be used as a graphical interface to the git repository. The benefits of using a repository is that there is always the possibility to revert changes in reports if, for instance, a change in a query breaks it. Also when implementing changes, users can still keep using the 'accepted' report on the master branch, until the newer version has been fully tested on a different branch and is then pushed to the master branch. Different branches can be created per department keeping all the reports separated. To cope with access rights and permissions, different roles can be created in the git client, so only the right people can access/alter reports if needed.

1.1.5 Measuring and monitoring through KPI's and report usage

Measuring and monitoring can:

- Provide a continuous evaluation of the usage of BI.
- Create business awareness by providing insight in the usage or lack of use of BI.
- Factual data to base and plan further improvements on and to determine long time goals.

An attempt was made to gather information from data source and report logs. This however did not provide the direct information that was expected, but more indirect information that could be validated by directly asking users what the information meant.

To be able to track the efficiency of BI use, a number of KPI's need to be defined. These KPI's can be different per tool since it is possible not every tool can track the same usage statistics. In this study a number of BI uses was analyzed and it was concluded that, although a lot of information was gathered concerning the use of various tools, this information was mostly about volumetric data, i.e. the amount of data transferred, the amount of navigational steps, the most frequent user of a report, etc., instead of actual analytical data that gives insights in use.

It is however possible to convert the volumetric data to information that can be used to monitor the use of BI tools if it was linked to other data. During this study, a quick scan of the logged data from Analysis for Office was performed and in the navigational step section it was noted that some queries had 0 navigational steps. This could indicate that a query is used to gather data and the data is then transported somewhere else. To find out several emails were sent to users asking them to what purpose they used these queries and this confirmed the hypothesis that they actually used the query to merely gather data for use in another program.

One user however also pointed out they used reports that were ready made and didn't need any navigational steps. The same user also said it's possible to make one or two navigational steps and then capture the data for further use. So there are in fact indications within the logged data about how the tools are being used, the data just needs the correct filter to become the information we need.

As Protiviti points out, monitoring could also revolve around the quality and usage statistics of the reports themselves. If for instance a report is not used for a longer period, it could indicate users discontinued to use it meaning it could be deleted. This forced version control makes it easier for users to find the correct report and makes sure that everyone uses this report in their daily work.

Linked to monitoring the usage of reports, the most used and most critical reports could be publicly listed within a set timeframe and within departments thus providing feedback to the community and to the report builders. This information could also facilitate self-regulation in report maintenance and help business users to discard outdated reports. A list of most critical reports could help the key-users or helpdesk evaluate the urgency of help requests and optimize their workflow.

1.1.6 Implementation

After proposing several methods to improve BI at ASML, it's clear not all solutions provide the same added value. To get a better view on what solutions have the most effect but cost the least effort to implement, a PICK matrix can be used to value the different proposals. The abbreviation PICK stands for Possible – Implement – Challenge – Kill and is used in the Lean Six Sigma methodology. Every word defines a different zone of the matrix and defines what action should be taken with the proposal (Vakjargon en Lean en Six Sigma termen, 2018).

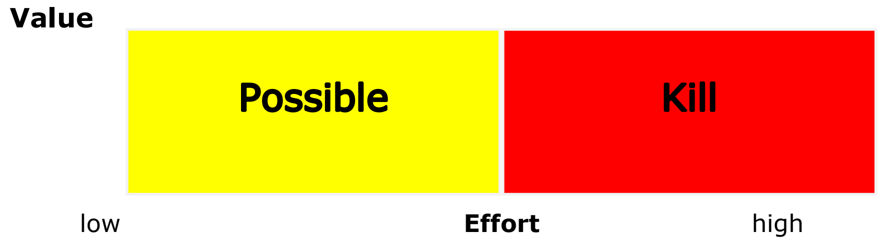
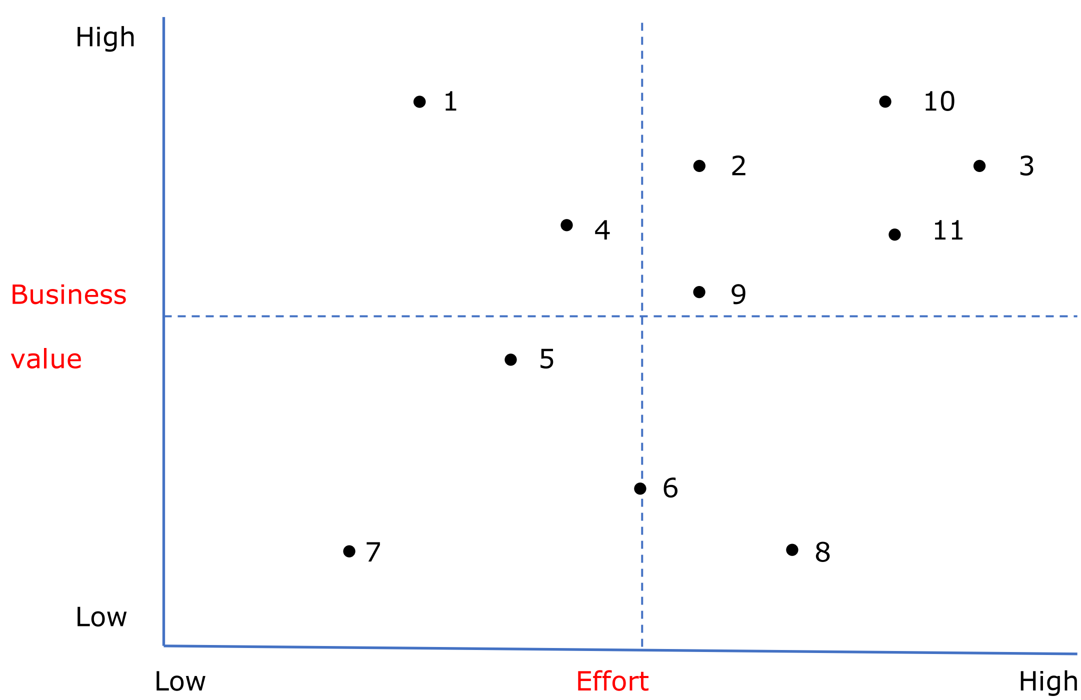


Figure ***Error! No text of specified style in document.****-6: PICK matrix according to the Lean Six Sigma methodology*

Placement of the solutions on the PICK matrix happened according to the authors best judgement, taking into account the estimated time it would take to implement the solution and the added value it would bring. According to the matrix the BI portal and community Q&A site would deliver the highest value in relation to effort spent. Having a good portal will help people find information quickly and will provide a means for IT to communicate with business users. Setting up a portal site and community Q&A platform will take an estimated time of 2 to 3 weeks, to build, test and find all relevant content.

For both solutions, IT is responsible to provide the platform and infrastructure to facilitate a portal and community Q&A site. It is however up to key-users and BI platform managers to provide content and to update the information on the portal site.



1. BI portal
2. Classroom-based basic training
3. Online video advanced training
4. Community Q&A platform
5. Meetups per user group
6. Templates
7. Style guide
8. Report reference list
9. Version control with git
10. KPI BI usage tracking
11. Report usage tracking

Figure ***Error! No text of specified style in document.****-7: PICK matrix of the proposed solutions to increase the use of BI*

Git version control takes little time to configure as well, but providing training for business users can be very time consuming, which makes implementing git is ranked in the challenge quarter. Setting up a git client is the responsibility of IT. Training to use git could be a shared responsibility, since some information is applicable to ASML in general, but other information, for instance which branches to use and the formatting of commit texts should be added in department specific education. Governing the git repository once it is set up, is the responsibility of the key-users who have access to the master branches of their department.

Training could also provide high value, but the time it requires to create content for a classroom training or to make video material and edit it for an online training, makes this less desirable for quick implementation. As a general course for BI training, the current existing course can be reworked to classroom based education. The course will however have to take place at set intervals which makes that, although the initial time to make the training is rather limited to a couple of weeks, the repeated nature of a classroom based course increases the total amount of effort to maintain the training.

Solution	**Time**	**Value**	**IT input**	**Business input**	**Priority**
BI Portal	Low	High	Platform, Content	Content	
Community Q&A portal	Low - med	High	Platform	Content	
CB training	Med – hi	High	General training		
Video training	High	High		Specific training	
Version control with git	Med	Med	Platform	Workflow	
KPI BI use tracking	High	High	KPI, report method, solution		
Report use tracking	Low-Med	Med - hi	Method, solution, report		

Meetups	Low	Med	Input, speakers	Input, speakers	
Style guide	Low	Low	Global style	Specific style	
Templates	Med	Low	Global templates	Specific templates	
Report reference list	Med – hi	Low		Content	

*Figure **Error! No text of specified style in document.**-8: Breakdown of time, value, input and priority (coloring based on the quadrants of the PICK matrix) per solution*

Video training is the opposite scenario. This kind of training takes a lot of time to create, but, unless a new version is released, once created takes very little time to maintain. The recording and editing of good video content and the creation of the training scenarios can take several weeks to months, which makes that this solution has a high initial cost as well, but little maintenance costs since content only needs to be altered when a new version of the software is implemented.

KPI use tracking and report use tracking have the same issue. A lot of work will go into drawing out a good methodology for objective use tracking so it will provide the required data. Reports and maybe additional info links need to be built to make this solution work, making this solution also more difficult, costly and time consuming to implement. This does not take into account some basic reporting already exists for Analysis for Office and Spotfire. If these reports are reused, it's a quick win with some basic information which will provide some insight in the use of BI tools. The idea behind reporting in this scope is however the creation of accurate information about report use and tool use, which will take time to design and develop.

Organizing meetups and making a style guide also takes limited effort, but according to the author the added value is limited. Meetups are great for spreading additional information and building a community spirit, the potential for in-depth learning is however rather limited. Therefore these solutions can be perfect additions to implement between the fast wins and the proposals that take more time to realize.

Organizing a meetup only requires a limited amount of time since basically it all boils down to finding a venue, a key speaker and sending an invite to the users. The initiative to organize a meetup could come from IT, but also from a well-placed member of the BI community. IT can provide the general topics and technical support, key-users from the business side know best who to contact as a potential speaker, making organizing meetups a joint effort.

Finally making templates and a report reference list have the lowest priority and therefore, due to the higher effort required to make these solutions happen, they can easily be omitted or ranked with the lowest priority. This however does not take into account some basic report list already exits. If this list is reused than this information can be used to provide some insight in the available reports. The main idea about the list however is that some automation should be built into it which makes it a lot more sustainable. This however will take some time to develop and get known by the business users.