Conflict Minerals Supplier Due Diligence Process Improvement

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Abstract

Electronic companies, which use conflict minerals to manufacture products, experience increasing operational burdens on 3TG traceability and compliance. Identifying strategies to hit 75% supplier responses, lessening manual processes, reducing high-risk and non-compliant smelters in the supply chain, could improve the supplier due diligence process. Data collection and analytical review were used to identify helpful strategies and impacts. Surveys and training to suppliers were conducted as well to gather best practices and help them to comply. Lastly, a knowledge-based system development was proposed. Overall, this revealed that focusing on top spend and a smaller number of suppliers and working with other companies to identify strategies and develop a conflict-free supply chain would be a great approach. Interestingly, it was also found that active smelters are now proactively engaging with the RMI audit protocols and, suppliers (both RMI and non-RMI members), are now getting aggressive to have high-risk smelters be removed from their supply chain. Design of a conflict minerals automated system has been started as well to reduce manual process that contributes to low supplier response rate and inaccurate conflict minerals data. Future tests and study to identify and verify efficiency results to end-users is recommended in this research.

Keywords
Conflict Minerals, 3TG, Due Diligence, Compliance, Knowledge-based system

1. Introduction

The rate of transformation and development in the electronics and technology industry can be surprising, especially over the past few decades. These companies need to be flexible and quick to last and they must be able to overcome both current and evolving challenges in the market to excel. Some of the challenges they face are decrease functional margins where they must constantly become more cost-effective to remain profitable. They must have a robust quality and traceability system that directly affects contract reserve and after-production service hours, short product lifecycles wherein consumers have a rapid change in their sense of taste and likings, ambiguous demands, evolving protocols and standards that force companies to account more and more for Corporate Social Responsibility (CSR) in decisions, and lastly having complex global supply chain where companies are having to conjure internal and external assets while staying within international standards. Moreover, issues such as traceability and compliance are operational challenges that are nowadays increasing. It is not rare for components and sub-components to reach three or more continents before getting into the end-consumer.

The company where the author belongs, which is one of the US-based leading electronic and technology producers in the world, is no exemption from the above-mentioned issues and challenges. In line with having a complex global supply chain, they must assure that the products they sell to the global market are of the utmost quality. To assure quality, our processes must meet a range of statutory requirements and some international standard, one of which is compliance. The company has two compliance departments, REACH/RoHS and conflict minerals. This paper will concentrate more on the conflict minerals side. Conflict minerals compliance department exercises due diligence on the company's supply chains for tantalum, tin, tungsten, and gold (3TG). They must ensure that their customers receive DRC conflict-free products where unlawful human rights violations occur (Islam et al. 2017).

Due diligence means reaching out to the upstream manufacturers and refiners to require them to submit a conflict minerals reporting template or CMRT disclosing their use of 3TG and where the minerals originated. Firms that extract, process, and refine raw materials are called 'upstream' companies. The company belongs to downstream companies. They send to over 5,000 suppliers a request to complete a CMRT then must be sent back to company. All CMRTs collected will then be consolidated by the team to generate the company's CMRT for its customers. The CMRT generation usually takes about 1 to 2 weeks which usually delays response to their customers. In generating CMRT, the smelters' audit status is identified through the data they receive from their membership with the Responsible Minerals Initiative (RMI). RMI is one of the most utilized and respected resources for companies from a range of industries addressing responsible mineral sourcing issues in their supply chains. Audit status is either compliant with RMI requirements or not. Non-compliance to RMI by smelters means they might be illegally sourcing 3TG from the DRC. With this, most of the company's customers demand that non-RMI compliant smelters should be removed from their CMRT. In addition, the company's CMRT is also being rejected by customers as they only get responses below 70% of the total number of suppliers wherein, customers require at least 75%. This is also one struggle the company tries to solve as this nearly has resulted in sales loss as one of their top customers threatened to pull out about 5 million dollars in sales. And they might encounter similar issues in the future if they fail to achieve such response percentage.

According to (Brink 2019), there is a lack of researches on conflict minerals due diligence practices and transparency. This study aims to lessen manual processes in their supplier due diligence such as smelter consolidation, evaluation of red flags in supplier CMRT form submissions, and generating CMRT with all information collected from suppliers. Moreover, the study also intends to hit at least 75% supplier responses annually after automated system implementation. This is limited only to identifying strategies for the company on its standardization of due diligence process which covers gathering, managing, and validation of data from suppliers, minimizing non-RMI compliant smelters, and reporting a more reliable and comprehensive conflict minerals information to the SEC which will fulfill its customers' legal requirements and other regulatory obligations. Moreover, this shall also cover in pointing out features of the system that suit the company's conflict minerals due diligence. Analyzing, development, integration, testing, go-live implementation, and operations and maintenance will not be covered as it opens to future study and research.

2. Literature Review

Conflict minerals responsible has become a vast interest for the past years. (Barume 2016) emphasized that there is a need for new approaches development in production and processes that promote the efficient use of 3TGs materials which will give conflict minerals awareness to the public.

In relation to responsible sourcing, (Young 2015) studied on 3TG which implies conflict in the DRC. According to him, reaching multiple levels to buy conflict-free products are one strategy that downstream companies is using. Conflict-free sourcing for Sustainable Supply Chain Management indicates how compliance and supplier development strategies can reach numerous levels to address social issues in developing countries. He cited that future study is needed on the sustainability performance results for the conflict minerals issues and better understanding on suppliers. Partzsch (2016) argues that mandatory due diligence policies are the result of a new foreign accountability standard about the circumstances under which natural resources are mined.

Companies should manage supply chains by mitigating risks and assure that there are sustainability requirements being met (Brink 2019). Through the analysis of sustainability structures, the extent to how far the traceability extends was identified. It is through the management of social, ecological, and/or economic sustainability of suppliers through vendor information. For vendors within multi-tier supply chain, (Lechler 2019) explored how these companies work together to manage suppliers relating to sustainability and verify the impacts on their management. Based on the outcomes, supplier assessment and supplier partnership practices are performed collaboratively among the members of strategic coalitions to improve suppliers' compliance with the company's corporate sustainability requirements.

One method suggested by (Frohm 2006) of improving manufacturing is using an automated system. He stated that automated systems perform more efficient, more reliable, and more accurate functions than individuals. Through systematic review and surveys, he concluded that an automated system is more economic as well as more harmless structure.

Companies are now going beyond their own strategies to fight to human rights violation in the DRC (Islam 2017). He cited that there is more impact on the conflict minerals disclosures' thoroughness through collaboration of Non-government organizations (NGO) with companies. With this, there is improved transparency to stop human rights violations. (Schutte 2019) on the other hand, he did a case study on tantalum and tin supply chains in the East and Central Africa where he evaluated international trade data of these minerals from the Great Lakes region. He concluded that due diligence execution improves consistency of international trade information. Organizations must therefore do sensible data collection activities and due diligence to guarantee that their vendors are following local protocols as well as aligned with the parent company's own guidelines and business aims. A risk-based approach is suggested for those companies that have limited capability for vendor data collection. Basic due diligence based on the knowledge of the company of the product could be used detecting possible red flags in their feedbacks (Sinha 2015).

With majority of the authors' recommendation, companies should strengthen their due diligence process and systems, including traceability systems to guarantee customers that they are not supporting conflict and have carried out all the processes and taken strong actions to lessen the risks of contributing to conflict and grave human rights abuses in accordance with international protocols. Hence, supplier due diligence process improvement proposal. They also suggest while it is great to goal conflict-free supply chain, a serious step to reach several tiers is linked with it and that more study in the future is needed.

3. Methodology

3.1 Collection and Analysis of Data

Data collected was used to identify the possible strategies to utilize for the conflict minerals due diligence improvement and how they would be implemented. The general discussion surrounding the due diligence topic is often focused on how much screening of suppliers is appropriate to ensure that compliance requirements are met, and sound risk management is guaranteed.

3.1.1 The year 2015-2020 Supplier Response History Data

Response rate data from the past six years was gathered, reviewed, and compared. From there, the KPIs and impacts of each year were identified and all improved areas were recognized.

3.1.2 Public SEC Disclosure Reports of Peer Companies

Public conflict minerals SEC disclosure report of the top 10 US-based electronics companies were reviewed. Their conflict minerals due diligence efforts and actions were recognized. The review of company conflict minerals disclosure reports could pinpoint and further analyze supplier due diligence strategies (Brink et al, 2019).

3.1.3 High-Risk Smelter Supplier Due Diligence Survey Form

90 of over 10,000 suppliers for the 2020 calendar year that has products with high-risk smelters were screened by requiring them to fill out and complete a high-risk monitoring form. Results concerning having high-risk smelters in the supply chain were analyzed through a t-test to see whether being an RMI member means having a better supplier due diligence process.

T-test analysis is used on the evaluation of two averages to verify whether a product is the same as the existing product. The type used is a two-sample t-test as non-RMI and RMI members will be analyzed whether their supplier due diligence process differs significantly or not and whether being an RMI member is important for process improvement. The two-sample t-test is manually computed as follows:

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\left(s^2\left(\frac{1}{n_1}+\frac{1}{n_2}\right)\right)}} \tag{3.1}$$

In Eq. 3.1, the t-value is t, $\bar{x}_1$ and $\bar{x}_2$ are the mean values of the RMI and non-RMI member suppliers being compared respectively, s^2 is the pooled standard error of the two groups, and n_1 and n_2 are the numbers of observations in each of the samples. A larger t-value means that the difference between sample means is greater than the pooled standard error, which is an indication of a more significant difference between the samples. s^2 is computed as shown in Eq. 3.2 (Hoffman, 2019):

$$s^2 = \frac{(N_1-1)s_1^2+(N_2-1)s_2^2}{N_1+N_2-2} \tag{3.2}$$

Eq. 3.2 must be computed to determine degrees of freedom, df, in a two-sample t-test. Degrees of freedom are computed by Eq. 3.3

$$df = N_1 + N_2 - 2 \tag{3.3}$$

The confidence level used is 95% because this is the range of numbers within which the true difference in means is 95% of the time. 95% is also very commonly used. In some cases, the t-test analysis is conducted in a spreadsheet program where the p-value is calculated. The p-value is compared with the alpha level being considered. In case that 95% confidence level is considered, the alpha level is 0.05. The null hypothesis, H0, is that suppliers who are non-RMI members have the same level of supplier due diligence process comprehensiveness as suppliers who are RMI members. On the other hand, the alternative hypothesis, Ha, is that non-RMI member suppliers have a less comprehensive due diligence process than suppliers who are members of RMI. Ho and Ha are then stated in eq. 3.4 and 3.5.

$$H_o: \mu_{non-RMI} - \mu_{RMI} = 0 \tag{3.4}$$

$$H_o: \mu_{non-RMI} - \mu_{RMI} \neq 0 \tag{3.5}$$

The critical value represents the threshold at which the difference between the two values should be considered statistically significant. The critical value can be identified using the alpha level considered and degrees of freedom that were calculated in the previous step using a t-distribution table. Once the critical value, Cv, is identified, the absolute value of the t-statistic is compared with it. t value < Cv means Ha is likely to be correct.

3.2 System Analysis

This method is a process for developing quality information systems that are used by companies to create and maintain systems that perform basic functions. It will explain the assumptions and expectations that will guide the project of the company of having its automated system for conflict minerals to be used for its supplier due diligence. This study will only be limited to the planning phase. The purpose of the planning phase was to find out the scope of the project, what were the problems, and why is the new automated system was recommended as a solution. Resources, customer concerns, time, and sales are considered here. Figure 1 shows the fishbone diagram to identify the root cause of the problems in our existing Conflict Minerals campaign process. It showed that resources have limited time yet there are a lot of manual processes that take place including review of supplier CMRT submission and verification of the presence of high-risk smelters in the CMRT, which delays customer response and has inaccurate data that results in loss of sales or customers. Supplier response rate target is also not being hit because of the current manual processes and limited headcount that take place.

About to with concerning the manual processes currently take place and the need to address that main root cause, a new automated system has been proposed. A flow chart of the current process has been developed to figure out the manual processes that need to be improved or address. Failure areas and addressable improvement points are identified by a yellow-colored explosion symbol. On the other hand, a flow chart of the new conflict minerals outreach process should the system be implemented was also developed. The two flow charts are then compared as shown in Figure 2 to see the improvement that is to be expected.

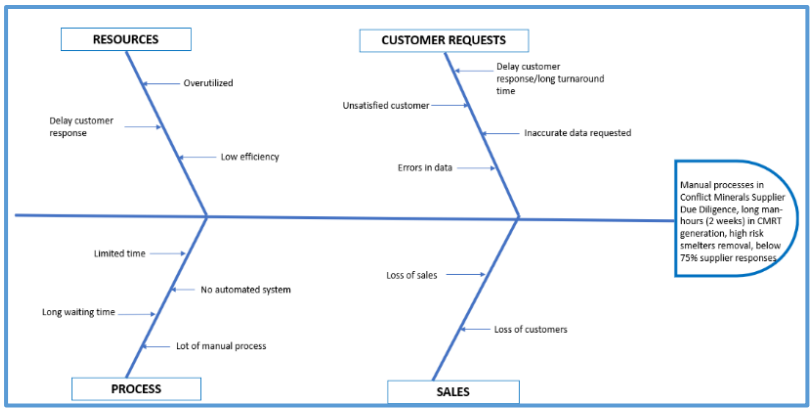


Figure 1. Causal Analysis Fishbone Diagram for Problem Root Cause Identification

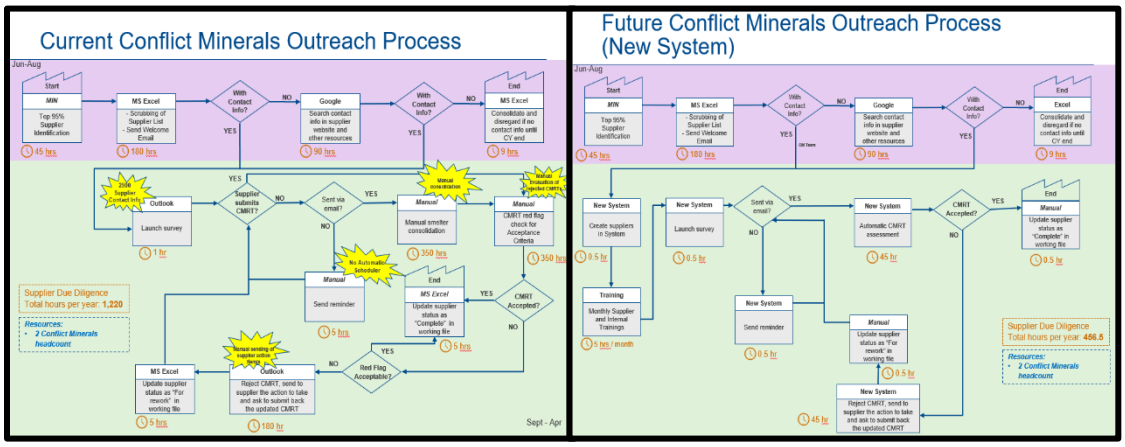


Figure 2. Current Conflict Minerals Supplier Due Diligence vs New Conflict Minerals Supplier Due Diligence with The Proposed System

3.2.1 Knowledge-Based System Development

In line with addressing the problems in Figure 2 the company has started with a knowledge-based system development for supplier due diligence for conflict minerals as the team has experts who would identify the needed features of the proposed new system. A knowledge-based system (KBS) which is an artificial intelligence (AI) form, intends to capture human experts' knowledge to support decision-making (Moore, 2007). Figure 3 shows the development methodology of the conflict minerals knowledge-based system.

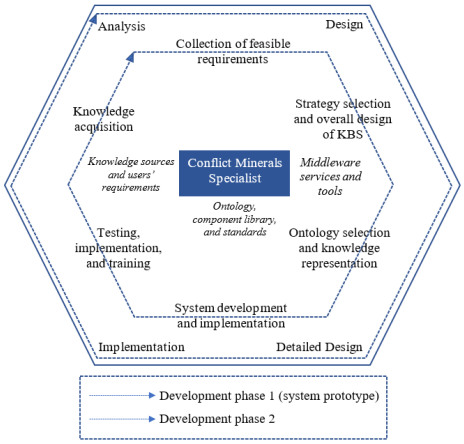


Figure 3. Conflict Mineral Knowledge-Based System Development Methodology

The development model in figure 3 is based on the system lifecycle. There are 7 major stages in phase 1. Phase 1 just gives the prototype and phase 2 gives the complete system development. This section is limited only to Phase 1 collection of feasible requirements to strategy selection and overall design of conflict minerals KBS. Collection of feasible system requirements was done through a list of users' features based on what the conflict minerals specialist would think are needed. The users are the conflict minerals team of the company, IT as administrator, and viewers as the management. On the other hand, strategy selection and overall design of conflict minerals KBS were documented through a Hierarchical Input Process Output Model (HIPO chart). HIPO chart is generally used to analyze a system and offer a means of documentation (Braunschweig, 2018).

4. Results and Discussion

This section of the research contains fields mentioned in the methodology that present the data collected, evaluation and discussion of these data, and comparison of results.

4.1 Evaluation of the Data Collected

4.1.1 The year 2015 – 2020 supplier response historical data

Figure 4 shows how supplier response rates have improved from the year 2015 to 2020. In 2015, wherein out of 7,400 suppliers surveyed, 27% responses were received. Based on the chart, KPIs and/or projects developed by the author helped in the significant increase in the supplier response rate. KPIs are escalation to the commodity managers of unresponsive suppliers, hiring of a resource for language barrier, getting the right contact information, conducting supplier training, and focus on top 95% spend suppliers. The top 95% supplier selection is based on the total spend the company spent for the current calendar. The company uses comparative analysis to identify which suppliers would belong to the top 95% spend. The trend however increases, appropriate steps taken were still not enough for the team to hit 75% response rate. However, since response rate target was not yet reached in the year 2020, the root cause was determined using the causal analysis fishbone diagram in figure 1 leading to identification of more improvement points in figure 2. As a result, an automated system to reduce manual processes was proposed. With this proposal, the company expects that it would hit its target of 75% response rate by 2021 after the implementation of the said system. The said system is discussed in sections 3.2 and 4.2.

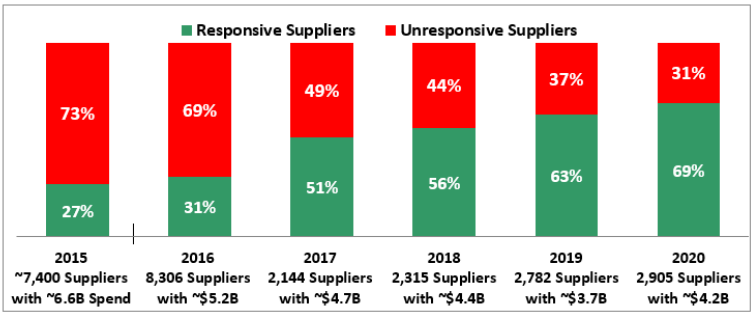


Figure 4. Response Rate Trend from Year 2015-2020

4.1.2 Public SEC disclosure reports of electrical and electronics companies

The author collected the SEC Conflict Minerals Form SD report of some 10 U.S. manufacturing companies from the year 2016 to 2020 and compared each other which is listed in Table 1. It is found that these companies exercise a due diligence on the refiners to ensure the quality and accuracy of the data received from suppliers It concluded that most companies surveyed a much smaller number of suppliers or they had focused their efforts on the top spend suppliers. In 2020, some companies released their list of smelters together with their report and some decreased the number of suppliers surveyed. These are the best practices of the suppliers that the company has started to apply in its conflict minerals process, with which contributed to the increase in supplier response rate in 2016.

Table 1: 2016-2020 Conflict Minerals SEC Report of 10 Electronics Companies

U.S. Companies	2016	2017	2018	2019	2020
ABB	45,000 suppliers identified 6,000 suppliers surveyed Released list of Smelters (ABB, 2016)	49,000 suppliers identified 6,600 suppliers surveyed Released list of Smelters (ABB, 2017)	47,000 suppliers identified Approximately 6,200 suppliers to be surveyed (ABB, 2018)	40,000 suppliers identified 5,300 suppliers surveyed 302 total smelters (ABB, 2019)	40,000 suppliers identified 5,000 suppliers surveyed 309 total smelters (ABB, 2020)
Dover Corporation	34% of total annual spend was surveyed - 79% response rate Released list of Smelters (Dover Corp, 2016)	41% of total annual spend was surveyed - 74% response rate Released list of Smelters (Dover Corp, 2017)	40% of total annual spend was surveyed – 61.5% response rate Released list of Smelters (Dover Corp, 2018)	531 suppliers surveyed equivalent to 33.1% of total annual spend - 54.4% response rate 127 total smelters (Dover Corp, 2019)	491 suppliers surveyed equivalent to 23.4% of total annual spend – 46.6% response rate 168 total smelters (Dover Corp, 2020)
Eaton	3,500 suppliers surveyed (Eaton, 2016)	3,100 suppliers surveyed (Eaton, 2017)	3,200 suppliers surveyed (Eaton, 2018)	3,200 suppliers surveyed (Eaton, 2019)	1,200 suppliers surveyed (Eaton, 2020)

Table 1: 2016-2020 Conflict Minerals SEC Report of 10 Electronics Companies (continuation)

Emerson	Focused on Top 95% Spend Suppliers (Emerson, 2016)	Focused on Top 95% Spend Suppliers (Emerson, 2017)	Focused on Top 95% Spend Suppliers (Emerson, 2018)	Focused on Top 95% Spend Suppliers (Emerson, 2019)	Focused on Top 95% Spend Suppliers (Emerson, 2020)
Honeywell	13,000 suppliers – 90% spend (Honeywell, 2016)	15,000 suppliers – 90% spend (Honeywell, 2017)	11,000 suppliers – 90% spend (Honeywell, 2018)	12,000 suppliers – 90% spend (Honeywell, 2019)	13,000 suppliers surveyed – 90% spend (Honeywell, 2020)
Ingersoll-Rand	Focused efforts on the top 90% suppliers by spend (Ingersoll, 2016)	Focused efforts on greater than 94% suppliers by spend (Ingersoll, 2017)	Focused efforts on greater than 89% suppliers by spend (Ingersoll, 2018)	Focused efforts on greater than 89% suppliers by spend (Ingersoll, 2019)	Focused efforts on greater than 93% suppliers by spend (Ingersoll, 2020)
Johnsons Controls	91% in-scope suppliers 33% response rate (JCI, 2016)	40% in-scope suppliers 55% response rate (JCI, 2017)	35% in-scope suppliers 55% response rate (JCI, 2018)	75% in-scope suppliers 44% response rate (JCI, 2019)	3,537 in scope suppliers 61% response rate (JCI, 2020)
Parker-Hannifin	Response from suppliers representing 83% spend (Parker, 2016)	Response from suppliers representing 83% spend (Parker, 2017)	Response from suppliers representing 83% spend (Parker, 2018)	Response from suppliers representing 75% spend (Parker, 2019)	Response from suppliers representing 75% spend (Parker, 2020)
United Technologies	1,690 suppliers surveyed Response rate was 70% (UTI, 2016)	1,556 suppliers surveyed Response rate was 78% (UTI, 2017)	1,556 suppliers surveyed Response rate was 78% (UTI, 2018)	1,484 suppliers surveyed Response rate was 91% (UTI, 2019)	1,709 suppliers surveyed Response rate was 92% (UTI, 2020)
3M	Focus on priority suppliers. Released list of smelters. (3M, 2016)	Focus on priority suppliers. Released list of smelters. (3M, 2017)	99% of suppliers were compliant (3M, 2018)	Focus on priority suppliers. Released list of smelters. (3M, 2019)	Focus on priority suppliers. Released list of smelters. (3M, 2020)

4.1.3 High-risk Smelter Supplier Due Diligence Survey Form

Table 2 displays the result of the survey conducted by the author last January 2021 wherein the correspondents are the top spend suppliers who have high-risk smelters in their CMRT. Upon analysis, there was 90 top spend suppliers for the 2020 calendar year that should be required to fill out the high-risk smelter due diligence form, in which a total of 30 have responded that has high-risk smelters in their submitted CMRT form. Of those 30, 18 are RMI members while 12 are non-RMI members.

Table 2: Conflict Minerals Supplier High-risk Smelter Due Diligence Form Results

Count, n	RMI Member	Non-RMI Member
1	2	3
2	3	3
3	3	3
4	2	2
5	3	2
6	2	3
7	3	2
8	3	2
9	3	3
10	2	2
11	3	3
12	2	2
13	3	
14	3	
15	2	
16	3	
17	3	
18	2	

Table 3: Descriptive Statistics of Samples

Sample	n	Mean	StDev	SE Mean	P-Value
RMI Member	18	2.611	0.502	0.12	0.28
Non-RMI Member	12	2.5	0.522	0.15	0.56

The data of the two samples in table 4 were verified for normal distribution by p-value calculation using a spreadsheet program. From the result in table 3, it can be concluded that both RMI and non-RMI samples are normally distributed since they have a p-value greater than 0.05 (or 5 percent).

Table 4: T-test Analysis Result

Difference	95% CI for Difference	t value	DF	P-value
0.111	(-0.285, 0.507)	0.58	23	0.568

Using the two-sample t-test analysis, the output generated is shown in table 4. Since the p-value is 0.568, which is much greater than 0.05 (or 5 percent), it can be concluded that there is no difference between the means of RMI and non-RMI members. Meaning both RMI and non-RMI member suppliers have a comprehensive supplier due diligence process.

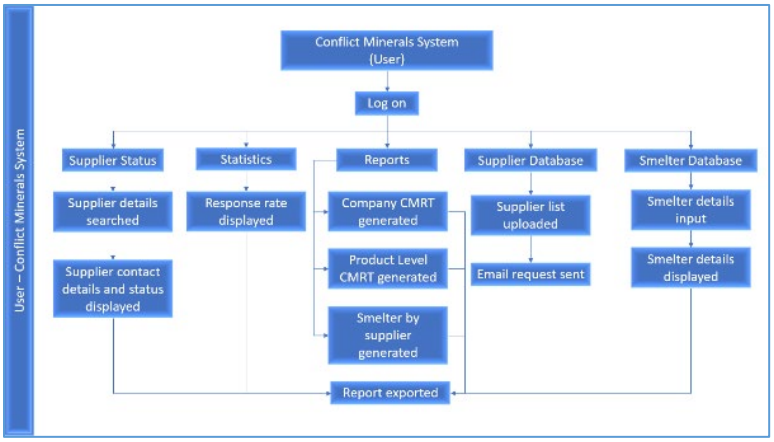
RMI would always be relevant to the Conflict Minerals chain as they are the ones contributing the tools like CMRT, provides the full list of smelters to its members, and audits and qualify smelters as being DRC conflict-free. Being an RMI member does not mean that they are only the ones who could remove or at minimum reduce the high-risk smelters in their supply chain. One can have a robust due diligence process even if not becoming an RMI member. Companies therefore in their supplier due diligence, instead of requiring their suppliers to become a member of the RMI, should push suppliers to have corrective actions in place in the supply chain to remove bad smelters and if possible, directly contact these smelters to commit to comply with all RMI audit protocols.

4.2 Conflict Minerals Knowledge-Based System

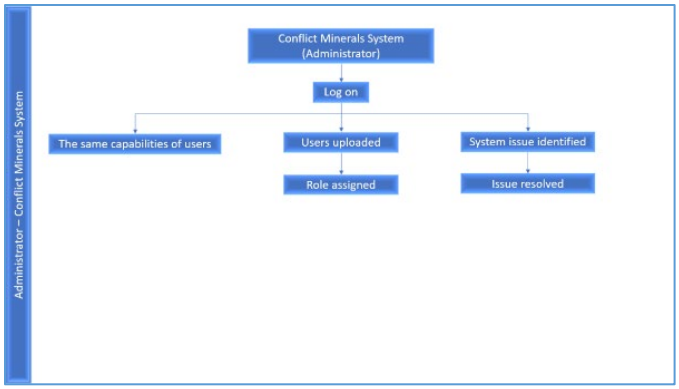
Due diligence requires vast data validation, problem solving, and decision making. Hence, handling thousands of suppliers would require an automated system for helping the experts with such decisions (Cena 2021). Artificial intelligence systems, such as knowledge-based systems would be a best way to help users pull out recommendations easily and could acquire diagnosis, interesting reports, and some useful techniques. The system prototype was designed based on the Conflict Mineral Knowledge Based System Development Methodology in figure 3. The system must have the capabilities which suit the needs of conflict minerals team for their daily activities. There would no longer a manual process because everything is already automated. The system must be efficient, user-friendly, more reliable, and much secure.

4.2.1 HIPO Chart (Hierarchical Input Process Output Model)

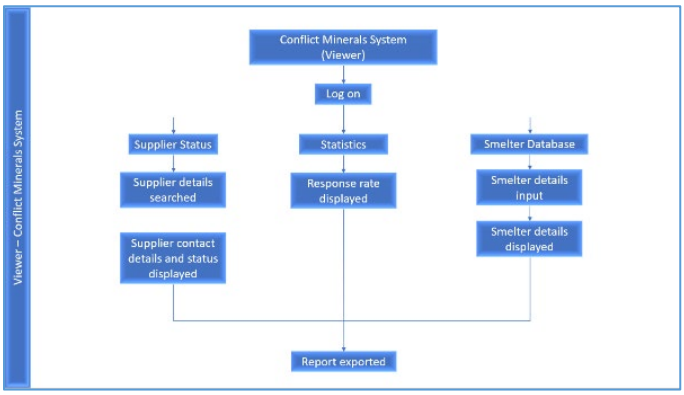
The system will have three interfaces. One for the conflict minerals teams which is called to be the users, the IT team that would be the administrator, and lastly the management which would be the viewer. Phase 1 of the conflict minerals KBS is the collection of feasible requirements and strategy selection and overall system design. In line with this, HIPO chart has been used. HIPO chart has been created to each user, administrator, and viewer.



(a) HIPO Chart – User



(b) HIPO Chart – Administrator



(c) HIPO Chart – Viewer

Figure 5. HIPO Charts

In figure 5, users, have various events to do on the system such as viewing supplier status, statics, reports, supplier database, and smelter database. In the supplier status option, the user can search a supplier by its name or ID and the supplier details will be showed. In the statistics option, response rate on the current date where it is clicked will be shown. In the reports option, the user can generate either company-level CMRT, product -level CMRT, or smelter by supplier report. In the supplier database option, the user can upload list of suppliers and send email request to them. Lastly, in the smelter database, the user can search for a smelter by its name or ID then the smelter details would show up. All these options can be exported from the system. For the second entity which is administrator, they have all the system capabilities that the users have. The added features for them are that they can only add or delete users and assign the roles to each user. They are the only ones as well who can view all activities made by each user and the date it was made. They are only the ones, too, who fixes any issues occurred from any activities a user made. Last entity which is the viewer only has the supplier status, statistics, and smelter database options. In the supplier status option, the viewer can search a supplier by its name or ID and the supplier details will be showed. In the statistics option, response rate on the current date where it is clicked will be shown. Lastly, in the smelter database, the viewer can search for a smelter by its name or ID then the smelter details would show up. All these options can be exported from the system. Overall, the system must display the primary functions needed such as the Dashboard, Supplier Status, Statistics, Reports, Supplier Database, Smelter Database, Administration. All kinds of users including administrator and viewer could also export any report they need in the system. The system must be able to display statistics such as supplier response rate. The development of conflict minerals knowledge-based system scopes only until prototyping, it opens to further research until the implementation of the system itself. This, however, need extensive information technology support and knowledge. Testing of the efficiency and effectiveness of the system is also recommended by the author on future studies.

5. Conclusion

This study aimed to create improvements in the present Conflict Minerals due diligence processes. Firstly, the comparison of the conflict minerals supplier response rate trend from 2015-2020 shows that KPIs implemented per year contributed to the significant increase in response rate. Though the response rate trend increases per year, it was still not enough for the company to hit the target of 75% response rate. This resulted to problem identification which is manual processes taking place in the department which lead to the proposal of an automated system. Secondly, looking at the form SD of some US public companies were an effective means to identify due diligence strategies and identify and manage risks throughout the entire mineral supply chain. Companies had exercised a due diligence on the smelter or refiners, and they had also focused their outreach on smaller number of suppliers. This research is purposely limited by research framework. Information gathered are publicly available. Working together with other major manufacturers to develop conflict-free supply chains would be a great approach. Additionally, the author analyzed whether RMI member suppliers have a better supplier due diligence process than non-RMI member suppliers by conducting survey and t-test analysis. It was found that non-RMI members do not have a less comprehensive supplier due diligence process than suppliers who are RMI members. This means that any company could do its part of reducing high-risk smelters in their supply chain by having corrective actions for these bad smelters and directly contacting its suppliers and smelters. Data validation and development of corrective action plan to mitigate risks in supply chain will help improve due diligence process and transparency. It will also help downstream companies to influence upstream companies. In addition, this study proposes that companies must establish not only a management system to support supply chain due diligence related to 3TG but also an automated system designed for conflict minerals. This led to the development of conflict minerals knowledge-based system (KBS) by the author. The implementation of the KBS, as the company believes, would be significant for them to hit its target response rate of 75% within this year. This methodology, however, is limited only to system requirements gathering until prototyping. The KBS methodology was developed starting when the author analyzed the case background of the project and conducted problem analysis to know the core problem and its root cause(s). As previously discussed, the conflict minerals KBS is limited only to system requirements collection and strategy selection and overall design of conflict minerals KBS. This study opens to the exploration of the rest of the process in KBS methodology. Through the new automated system of the conflict minerals team, it is expected that they would be able to hit, and even exceed their target response rate and data reliability. In addition, the management will be more efficient, and the employees would be more productive in the business. These results hopefully affect the customer satisfaction rating of the company since it will provide more accuracy and faster services to the customers. Since the company still in its planning phase, the author suggests future tests, monitoring, and study to identify and verify efficiency results such as survey to end users. This will determine whether also the proposed system will be acceptable to users or not.

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