Process Flow Documentation

A Flowchart Guide For Micro & Small Business

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Abstract:

Micro and small businesses have continued to struggle against expanding their customer base in their home market and overseas, as well as, their bottom line. Rising internet competition; small manufacturing start-ups; direct factory to customer sales; along with their own way of handling business are hindering this. However, due to their size, they have little resources to spare for these problems.

The use of process documentation through flowcharts, would allow micro and small businesses to react more quickly against competition, threats to their business, as well as, making their business process and employees more efficient and effective.

What, Why, How. and any issues concerning flowcharts are discussed using sound reputable sources. While the review of concept software comes directly from the makers of such software, as well as, intensive tests conducted by the author.

Issues with flowcharts were addressed by further adapting known solutions, as well as, implanting newly formed ideas by the author. This will hopefully help micro and small businesses when using flowcharts.

This information along with personal work experience and newly gained insights from an International Business education at Arcada University of Applied Sciences is combined into a paper that could be used as a guide on getting started with documenting and integrating flowcharts into a business.

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FOREWORD

Many thanks to all that have helped me out during my time at Arcada!

Jen & Gus your help along the way and especially with my thesis journey was much appreciated!

You all rock!

1 INTRODUCTION

Micro- and small businesses, like most organisations have recurring tasks, such as maintaining the flow of products for customers to buy. These tasks once learned work on auto-pilot and, as they are passed on from one employee to another, often degrade in their efficiency and effectiveness. These businesses seldom diagram their processes, as they often lack the knowledge, understanding, willingness to invest the time and effort, or a combination of these. (Giunipero & Eltantawy 2004; R. M. Monczka et al. 2008; Stapleton 2016; Francesca 2011)

As a manager at a computer speciality store for a small business franchise the author created and implemented process flowcharts. This helped to improve customer experience by giving all customers the same high-quality service, general work processes became more fluid and were done quicker, and the repair process for computers and notebooks saw a substantial increase in productivity.

With this experience and information in mind, the author researched how to best document process flows. Per the International Organisation for Standardization (ISO) the best way to do so is via ISO 5807: 1985, as they are the largest standardisation body. ISO 5807: 1985, develops and publishes standards that, among other things, keep costs and waste down, reduce errors, as well as, increase productivity. Flowcharts were chosen as the method of choice. (ISO 2017a; ISO 2017b; ANSI 2016)

Clearly from personal experience and as an ISO standard process flowcharts are beneficial for organisations of all types. That they are not being used shows that a lack of knowledge, understanding, willingness to invest the time and effort or a combination of these is a key factor.

This paper tries to help micro and small businesses to understand how to use flowcharts to document their processes. This is done by presenting what they are, their shortcomings and advantages, as well as, presenting variations.

1.1 RESEARCH AIM

This paper's aim was to define and review process flows, and evaluate concept software that can be used to create flowcharts for processes. The author aimed to present them in everyday terms so that micro and small businesses can profit from their use.

A summary is made of the found information concerning process flowcharts and the author's thoughts. This results in experimentation about improvements to the current methods. These experimentations gave way to a new way of showing the responsibilities of the steps within a process flowchart. The conclusion is a summary of these experiments and a reflection on the need for using new methods and their benefits.

The main areas of process flowcharts that are part of this paper are:

- What they are
- Why they should be used
- How to use them
- The issue with them
- Solutions to those issues
- A review of concept software that can be used to make them

1.2 RESEARCH METHODS

This paper is a literature and software review concerning the theoretical need for micro and small business to make use of diagramming their process flows, and how to do so. The needed information to write this paper was gathered through secondary sources from academic libraries and the internet. The credibility of sources was vetted and limitations of the paper are discussed.

For this paper, the following search queries, and variations thereof, as well as, combinations were used as is or with more text found from previous results.

- Flowchart standard
- Document business process

- Diagram business process
- Process flow
- Flowchart problems
- Process flow management
- Process documentation
- Information processing
- Process mapping software
- Diagram software
- Concept software

1.2.1 Libraries

Academic libraries offer specialised databases to search for vetted academic books and scholarly papers from within their libraries, connected academic institutions, and academic journal databases. These services were used to acquire information for this paper. While they have improved their services for obtaining specific information from their databases they lack the ease of use that the search engines on the internet offer. This led to libraries acknowledging that students and others wish to obtain information directly from the internet. That academic libraries started to provide internet services also gives credibility to the type of information found on the internet. (Georgas 2016; Newton & Silberger 2016)

1.2.2 Internet Sources

Even with sources available from academic libraries the author also relied on Google for this paper, as Google also has features to search for books, scholarly papers, and the ability to search within a specific website. Google books has a database of 30 million books, which depending on the book may offer the user basic information about the book all the way to being able to read the entire book. Google scholar has scanned about 88% or 160 million papers. To achieve search results that were in line with this paper and as credible as possible the author while using a diverse range of search queries kept them simple and to the point without prepositions. Doing so returns more precise

information. (Google n.d.; Georgas 2016; ISTL 2016; Vinderslev 2016; Wu 2015; You 2014; Net Applications 2016; comScore 2015)

1.2.3 Concept Software

As each concept software was tested the information concerning features and documentation comes from within the software itself and is cited as such. The different software products were tested according to the parameters that are set in the software review section of this paper.

1.2.4 Source Credibility

Through the internet, information has become more freely available and there is more of it. This has had a negative effect on the quality of journalism and the line between reliable and unreliable information has been blurred, often to the point of making it indistinguishable for people. (Hathaway 2014; Vinderslev 2016; Sass 2016; Lazauskas 2016)

Scientific journals may also not be as reliable as once believed as it is now common to have published papers that were not reviewed properly or papers with grave errors that are not corrected. (Allison 2016; Smith 2006)

To avoid those drawbacks the author researched how to examine online and offline sources for credibility and created a credibility checklist, which can be found in Appendix 2/3 with their sources in Appendix 3/3. Further information concerning the credibility checklist can be found in Appendix 1/3.

1.2.5 Limitations

While this paper is based on ISO 5807:1985 other proven and accepted methods for visually documenting an entire process flow, including the transition between departments and those responsible for the tasks could not be found. There will be a brief overview of ISO 5807:1985 in the theoretical framework of this thesis.

The ISO standard that concerns workflows are behind a paywall and were not accessed for this paper. Instead, the information comes from books and papers that cite this standard or discuss workflows were used. (ISO 2015)

To provide micro and small businesses the most appropriate information from the found sources, offline or online, the most widely discussed and presented information is used throughout this paper. Other less discussed or specialised aspects concerning flowcharts were not considered.

The use of information from secondary sources is mainly limited to the most widely discussed and presented found information from the sources are used.

Over 90% of internet users click on results that are displayed on the first page of a search engine while there is a drop of viewers from page one to two by 95%. This makes the first result page the preferred landing page for companies, as this can lead a user to a company's site, and in turn, may boost their revenue. To take advantage of this companies optimise their site to be in the top rankings so they are on the first page.

(Chitika 2013; Clicktraffic 2012)

As Google provides several different types of services the results at times may have been returned in their favour (Winkler & Mullins 2015).

Concerning the review of concept software maker's products, information that was not found on the web page, blog, embedded videos, how to guides or help documentation of the individual software provider could of course not be included within this paper at the time of the writing of that section. This may have led to discrepancies between the paper and the offerings by a concept software company.

All the above factors may have limited the literature and software review of this paper, as well as, the author's thoughts and conclusions.

2 THEORETICAL FRAMEWORK

This thesis was based on literature surrounding the topics of ISO standards and process flowcharts. The author defines process flowcharts, how and when they should be used,

and the potential benefits and drawbacks of their use. Additionally, the ISO standard is briefly defined to provide a basis for the flowcharts.

2.1 ISO Standards

As already noted, this paper is based on ISO standard 5807: 1985 information processing – documentation symbols and conventions for data, program and system flowcharts, program network charts and system resources charts. In some industries certification for complying with an ISO standard is a legal requirement to function, this lends even more weight to the authority behind ISO 5807: 1985 that concerns the use of flowcharts. (ISO 2017b; ISO 2015; ANSI 2016)

Micro and small businesses are under intense pressure due to consumers now being able to use the internet to buy products. Many manufacturers now target end-consumers directly and allow them to buy from them through the internet. For both the manufacturer and consumer this is a wanted connection and will continue to grow in the future. (Hagel 2015)

These businesses seldom diagram their processes, as they often lack the knowledge, understanding, willingness to invest the time and effort, or a combination of these. (Giunipero & Eltantawy 2004; R. M. Monczka et al. 2008; Stapleton 2016; Francesca 2011)

2.2 Flowcharts

Process flowcharts are a detailed logical visual representation of all the actual steps that are done to complete an entire task or process, such as for purchasing a new product. They can also be created to show the flow between businesses to improve supply chain management. Multiple process flowcharts are also referred to as flowcharts. (Tague 2005; R. M. Monczka et al. 2008; Giunipero & Eltantawy 2004)

Often included within a process flow or flowchart are the following basic steps, product quality, quantity, storage needs and price, import taxes and possible test product order placement, delivery method with return possibilities, time and insurance information,

ordering of first products which may be a trial run for further order placements, invoice inspection and storage of delivered products, payment of said products, recording other steps in a database and updating it with a recommendation of further orders. (Tague 2005; R. M. Monczka et al. 2008; Giunipero & Eltantawy 2004)

These flowcharts are either drawn up digitally with concept software or by hand. Steps can be represented by specific symbols that represent the start, finish, decisions, as well as, other types of steps. (Tague 2005)

2.2.1 Use and Benefits

There are many situations in which a visual representation should be used to make it easier to develop or improve a process and see an entire process flow, as well as their specific steps and details (Tague 2005). The main reasons a process flowchart should be used are listed below in Figure 1 Process flowchart uses (Tague 2005).

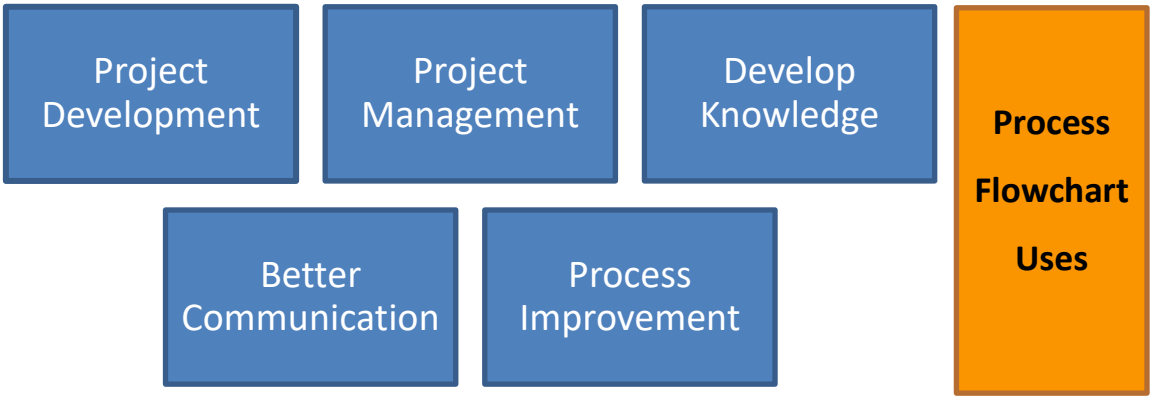

Figure 1 Process flowchart uses (Tague 2005)

Information that is displayed with visual cues relevant to the topic being viewed are looked at more often than text without images. They are processed 60 thousand times faster than text and retained for longer. (Nielson 2017; Visual Teaching Alliance 2013)

Those visual aspects along with the individual steps and the links between steps to allow for problem areas to be more easily found and improved upon. (Rosing et al. 2014; Giunipero & Eltantawy 2004; Tague 2005)

Process flowcharts can also be used to illustrate the monetary and material flow within an organisation, but also those outside of an organisation. (Rosing et al. 2014; Giunipero & Eltantawy 2004)

Not every person will do an entire process in the same way, as quickly or, as well as, someone else. Having a list of exactly how things are done allows employees to do each step correctly, verify that they have done each necessary step, and makes it easier to learn the steps. (Rosing et al. 2014; Giunipero & Eltantawy 2004)

Ensuring that a business is prepared for different eventualities is an important aspect of successfully running a business. Taking these factors into account it is essential for every organisation to continuously update and assess their process flowcharts risks to secure themselves and others, as well as, possible against unexpected events. (Giunipero & Eltantawy 2004; Banham 2010; Joyce & Woods 2003; Deloitte & Touche et al. 2012; Hagel 2015)

Once a flowchart is completed it should be changed as necessary and of course made available and taught to everyone that needs to do those processes. The more details it incorporates and the better it looks and functions the more beneficial it will be for employees to learn from. This speeds up the learning process and often frees up the training of employees. (Rosing et al. 2014; Giunipero & Eltantawy 2004)

If each process flow is reviewed regularly the latest updates to administrative methods; new market trends; actual work steps; technological advances; as well as, new solutions to current and new risks can be incorporated. Doing so ensures that work can be done as efficiently as possible. (Giunipero & Eltantawy 2004; Long 2016; Joyce & Woods 2003; Tague 2005)

Another benefit of utilising flowcharts is that risks within and outside of an organisation can be more easily identified. Suitable countermeasures should be looked for and implemented within the process flow. Continuously updating and adjusting workflows for today's work environment and tomorrow's risks should be done on a regular basis. (Giunipero & Eltantawy 2004; Long 2016; Joyce & Woods 2003; Tague 2005)

To benefit even more from the assessment of the completed flowchart specialised tools can and should be used to assess and solve such problems. Two such tools are risk

matrices and fishbone. (Thakur 2006; Microsoft 2016; CGE Risk Management Solutions 2016; ASQ 2014)

Risk matrices are used to help view and determine which risks need to be analysed and eliminated or at least mitigated according to the frequency of them occurring and the consequences that might arise if they do. (Thakur 2006; Microsoft 2016; CGE Risk Management Solutions 2016)

Fishbone diagrams are used to multiple causes of a problem that is formed as a why question. The discussion of the problems will help to identify the root cause and to solve those causes through brainstorming within groups. (ASQ 2014; Tague 2005)

2.2.2 Drawbacks and Challenges

As the following sections illustrate while a process flow has many benefits it is essential to keep them structured and to the point. As they become larger and more complex so does the amount of time needed to view and understand them.

The larger a process flow the harder it becomes to view the details when in printed form, as can be seen in Figure 2 Complex horizontal swim lane process flow (Long 2016).

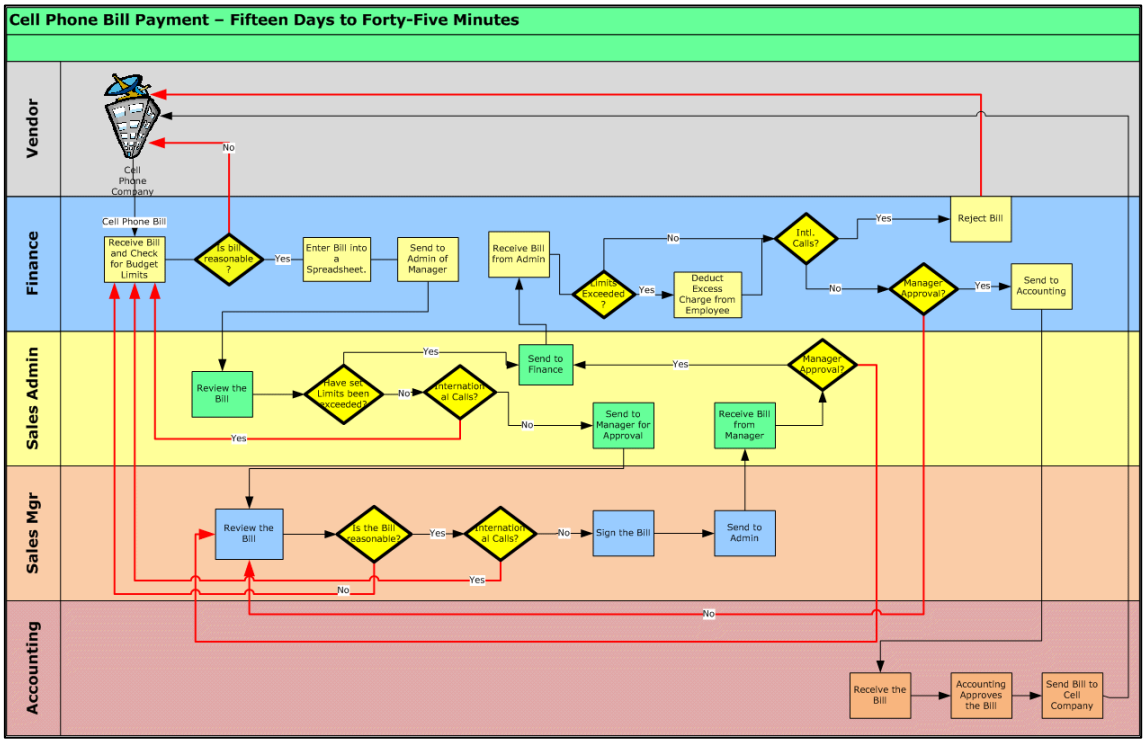

Figure 2 Complex horizontal swim lane process flow (Long 2016)

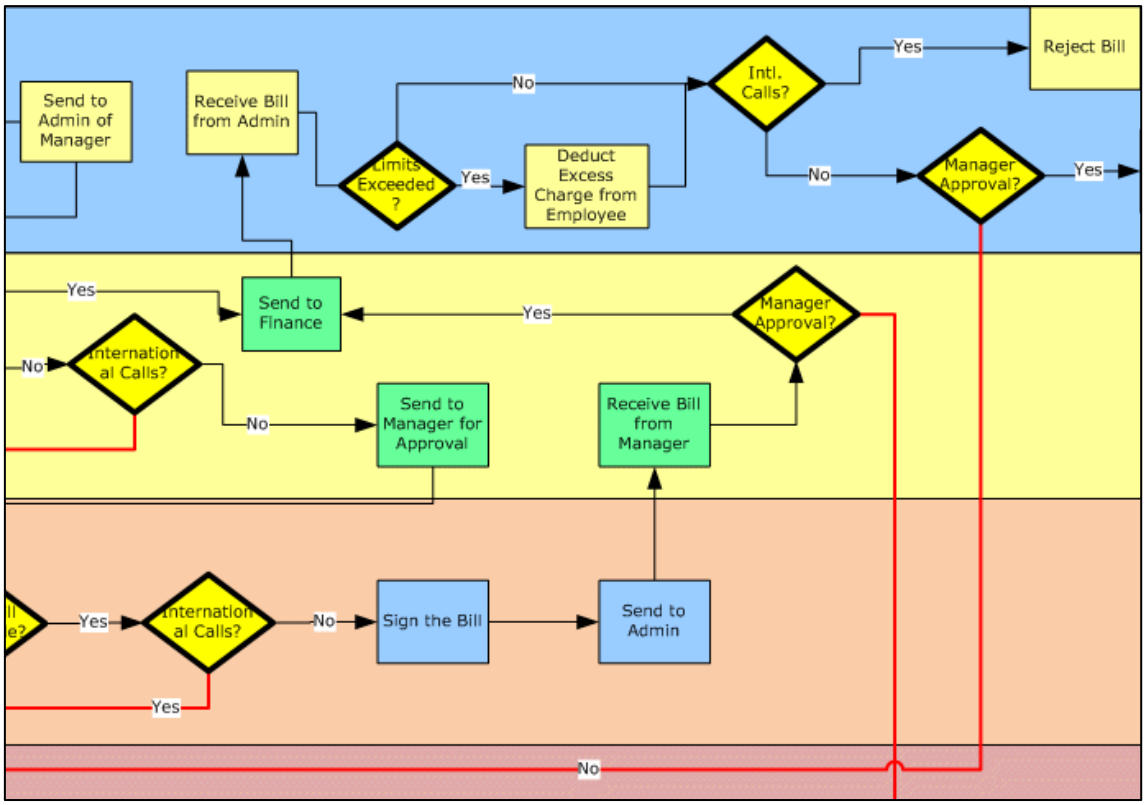

Figure 3 Zoomed snippet of figure 2 (Long 2016)

When the text of Figure 2 becomes viewable in Figure 3 Zoomed snippet of figure 2 (Long 2016), parts of the diamond text “international calls?” is covered by the diamond, and the top second diamond from the right has the text shortened to “intl. Calls?” ¨Such oversights distract from the process flow, as it is not always clear if they are the same thing or not. In other scenarios, the information may be wrongly interpreted, which in turn may lead to risks within the process. (CS Odessa 2016a)

As can be seen in Figure 4 Complex swim lane process flow with symbols (Legal Design Lab 2016), horizontal and vertical process flows can be done and even symbols can be used within process flows. While the duo types of swim lanes allow for a better and quicker understanding the beneficial limits of symbols can be seen in the three bottom lanes. The exact definition for these symbols was not listed as part of the illustration and not available from the source.

Traditional process flowcharts may have reached their limits in terms of being able to display large amounts of information. The limit is not only apparent in printed versions of a process flow but also in digital versions with scrolling functions or pan and zoom. (James 2015; Hebb 2017)

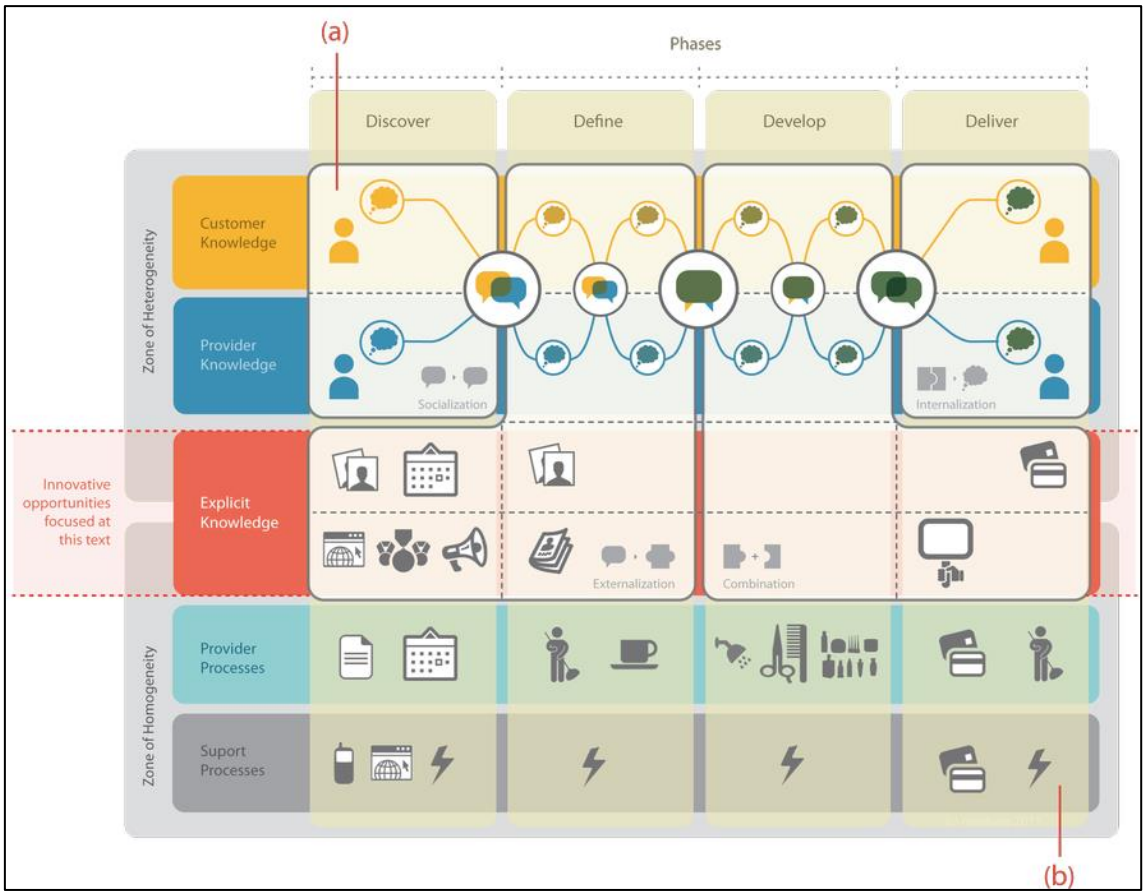

Figure 4 Complex swim lane process flow with symbols (Legal Design Lab 2016)

In all the above examples, no legend was used to explain the charts. This makes it more difficult for a viewer to read and understand. (Oriel Incorporated 2002)

This negative aspect of flowcharts can be seen in Figure 4 Complex swim lane process flow with symbols (Legal Design Lab 2016). Apparently, the provider process includes defining sweeping, as well as, breaks and there is a need to develop personal grooming equipment or a time to do so. Perhaps the listed support process includes mobile, website and lighting support, whatever that may be. Whatever these symbols should represent is lost on the author, making them unhelpful and distracting.

Just because a process has been documented does not mean that each step within will run smoothly. Time constraints, IT problems or subtasks, exceptions to a step within the process, along with other points may be the root cause and are often not documented within a flowchart. (James 2015; Hebb 2017)

As a task is handed off to another person not only is the responsibility being shifted but also all the information concerning the current state of the process. Swim lanes and

other methods of showing that hand off for a task often do not reflect the communication needs involved. (James 2015; Hebb 2017)

A process may not always have one acceptable outcome and decision symbols and looping back do not always show this in a clear manner. Loops within flowcharts often end up as never ending even though each process has a clear end to it. (James 2015; Hebb 2017)

As previously stated once a flow has been created it needs to be maintained. Not doing so pushes the use of the flow further away as technological advances are made that may change the way a process can or should be done. Administrative regulations or procedures, along with how competitors and partners handle their business may change. (Giunipero & Eltantawy 2004; Long 2016; Joyce & Woods 2003; Tague 2005)

Not having a reliable workflow may therefore impede business and lead to a loss of efficiency, while at the same time an investment must be made to maintain them. (Giunipero & Eltantawy 2004; Long 2016; Joyce & Woods 2003; Tague 2005)

2.2.3 Usage

To create a flowchart, it is essential to know what the process is supposed to be used for, what each step is, the details of each step, to keep the order of the steps, and to make it readable for the end user of the flowchart. (Tague 2005; Oriel Incorporated 2002)

Identify

- Enlist those that are involved in the process to help.
- Identify the purpose of the process.
    - Process output – product or service.
    - Who uses the finished product or service.
    - What do they do with it.
    - Identify what is needed to complete the process – raw materials, documents, permission, information, etc.

- List each of the tasks in a step by step basis in the order that they are done.
    - For each step note who is responsible, their position and department.
    - If material, permission, information etc. is needed for a step it needs to be listed.

(Tague 2005; Oriel Incorporated 2002)

If many sub-steps are contained within a process a separate flowchart can be created and linked via the main process flowchart. Concept software can be used to create and link process flowcharts. These apps use the standard shapes for specific functions and most often they can be dragged onto the flowchart. Data can be copy pasted or imported directly to make things easier and speed up the creation and maintenance of flowcharts. Such apps were reviewed in a subsequent chapter.(Lucidchart 2014a)

Pre-documentation

- Title the process.
- Include creation or update date.
- Note the chart author and enlisted team members that were consulted or helped to create the chart.

(Oriel Incorporated 2002)

Documentation

1. Either by hand or with concept software document the following.
2. Set a terminator for the start of the process.
3. Add a symbol to represent the step or sub-step.
4. Enter the needed information into that step or sub-step.
    a. Responsible party / position and or department.
    b. Specifically, list what needs to be done and with what in that step or sub-step.
5. Connect the created step with an arrow to the next step or sub-step in the sequence, generally from left to right.

6. Repeat point 3 until all steps or sub-steps have been added.
7. Set a terminator to represent the end of the process.
8. Add a legend for the used symbols.

(Oriel Incorporated 2002)

Review & Revise

Once a flowchart has been created it needs to be worked through by the people who do the process. Each sequence of steps within the flowchart, along with all the listed information should be done exactly as laid out in the flowchart. This will ensure that the flowchart works correctly.(Oriel Incorporated 2002)

This newly created flowchart is how a process is done but it may not necessarily be the best way that it could be done. (Rosing et al. 2014; Giunipero & Eltantawy 2004; Tague 2005; Oriel Incorporated 2002)

As a team, each step of the process, including their connections and the relationship between steps, connections, and responsibility hand-offs, should be reviewed. Any conflicts or improvements that were found during the review process should be implemented. After that, the flowchart needs to be worked through again as is. (Oriel Incorporated 2002)

2.2.4 Visual Cues

The basic steps do not list several different and crucial factors: internal and external communication steps, the need to affirm and reaffirm different parts of each step, changes of the product or procedures which, may in turn make a step having to be redone or done differently, nor does the list show the exact details that are needed for each step such as what type of delivery methods are preferred (R. Monczka et al. 2008)

Process flows have a few different ways around the problem. Symbols are used to define different types of steps: decisions, documentation, waiting periods, sending of information and directional arrows are but a few. The arrows can be used to loop back to a step when something has not been completed, such as fixing an issue. Within or

near the symbols a list of details can be included. Swim lanes can be used to separate departments or areas within departments. (Tague 2005)

As seen in Figure 5 Flowchart symbols per ISO standard 5807: 1985, a terminator symbol is usually used to represent the start and end of a process. The start terminator is often green and the end terminator point red. As this makes it easier for a viewer to read it is advisable to maintain that colour arrangement.

Adding colour to the symbols has its benefits as it allows a viewer to easily spot the types of process by the used colour. This is very practical for when a large and complex process flow is being viewed or when only certain aspects of the flow need to be viewed. (CS Odessa 2016b)

Lines and arrows are used to show the next step and to loop back to previous steps whenever needed. (Arlbjørn 2010; O'Connor 2002; Tague 2005)

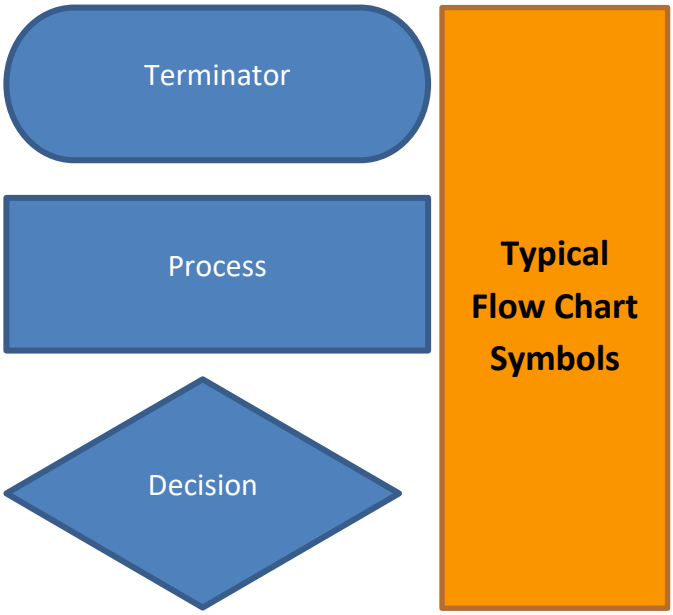

Figure 5 Flowchart symbols per ISO standard 5807: 1985 (ISO 2015)

A consistent usage of symbols and colours along with a legend explaining the different symbols, icons, colours, and other information should be included to ensure that the chart is easily readable for all viewers. (Oriel Incorporated 2002)

2.2.5 Variations

A basic flowchart integrates information within the steps in an undivided diagram. Swim lanes and opportunity flowcharts have a divided diagram. This is used to better display and assess certain information.

Swim Lanes

The usage of swim lanes or cross-functional diagrams allows each step that concerns a specific type of responsibility to be easily viewed, as it is contained within one lane. This type of view is practical to find bottlenecks, and the department that it concerns. Another usage of swim lanes is to help integrate process between those responsible for each step, clarify staff, material or technological changes. (SmartDraw Software 2017b; CS Odessa 2016b; Lucidchart 2014b)

For each different type of responsibility or sector that a step is a part of is listed either vertically or horizontally. A sequential and logical order should be chosen for the flow of the process. This may be top to bottom or left to right while keeping each step within its respective lane, as can be seen, n Figure 6 Vertical swim lane process flow (CS Odessa 2016b). (SmartDraw Software 2017b; CS Odessa 2016b)

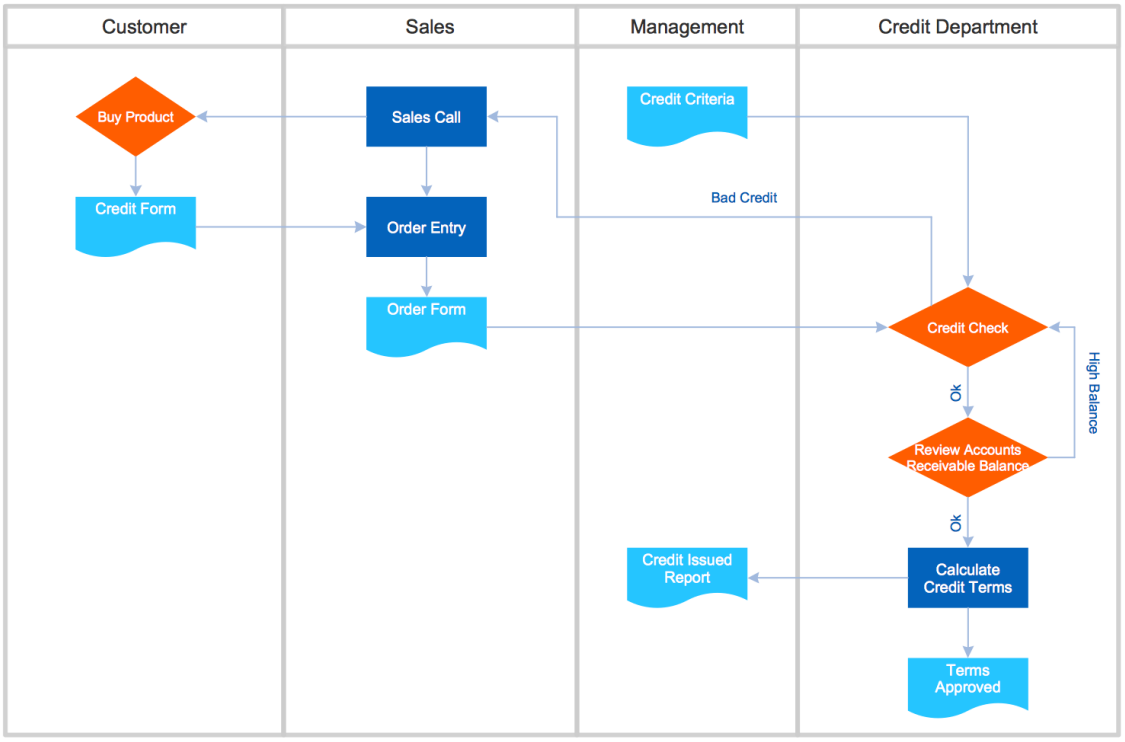

Figure 6 Vertical swim lane process flow (CS Odessa 2016b)

Opportunity flowcharts

As can be seen in Figure 7 Opportunity flowchart (SmartDraw Software 2017b), opportunity flowcharts are a variant of swim lanes. They are divided into value added (things are being done right) and cost added only (things are not going right). (Oriel Incorporated 2002; SmartDraw Software 2017b)

This type of flowchart, while difficult to construct allows viewers to better concentrate on those situations within a process that are wasting time and money. (Oriel Incorporated 2002; SmartDraw Software 2017b)

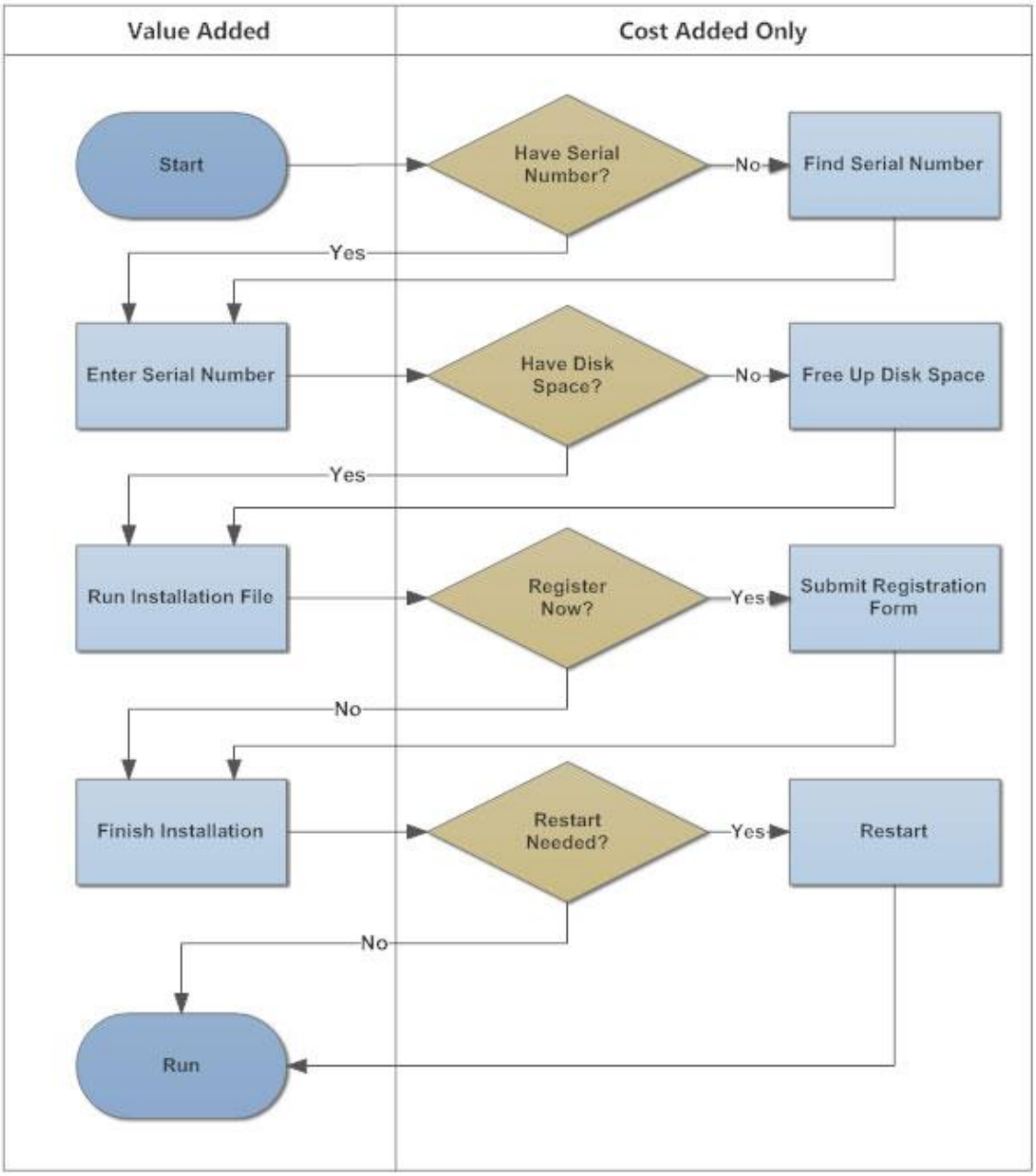

Figure 7 Opportunity flowchart (SmartDraw Software 2017b)

The key to using this type of flowchart is to constantly determine which steps are needed to complete the process perfectly every time. Those steps that involve the fixing of errors should be considered as cost added only steps. This raises the awareness level of how decisions and cost added steps may be adding to inefficiencies. If a process is not very inefficient than this type of flowchart should not be used as it would provide little benefits. (Oriel Incorporated 2002; SmartDraw Software 2017b)

2.2.6 Business Integration

Most employees of a business do not understand the benefits that documenting their processes can bring and how they can improve upon a task. Employees often object to being told how to do a task, especially if they have been doing that task for a long time and of course while they know how to do it. Sometimes they are also concerned that if they have to follow specific rules or procedures on how to do something they will be tracked by management. (Stapleton 2016; Oriel Incorporated 2002)

As this is the case it is important to help employees understand the benefits that not just the business will gain from documenting processes but how they will individually benefit from it. (Stapleton 2016)

Documenting and improving a process flow is clearly about more than just documenting the process itself. It should start with making clear that it is not about tracking an employee but changing things for the better by organising their work and workspace to allow them to complete tasks as efficiently as possible. (Stapleton 2016)

For that to happen it should be made clear that documenting a process flow can and should allow for the following to take place. (Stapleton 2016)

- Any other employee can continue a task should someone that is normally doing that task not be available to do it.
- Time is reduced as documenting exactly what needs to be done should something go amiss will allow for a smoother run business and less back and forth with emails or other communication methods.
- A reduction in the time spent preparing for each task.

- Employees will be able to easier note their own performance and if they are exceeding their targets.
- Once a task is documented it may become easy enough for another employee to do freeing up the current employee for other more important tasks.

Discussing such benefits with employees will allow for a more open attitude to the entire documentation process and integration of flowcharts within a business. (Stapleton 2016)

3 PROBABLE SOLUTIONS

The conclusions of the preceding sections of this paper show that for documenting process flows with flowcharts there is not only a lot of room for improvement but the need for it to happen is there as well. Probable solutions to those issues are presented below. A search and testing of found concept software that allows for creating flowcharts is done and presented as well.

The previously stated issues for flowcharts do have solutions which are listed below.

- Care should be given to making sure that the text fits within the symbol it is written in and the same type of phrasing should be used throughout a flowchart.(CS Odessa 2016a)
- The handoff of part of a process from one department or person to another it is crucial to ensure that the information that the new person needs is correctly given. A note that is referenced or linked can be inserted within the flowchart. (James 2015; Hebb 2017)
- As a process may contain a sub-process, time constraints, IT problems, exceptions to a step within the flow, or other aspects that are not clearly discussed when a process is charted it is important to remember to do so and note that down within the flowchart. (James 2015; Hebb 2017)
- If a process has different acceptable outcomes than they should be charted that way. This may mean moving away from a decision and properly showing

multiple paths. Infinite loops can be avoided by inserting time constraints or other checkpoints. (James 2015; Hebb 2017)

- If symbols are used, they need to be an improvement and not a detriment. Adding explanations to a lot of symbols makes the whole point of having them redundant. The same can be said for an overuse of symbols or overly complex ones. (CS Odessa 2016a)

The current methods of process flow design leave a jumbled mess of diagrams and lines as they become larger and more complex. Figure 8 Effective process flow (Textographo 2016), is the furthest implementation of an effective redesign that could be found. As can be seen, some steps have symbols attached to them. Teams, groups, or departments can be identified in this manner much quicker and the overall presentation is less cluttered.

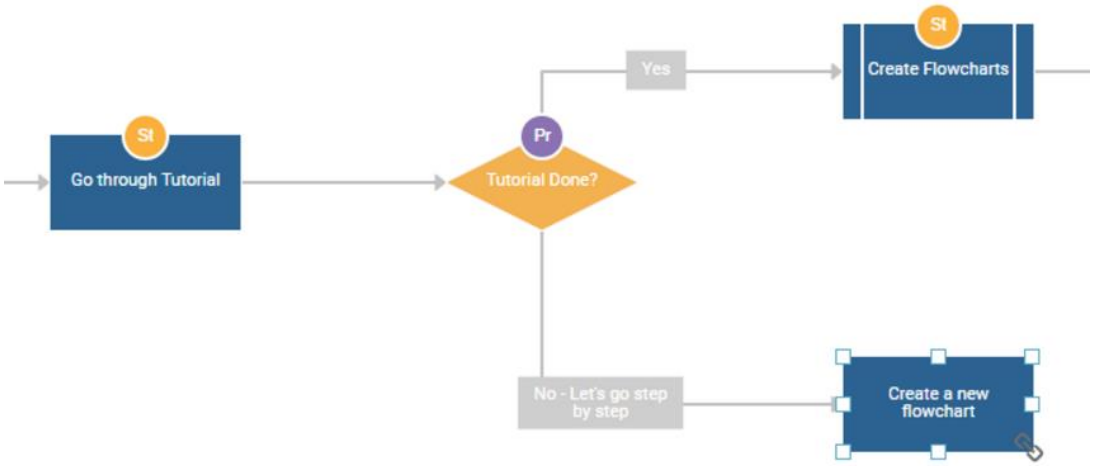

Figure 8 Effective process flow (Textographo 2016)

For the most part, the solutions are different for each issue, yet they are subjected to the same root solution. This overarching solution is that each part of a flowchart individually and as a sum of itself needs to be properly documented. A discussion should ensue and any problems or risks that are found should be further explored and solved. This way greater bottlenecks and risks can be identified and solved.

As stated micro and small businesses have limited resources and to waste them on building and maintaining process flowcharts that are cumbersome when it comes to presenting them in meetings or using them in everyday life is pointless.

3.1 Enhanced Process Flow

This section is based on the symbols implemented by Textographo from the preceding section of this thesis by the author.

Below in Figure 9 Standard process flowchart provided by Lucidchart as a template upon sign up, a standard process flow that was provided by Lucidchart as a template, can be seen. The positioning; sizes; colours; shapes; and text of the steps; as well as the connections between them; etc. was not changed. In short, this is how a company that is specialised in providing the means to create process flowcharts views a proper and well-illustrated process flow.

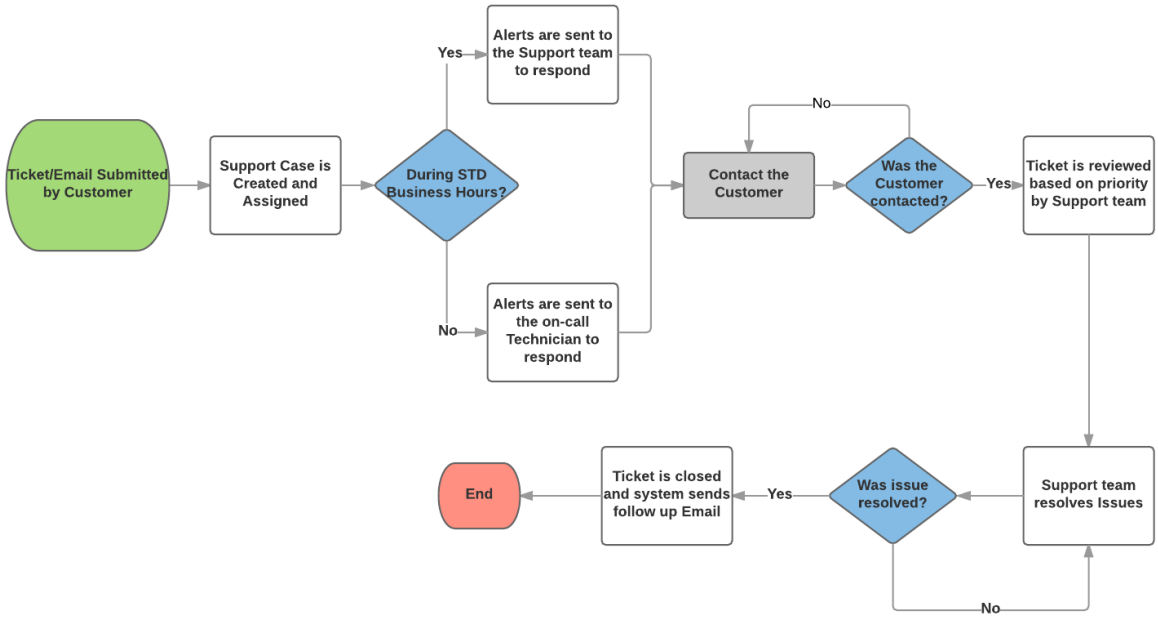

Figure 9 Standard process flowchart provided by Lucidchart as a template upon sign up

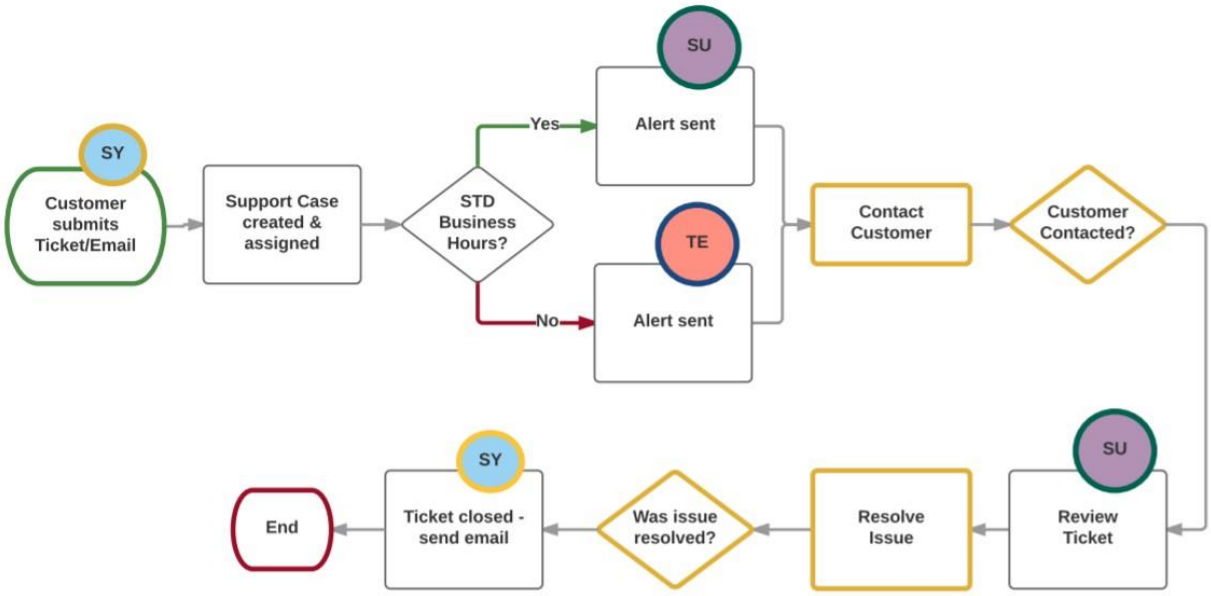

Figure 10 Enhanced process flow of figure 9

The process flow of Figure 10 Enhanced process flow of figure 9, has been designed from the beginning with the knowledge that the end viewer or user needs a process flow that they can easily and quickly understand, while keeping in mind that attention to details is required and that any needed changes do not make the creation or upkeep of the process flow any more complicated.

3.1.1 Icon Representation

Pale coloured icons with two or three letters are used to represent who or what is responsible for a given step. The bold coloured borders with strong colours represent the department or section of a business.

As a step becomes active so does the icon representation, it also stays active until another icon representation is listed on a step. This means a single icon representation represents two different areas of a business this helps to guide any person through their own specific steps. The same holds true for a manager wishing to view their department's steps. Anyone interested in the entire process flow can easily do so and at the same time still view specific details easily.

The icon representation could further be adapted to include the type of material that is being transported to allow for all types of material flows within a single process flow.

This would be another unique and useful feature for all concerned, which would in turn highlight the merits of using process flows to find and solve risk scenarios.

3.1.2 Visual Cues

Arrows have been reduced to a minimum through colour linking decisions and their repeat steps. This is done with a bold strong coloured border. Different colours can be used if multiple decision steps are close to each other.

The start and end diagrams are easily identifiable not only through their shapes but also the bold strong coloured borders. Better and standardised wording within each diagram is necessary and can more easily be done because of the use of icon representations. Larger fonts can at times now be used without burdening the diagrams or process flow.

As wording within each diagram is reduced the space within and outside of diagrams is less likely to be focused on. Each diagram can be quickly and easily read, especially if larger fonts are used. A lower loss of functionality and design is seen even when large amounts of departments, systems or people are contained within a process flow.

3.2 Concept Software

This section establishes the parameters and information used for the in-depth software review section of this paper of concept software. These products are used to create flowcharts, mind maps, floor plans, and other types of diagrams. The use of a concept software to illustrate the steps and relations within a small or medium sized process flow is very effective. A user can see the larger scope of the process and where it fits within a company's work process while allowing for a very detailed view of each step, flaw and their risks. (CS Odessa 2016a)

To determine the best available concept software the following points needed to be completed:

- Find concept software that allows for the easy creation of flowcharts.
- Compare concept app features and create a list of best known and hoped for features.

- Determine if found software fulfil the wanted features.
- Test software that fulfil the above requirements the best and review them in-depth.
- Establish software test parameters.

3.2.1 Concept Software Products

As not all concept software is listed as concept software a wide range of search terms, along with the reading of blogs was used to find appropriate software. Once found the application's website was reviewed to see about the ease of use and features. When necessary the software itself were tested. The easiest to use and most intriguing of software choices were looked at in more detail. Figure 11 Current concept software, shows the found fourteen software choices.

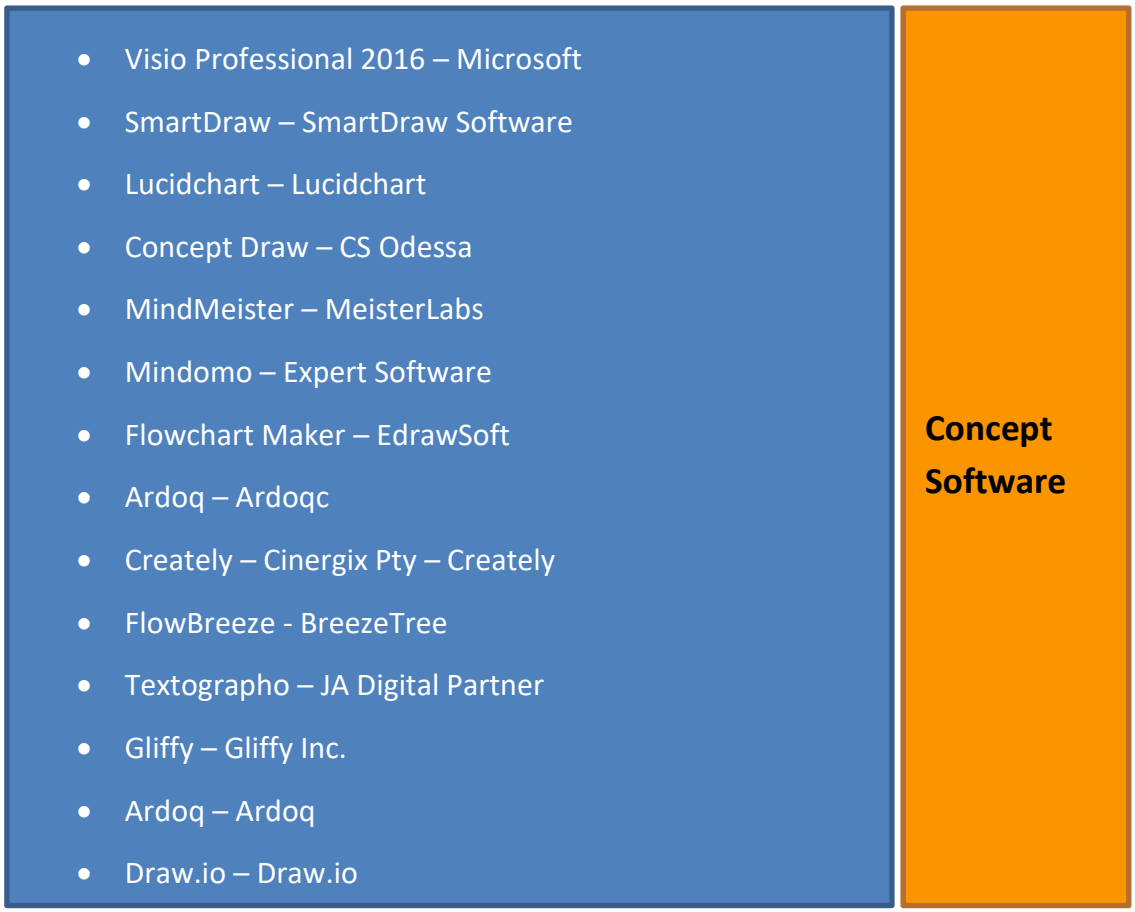

Figure 11 Current concept software

The fourteen different concept software choices, listed in Figure 11 Current concept software, were checked and tested to see if they had the wanted features. Five of them

fulfilled the most basic of wanted features and were deemed to be easy enough to use. These five were subjected to more in-depth tests and the resulting information can be found in the software review.

3.2.2 Wanted Software Features

The need for creating and using flowcharts will often not outweigh the time it takes to create and maintain them. Nor will management and the people that would make use of them, on a daily basis be sold on the idea of using them if they are not presentable, up-to-date, or contain the process as it should be. As previously stated this can have a very negative affect on a business and hinder micro and small businesses from reaching their full potential.

Any software benefits greatly when ease of use is a top priority, as this allows for quicker integration and use within an organisation due to better overall user experience. The editing and viewing of flowcharts is another significant aspect, as there is a constant need to update them and of course to view and present them. To make this aspect easier it would be beneficial to be able to display information, such as a team, individual or department, with just a click instead of having to view the entire flowchart.

When business' share their flowcharts with each other for editing purposes the exported file needs to be compatible with using scalable vector graphics (SVG) as this along with the Visio's format VSDX are the most common used standards. SVG does not allow for all aspects of a chart to be used within Visio, so VSDX is the better format should it be available.

Concept software should be able to present not just an entire process flow or part of one but display information, such as a team, individual or department, with just a click. An app with these features will make it much easier to input and update data. Other hoped for features, as seen in Figure 12 Wanted concept software features, would make any process flow, no matter how complex easier to view and understand.

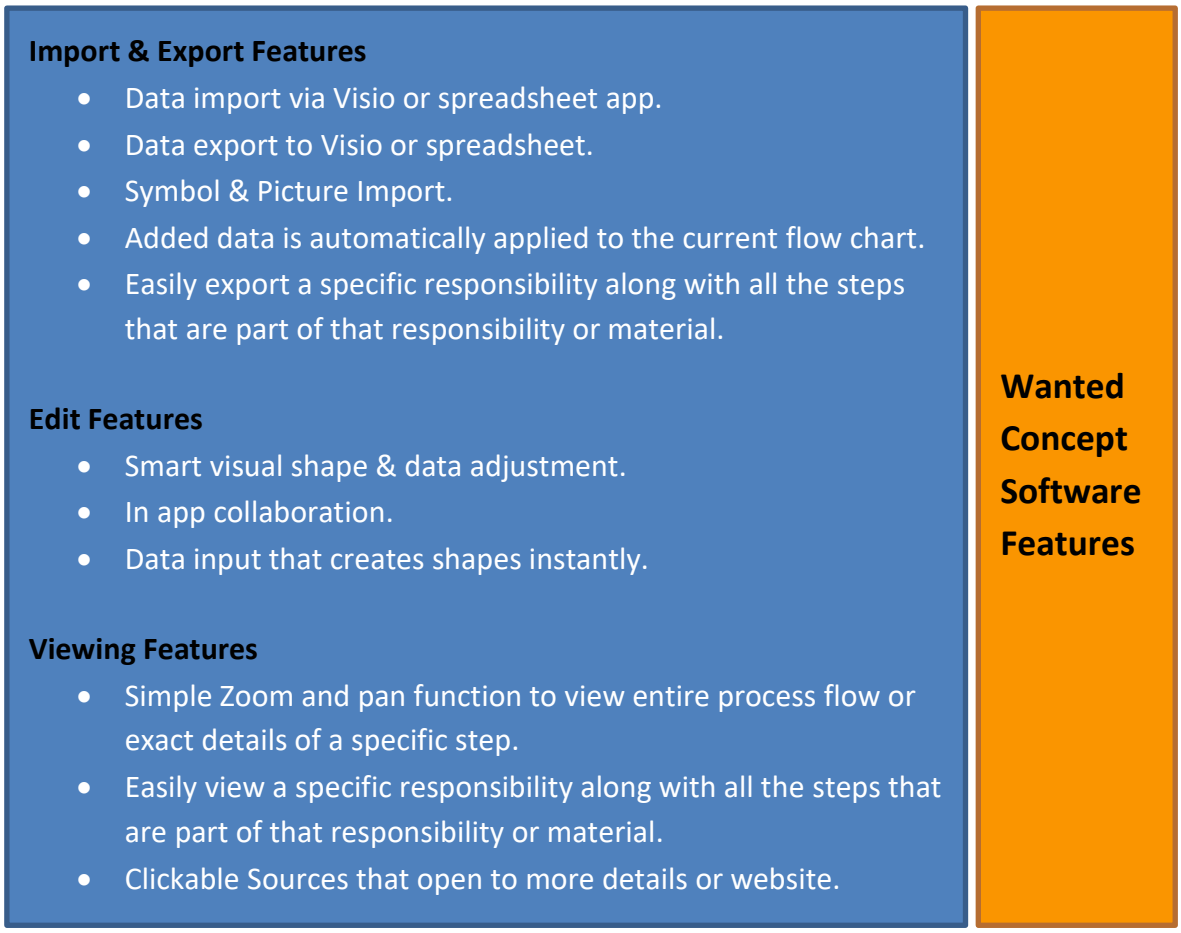

Figure 12 Wanted concept software features

Each of the listed wanted features from Figure 12 Wanted concept software features, was extensively looked for in each of the software products from Figure 11 Current concept software. This was done by viewing the available blogs, videos, feature examples and by testing the software.

3.2.3 Software Test Parameters

As smaller micro and small businesses especially have a very restrictive budget, less expensive software is a significant plus. This also means that the number of users or computer installations should remain small. The software should run on newer versions of at least windows and Mac as these are the most used systems. Online versions are considered a preference as it does not require installations and can be used from multiple systems and more than one user could use it. To ensure functionality of online software across these systems the testing was done with versions of windows, Mac, and Linux. Different versions of the most used browsers for each system were used. These

browsers were updated to the latest version as well to ensure they contain the latest compatibility features. The use of different main-stream browsers is of importance as the preferences of users for a browser varies and an online app not working on a main-stream browser would require installation of a different browser. This would result in more difficulties and reluctance on the part of users.

Further test parameter points are listed below:

- Ease of creating and changing a process flowchart.
- Availability of each wanted feature.
- Ease of use for each wanted feature.
- Compatibility with Mac OS x 10.10 / 10.11 & MacOS 10.12.
    - Newest browser versions: Chrome, Firefox, Opera & safari
- Compatibility test with Linux Ubuntu: 14.04 / 16.04 / 16.10 & 17.04
    - Newest browser versions: Chrome, Firefox, Opera & Konquerer
- Compatibility with Linux Mint, Cinnamon and Mate versions: 17.3 / 18 / 18.1
    - Newest browser versions: Chrome, Firefox, Opera & Konquerer
- Compatibility test with Windows 7 / 8 and 10
    - Newest browser versions: Chrome, Firefox, Opera & Explorer / edge

3.3 In-Depth Software Review

The software that clearly could not fulfil the need to create mind maps and process flows were left away from a more in-depth assessment. Those products that did not mention that they were incompatible with SVG or Microsoft Visio VSDX files were tested to see if an export feature would allow exporting or saving to those formats. If no support was available for the aforementioned formats they were eliminated from further testing. These apps are listed in the “Not Recommended Concept Software” section below.

The following features were not found in any of the tested concept software products.

Import and export features

- Easily export a specific responsibility along with all the steps that are part of that responsibility or material.

Edit features

- Easily view a specific responsibility along with all the steps that are part of that responsibility or material.

Viewing features

- Easily view a specific responsibility along with all the steps that are part of that responsibility or material.
- Clickable sources that open to more details or website.

3.3.1 Not Recommended Concept Software:

- Ardoq

  Not suitable for flowcharts. (Ardoq 2017)

- Mindmeister

  Not suitable for flowcharts. (Mindmeister 2017)

- Mindomo

  Not suitable for flowcharts. (Mindomo 2017)

- Textographo

  Cons: Premium version allows for SVG export, no SVG import, no collaboration.

  Pros: Flowcharts can be created just through text input. (Textographo 2017)

- FlowBreeze

  Cons: No SVG import or export, Excel addon for Windows and Mac OS. results in an error page being loaded, no automatic connectors.

  Pros: Excel addon, easy to initially use as text based. (BreezeTree 2017)

- Gliffy

Cons: No SVG import, create a diagram via google docs results in an error page being loaded, no automatic connectors.

Pros: Collaboration via google docs. (Gliffy 2017)

- Flow chart Maker

  Cons: No collaboration, must be installed, expensive add-ons.

  Pros: SVG import and export. (EdrawSoft 2017)

- Smartdraw

  Cons: No SVG import, no collaboration, slow response time, connectors are somewhat automated but complicated to use.

  Pros: Visio import, SVG export, comment feature, shapes auto expand according to text input. (SmartDraw Software 2017a)

The five software products that remained went through all the test parameters that they support and tested for each wanted feature. They have shown that they are moving in the right direction as they have progressed further with how data can be inputted in a more efficient manner than most other reviewed software. These software makers have also rethought the way process flowcharts are used, viewed, and designed. As concept software, the reviewed software can also be used to create floorplans, mind maps among other uses.

3.3.2 Recommendable Concept Software:

- **Creately**

  Public: free, limited to one project, viewable for anyone,

  Personal: €3.78 per user per month for one year / monthly plan €4.63,

  Team plan, five members: €19.22 per month for one year / monthly plan €23.17.

  Cons: files must be exported to be presented, diagrams created with the test version (public) are viewable for all, slow to load and use. Requires Adobe Flash which may cause instability, need to be activated in the browser or require a plugin update. (Woollaston 2016; Murnane 2017)

Pros: SVG import and export, collaboration, comment and post-it note features.

(Creately 2017a; Creately 2017b)

- **Concept Draw Pro 11**

  €184.28 per installed copy (1-time payment)

  Cons: collaboration is possible with a bought add-on, must be installed.

  Pros: supports VSDX import and SVG export, smart connectors: connect different shapes simultaneously. (ConceptDraw 2017a; ConceptDraw 2017b)

- **Draw.io**

  Free.

  Cons: extremely limited templates, shapes do not auto expand with text.

  Pros: SVG import and export, collaboration via google docs, smart connectors, responsive interface. (Draw.io 2017a; Draw.io 2017b)

While the recommendable software doesn't fulfil the hoped-for features they have shown that they are moving in the right direction as they have progressed further with how data can be inputted in a more efficient manner than non-recommendable products.

3.3.3 Highly Recommendable Concept Software

- **Lucidchart**

  Basic version: €4.95 per user per month for one year / monthly plan €5.95,

  Pro version: €8.95 per user per month for one year / €9.95 per month,

  Cons: non-paid plan is limited to 60 objects per file, no SVG export, shapes do not auto expand with text input.

  Pros: SVG import and export (with a pro version), Excel import, collaboration, comment and post-it note features, presentation mode, responsive interface, smart connectors, google drive integration, extensive & clear help section, offline version via Google Chrome. (Lucidchart 2017a; Lucidchart 2017b; Lucidchart 2017c)

- **Visio 2016**

  Standard desktop, €399 per installed copy (1-time payment)

  Professional desktop, with Office 365 license: one user: €11 per month, annually.

  Professional desktop: €739 per installed copy (1-time payment)

  Cons: must be installed, windows only, can be expensive when compared to other concept software.

  Pros: collaboration, smart connectors, SVG import and export, data import via spreadsheet, symbol and picture import, added data is automatically applied to the flowchart, shapes adjust to the text size. (Microsoft 2017a; Microsoft 2017b)

Visio 2016

Visio is the long-time standard in concept software. A large assortment of templates are available and recent updates have focused on being able to easily import and update any data that would need to be in the flowchart via Excel. This along with the new collaboration features and more emphasis on creating and changing the placement, link between steps and each type of step makes for a very comprehensive software. Visio is not available online so a test with different browsers was not done.

In the professional version industry, standard diagram templates are available, as are enhanced functions that allow for a more efficient, advanced creations, such as partial processes and rules. True collaboration, automatic updates to a workflow through linked data, and the use of icons and colours to spot patterns easily are also included. A well-rounded and powerful software from Microsoft that allows for easy customisation.

Ease of use for beginners with tutorials and how-to guides for different scenarios is not what Visio does. As this is the case it is not very well directed towards those that have not used such software before, are new to flowcharts or small businesses.

Another case in point of Visio being over complicated is turning certain well-meant features, such as the connectors that are auto-placed between steps off or on. These settings are often hidden behind multiple menus with titles that don’t make it easy to find them, leaving the overall user experience lacking.

The experience is further hindered by the lack of documentation concerning how to best benefit from Visio and missing how to steps. This stops it from being as easy to use as other reviewed software. On top of that Visio with their abundance of features makes it harder for smaller enterprises to be able to use it straight away as there is a steeper learning curve.

Lucidchart

The interface from Lucidchart makes for a smooth and easy to use experience. The ease of using Lucidchart is helped along with their clean up layout button that automatically adjust the spacing of shapes and lines, which results in a more presentable flowchart. The page of the flowchart auto expands as needed and the advanced drag & drop feature allows for auto shape creation as needed saving time and effort to do those manually.

Mindmaps, SWOT, Fishbone and other business tools can also be easily created with Lucidchart. The use of page linkage which allows each page to be linked to one another is very useful for creating a professional and detailed documentation of process documentation and ongoing business strategies.

Lucidchart is not only compatible with Visio but also with google apps, as well as, with Dropbox, among a vast set of other useful storage and business software. As with Visio, there is a large assortment of templates available for Lucidchart.

While the templates are of high enough quality that they can be used for presentations the features of being able to collapse groups of symbols allows for flowcharts to be presented in simplified and expanded views. Links can also be placed within the flowchart making it easy to present more detailed information whenever necessary.

Collaboration through group chats and comments functions, as well as, revision history make it easy to keep track of changes when multiple users are working on the same flowchart.

Lucidchart was easier to learn and use than other concept software as the provided help documentation is simple and to the point and with illustrations. Their clear view of making things easier not just for the creator of flowcharts but those that view the result

Lucidchart is clearly headed in the right direction concerning their features, ease of use and overall experience, especially for small businesses.

3.3.4 Software Review Summary

Concept software clearly makes the creation of presentable flowcharts easy, as once the original steps have been created they can easily be further changed and adapted without having to start over. The amount of time needed to create them is reduced through clever tools that allow for steps and connections to be realised quickly and easily.

While searching for and reviewing concept software it became clear that not all wanted features are currently available. Software change logs within the software products and the amount of competition in the concept software market indicate that innovation to improve the user's experience is taking place.

When first starting out with the creation of flowcharts using concept software the recommendable list is a great place to start. This is because they have more options available with free versions and still provide a reasonably useable user experience and therefore they can be used to create presentable flowcharts.

As the use of flowcharts increase in a business a paid for version from the recommendable list may suffice. While Microsoft Visio is also highly recommendable the pricing is quite high, especially if not a lot of flowcharts are created. Serious consideration should be given to Lucidchart as they provide a high level of expertise with their software and help documentation while keeping their prices very competitive.

4 CONCLUSION

ISO is by far the leading worldwide standardisation body for organisations and is dedicated to making organisations more productive. As such using their standard ISO 5807:1985 which concerns the symbols and methods of flowcharts to visually document a process is clearly a system that benefits organisations.

Micro and small businesses are under intense pressure due to competition, the rise of the internet and small manufacturing methods. They clearly have a need to document their process as this can take some of that pressure off and free up an employee's time. Doing so allows employees to do more complicated tasks quicker and with assurance that they will be done in a correct manner.

Accidents, delays, and misunderstandings happen and being prepared to handle them can be a large competitive edge. Having an internal process flow available about how to handle such situations and an external process flow concerning, for example where supplies are currently being ordered from and which route a shipment takes and possible alternatives for the supplier and route is practical, cost effective, and will make a business benefit from being able to quickly identify and know how to handle those situations.

Being able to overcome such risks with a solution, workaround, or reduction of them happening ahead of time is necessary for micro and small businesses that are set on expanding or keeping their business.

A process flowchart should be used to facilitate communication, improve upon, or develop a product or service, and whenever there is a need, to develop knowledge. In short, just about every task that is done more than once may benefit from a flowchart. Especially if the task is complicated.

Flowcharts should include each step of a process, including sub-processes, references, notes, explanations, and departmental and employee handoffs of any part of the task, in some form or other. All information within a flowchart should be written in clear and to the point manner. Doing so eliminates the need to find extra information elsewhere and speeds up the understanding of the flowchart and process.

Using online or standalone software allows for tasks to be more quickly documented. Doing so also results in the information being readily available and linked to further information or sub-tasks should it be needed.

The features that such software should have were defined and used to complete an extensive software search and review to find the software that best fits the needs for micro and small businesses. These needs are clearly to have functional software that fits within their price range and allows for employees to easily build and maintain a database of flowcharts.

The best-found products, function, and price wise are within a price range that is suitable for micro and small businesses. These products continue to improve quickly with new features being added regularly. They are for the most part easy to use and allow for exporting and importing of suitable formats so a business is not forced to stay locked within a specific company's ecosystem.

Process flows can easily become cluttered and unreadable which defeats their very purpose for existing. Ways to reduce such negative aspects of flowcharts is to use icons to display who or which department is responsible for a task. Icon representation allows for the automatic activation and deactivation of the person, system, or department throughout the entire process flow. It can be further expanded upon to include the type of product giving new insight into material flowcharts that are combined with process flowcharts and associated risks. This does away with many constraints and allows for a better presentation and viewing experience while allowing for more information to be contained within a process flow.

Another area of improvement is the colouring link between decision diagrams and the immediate step back, as well as, using colours on the borders of a process flow. This frees up space by removing the back arrow and by allowing diagrams to be free of colour within them. The result is less actual clutter and distraction for the viewer.

Great care should be given to avoiding such issues by maintaining a sleek, logical, and to the point flowchart. Just as much care should be given to maintaining them, finding risks and bottlenecks within the process flow and developing solutions for them.

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APPENDICES

The following pages concern the need to have a productivity method that allows for a quick check if a found source of information is valid or not and how to cite sources in a quick and easy fashion. As there was no over-reaching source the author created a simple and effective credibility checklist.

Credibility checklist

To research and write a proper paper access to credible sources is necessary. People, for the most part, bungle looking at the credibility of a source. The last thing that is needed is for a person or organisation to react to news or information that is faulty. This is especially important, now and in the future, with the rise of disinformation from governments directly but also through intermediaries.

As no one site had this type of information the author created one that was used to vet sources for this paper. This can be found in Figure 13 Credibility checklist (Harvard College 2016; Wikimedia Foundation 2016; University of Maryland Libraries 2016; Easybib 2016), of Appendix 3/3.

It, of course, can and should be used by others, as reducing the absurd length of time it takes to vet sources and to document them correctly within a text is needed. This, in turn, leads to better-finished report and presentation possibilities.

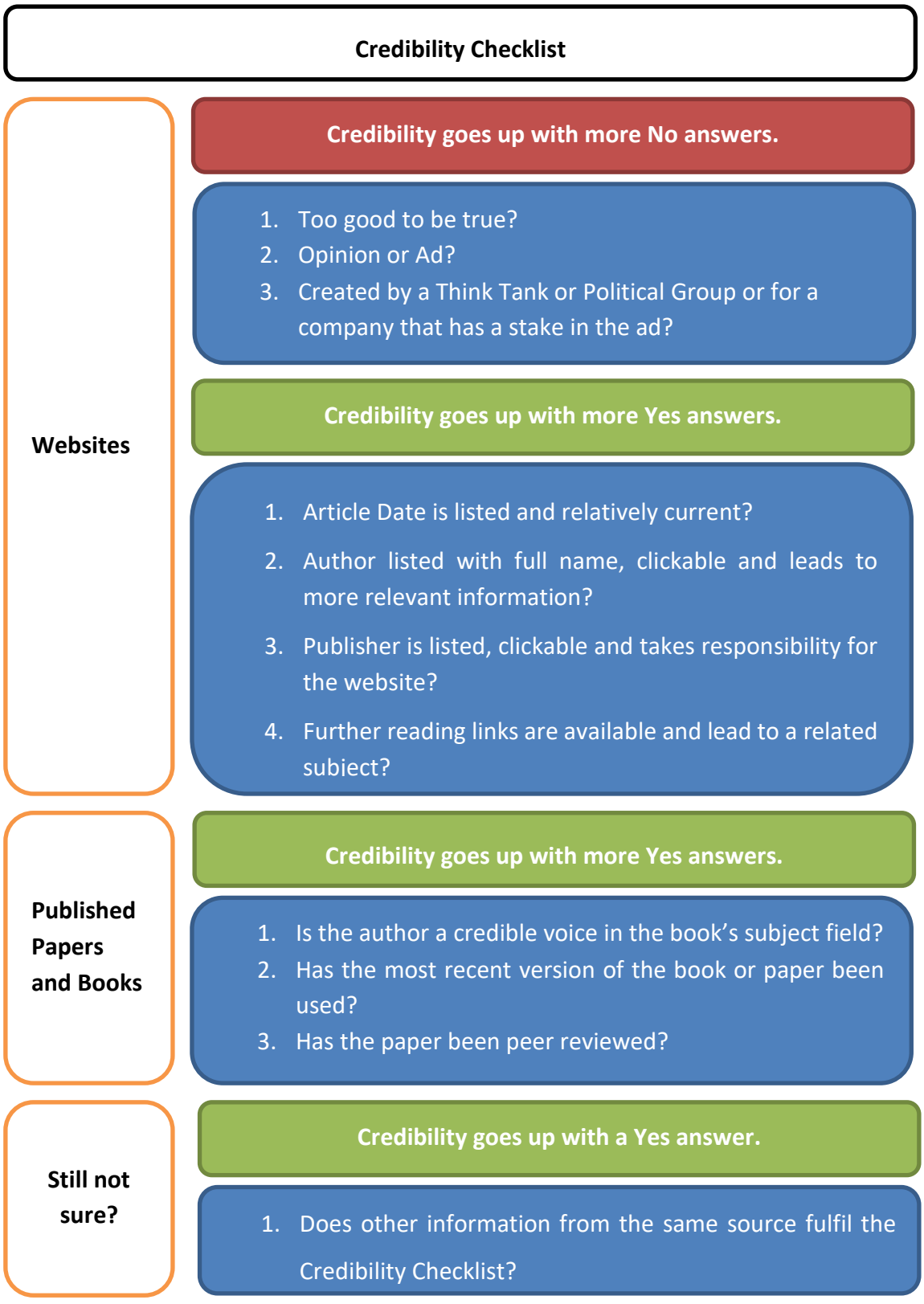

Figure 13 Credibility checklist (Harvard College 2016; Wikimedia Foundation 2016; University of Maryland Libraries 2016; Easybib 2016)

The people that assess risks and write the subsequent reports need tools that allow them to do so with ease. The developed credibility checklist in Figure 13 Credibility checklist (Harvard College 2016; Wikimedia Foundation 2016; University of Maryland Libraries 2016; Easybib 2016), combines the efforts of four individual sources into one simple to use tool. It also goes further than any of those sources by making it easy to assess the credibility of a source through simply answering yes or no to eight questions for a website credibility check, three for a check on books and a separate one question part in case it is still not clear if the source is credible or not.

While non-credible sources can slip through as they have always done in the past the entire process of knowing what to look for has been modernised and become more efficient. Though it may not be the perfect answer it is surely better than having to repeatedly check how to assess if a source is credible or not.

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