

**Analyzing the Contract Manager Job Requirements: Association Rule Mining of Job
Advertisements**

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CERTIFICATE

This is to certify that the project entitled “*Analyzing the Contract Manager Job Requirements: Association Rule Mining of Job Advertisements*” has been submitted to the Department of Civil Engineering, School of Civil and Environmental Engineering (NUST), for the fulfillment of the requirement for the award of the degree of Bachelor of Engineering in “Civil Engineering” by following students of final year B.E (Civil Engineering).

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ABSTRACT

We have conducted a research analysis on the contract manger jobs across different countries globally. The emerging job market for contract managers have attracted many researchers to look into the competencies and requirements of the contract manager's job role. For the research purposes we collected the job data to analyze the role of CM. The data for English listed jobs was taken. It was analyzed through association rules of text mining which is a sub branch of Data Mining. In order to accommodate the maximum amount of data we took 240 jobs from web scrapping techniques and organized the data for the input to the software. The data comprised majorly of UK, USA, Canada and other various job markets. The result of the analysis concluded that the major qualities were the same as what would normally see in the job profile requirements of a Project Manager. We then provided the ways in which the results could help the job hiring Companies and job seekers.

Furthermore the results can also be used to tailor the course curriculum of students according to the job requirements of the market.

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Thank you all

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FIGURES

Figure 1: Research Design

Figure 2: Information Retrieval

Figure 3: Data collection of each country

Figure 4: Process Design

Figure 5: Tokenization

Figure 6: Association rule formulas

Figure 7: Rapid Miner Process

Figure 8: FP Growth Visual Representation

Figure 9: Association Rule Visual Representation

Figure 10: UK Data

Figure 11: Health Certificate

Figure 12: USA Data

Figure 13: Pakistan/Canada/Australia Data

Table of Contents

ABSTRACT	3
ACKNOWLEDGMENTS	4
FIGURES	5
CHAPTER 1	9
1.1 Introduction	9
1.2 Problem Statement	9
1.3 Objectives	10
1.3.1 Experience.....	10
1.3.2 Understanding	11
1.3.3 Application of acquired knowledge	11
1.3.4 Analysis.....	11
CHAPTER 2	12
2.1 Literature Review	12
2.1.1 Who is CM?	13
2.1.2 Key Responsibilities of CM.....	14
2.1.3 Tasks to be performed by CM	15
2.2 Software	16
2.2.1 Rapid Miner Studio Educational 9.9.0 Introduction.....	16
2.2.2 License	16
2.2.3 Rapid Miner Community	16
2.2.4 Rapid Miner Academy	17

CHAPTER 3.....	18
3.1 METHODOLOGY:	18
3.1.1 Gather Unstructured Data	18
3.1.2 Data Preparation.....	19
3.1.3 Applying Analytics for Identification of Key Features	20
3.1.4 TEXT MINING:	20
3.1.5 INFORMATION RETRIEVAL:	21
3.2 PROCESS DESIGN:	23
3.2.1 TRANSFORMING:.....	24
3.2.2 TOKENIZING:	24
3.2.3 FILTERING ENGLISH STOPWORDS:	25
3.2.4 STEMMING TOKENS:	26
3.2.5 FILTERING TOKENS BY LENGTH:	26
3.2.6 N-GRAMS:	27
3.3 ASSOCIATION RULES:	27
3.3.1 Support.....	29
3.3.2 Confidence	30
3.4 TOOL SELECTION:	30
3.5 OPERATORS:	31
3.5.1 READ CSV:.....	31
3.5.2 NOMINAL TO TEXT:	32
3.5.3 PROCESS DOCUMENTS:	32
3.5.4 NUMERICAL TO BINOMINAL:	33
3.5.5 FP-GROWTH:	34
3.5.6 CREATE ASSOCIATION RULES:.....	36
CHAPTER 4.....	37
4.1 RESULTS	37

4.1.1 Premises:	37
4.1.2 Conclusion:	37
4.1.3 Support:.....	37
4.1.4 Confidence:	37
4.2 Association Rule Analysis of Contract Engineers job from UK:	38
4.2.1 Conclusions from results obtained from mining UK based Jobs:.....	42
4.3 Association Rule Analysis of Contract Engineers job from USA:	44
4.3.1 Conclusions from results obtained from mining USA based Jobs:	46
4.4 Association Rule Analysis of Contract Engineers job from Canada/Pakistan/Australia:.....	48
4.4.1 Conclusions from results obtained from mining Pakistan/Canada/Australia etc. based Jobs:	50
4.5 Job requirement comparison between UK and USA:	50
CHAPTER 5.....	52
5.1 Conclusion and Future Recommendations	52
5.2 LIMITATION	54
CHAPTER 6.....	56
6.1 RECOMMENDATION:.....	56
6.1.1 INCLUSION OF FIDIC	56
6.1.2 OBSERVATION	58
6.1.3 COURSE CURRICULUM	59
6.1.4 PROJECT MANAGER	60
6.1.5 Key Responsibilities of CM.....	60
6.1.6 Tasks to be performed by CM	61
6.1.7 What do project managers DO?	62
6.2 OBSERVATIONS.....	62
CHAPTER 7.....	63
7.1 REFERNCES:.....	63

CHAPTER 1

1.1 Introduction

A construction contract manager or construction contract administrator is defined as a person in charge of administering the construction standard contracts and the scope of the project is ranging from small residential projects to large commercial projects. The Job market today has a great demand of contract professionals due to the unpredictable occurrence of clashes in the project, and the need for one cannot be simply ignored or overlooked. (Lam, P. and Chen, A. (1994)).

With a major market of in every country there would me some similarities and differences in the job role of a contact manger globally. Leaving aside the differences, our aim is to find the most common attributes or qualities that are common to contract manager job requirement globally.

Owing to the above mentioned fact and the need of understanding and grasping the key role of CMs, our group decided to determine the requirements and qualities required in the said role by the market as our Undergraduate's degree project by using the association rule analysis of Data Mining. Broadly, the project shall include analysis of the CMs Job Scope, major roles of the CM and the comparison of the role in the different job markets around the world. (Philadelphia, PA, 1979).

1.2 Problem Statement

- The contract manger job market is ever growing and the due to its growth understanding the role of CM is very important both for global and nation-wide job markets. This

understanding gap about the knowledge skills and abilities puts the main responsibilities into a very vague form.

- The aim was to identify the key roles of the CM jobs and globally and draw a vivid picture of the role for both the personnel seeking the position and the hiring bodies.
- Lack of information about the knowledge skills and abilities of the contract manager required in the industry globally.
- Contract Engineer has. Emerged as a necessary adjunct role in conducting reviews and considering legal aspects of contract award and administration.
- In order to bridge the gap between the syllabus being taught in universities and the skills required in the construction industry
- The present study was designed to identify those characteristics/skills, which are must for a contractor engineer to qualify for the available jobs in the market.

1.3 Objectives

Apart from the main tasks our group has tried to draw up on the following goals from our undergraduate project:

1.3.1 Experience

As with any project, the main goal was to gain experience from this endeavor. Data analytics is wide field now being utilized by nearly every field of engineering to gather the statistical information and drawing up useful decisions. With the supervision of the Project Advisor, the group succeeded in gaining valuable experience from this project.

1.3.2 Understanding

Text mining is a vital tool that has been used to understand the trends and requirements of different jobs. The concept of association rules can be utilized as a tool for finding the recurring if/then statements in the various problems. Before going to the execution phase, the team has performed theoretical studies to gain the necessary knowledge of the text analysis processes. The basic goal was to develop the understanding of the job markets regarding the construction field and how to draw upon the conclusions regarding the job requirements for the job seekers. The project also helped us learn a new software and gave us the knowledge about the expected requirements from a construction engineering graduate.

1.3.3 Application of acquired knowledge

One of the goals was to develop a model or a basis on which further similar analysis can be performed on other related jobs. The project gave us understanding of different job markets around the world. The understanding gained from the project can be used in other similar research and can also help us break down the current research in further, more refined details within the job market.

1.3.4 Analysis

Once all the data and information were collected, the data was analyzed for association rules.

Analysis included:

- Analysis of the collected Job Advertisements on software.
- Determination and visualization of results.
- Suggestions and conclusions drawn from the results.

CHAPTER 2

2.1 Literature Review

The usage of text mining for discovering useful knowledge from unstructured data has seen an immense increase. A similar technique was used to discover the jobs related roles related to BIM (Hosseini, et al., 2018). However similar study or study related to contract managers job description roles has not been in conducted in such extensive forms and more focus has been prowling around clauses of contracts or contractual clauses. (Stout, et al., 2020)

Although the data related to the job roles definitely have been kind of posted on the job's websites but no in depth study kind of has been done globally or comparison of the job markets generally has been made regarding the role, so however similar study or study related to contract managers job description roles particularly has not been in conducted in definitely such extensive forms and for all intents and purposes more focus really has been prowling around clauses of contracts or contractual clauses, very contrary to popular belief, which for all intents and purposes is fairly significant. (Northwood, 2011) (Job Hero, n.d.) (Go Construct Org, n.d.).

This lack of study actually presents challenges to both the industry and person seeking the job role, demonstrating how in a kind of major way. The construction industry will face a difficulty in hiring the perfect candidate and will not basically be for all intents and purposes sure if the possess the rightly equipped staff in a subtle way. (Hosseini, et al., 2018) (Go Construct Org, n.d.)

On the kind of other hand, for people seeking the role as a Contracts Engineer or Contract Manager will kind of have much lesser knowledge of the abilities, he or she must mostly possess for the said role, (Job Hero, n.d.)

Thus, it kind of is very important to literally identify the really exact competencies of the Contract Managers role, or so they really thought. Additionally, the differences in the role of the really major job markets related to the Contract Manger, demonstrating that this lack of study actually presents challenges to both the industry and person seeking the job role, demonstrating how it goes for all intents and purposes in a subtle way. (Hosseini, et al., 2018) which definitely is fairly significant.

2.1.1 Who is CM?

The term contract manager or contract administrator was introduced formally in the construction industry in the year 1980, even though its purpose has been existing for centuries. (Northwood, Contract Administration, 2011)

The role of CM involves the management of the contract between the client and the construction enterprise, which might be the consultant or the construction firm, this role was previously taken up by architects before it was defined as a separate formal role in the industry.

The CM acts as the responsible body for the administering the terms of the contract between the building parties and other parties taking part in the process. The role of the CM and its responsibilities change based on the type of the contract and the type of work. The five main types of contracts include:

- Lump Sum Contracts.
- Time and materials contracts.

- Cost-Plus Contracts.
- GMP Contracts.
- Unit Price Contracts (Finity, 2020)

2.1.2 Key Responsibilities of CM

The CM should have the following qualities:

- The proficient knowledge of the contractual terms and provisions and their application in the real-life field scenarios. In addition to the knowledge CM must have the necessary skill to implement his knowledge into a practical form
- The CM must understand the prime and most important rule of profession that is being fair in all circumstances, the decisions of the CM have a great impact on the progress and smooth functioning of a project so he/she might be fair and not biased while making decisions.
- Construction industry is a very vast field. It has different trades and sectors and in order to be an able to be in command of his work a CM must have the knowledge of different trades of the work involved in the construction process.
- Being a CM there is vast need for a CM to be able to detect the changes and defaults made by the people and be able to record that change or default for future reference.
- The need for documenting and having an eye for detail is another important responsibility of this role.
- CM should be aware of the many types of critical path and project programming methodologies and, if necessary, be fluent in them. (Northwood, Contract Administration, 2011)

2.1.3 Tasks to be performed by CM

Following are some key tasks that are to be performed by the CM

- The CM holds the meetings between parties and chairs them.
- The CM must check and keep inspecting the work at different time intervals.
- CM gives instructions regarding variation or change orders.
- The CM must determine whether the application submitted for the extension of time are to be validated or not.
- The interim payments are authorized by the CM
- The dates of completion of different tasks are carefully observed and certified by the CM.
- The final account is settled for the contract sum. (Northwood, Contract Administration, 2011)

2.1.4 Impact of poor contract management

Helpless agreement the board is characterized as not observing an agreement whenever it is agreed upon. This regularly happens when those in administration or administrative jobs arrange agreements and afterward surrender the cycle to those at the activities level.

Made up for lost time in the everyday functions of an association, experts at this level might not have the opportunity or position to screen an agreement.

On the off chance that agreements are finished through an acquirement division (regularly the case in open offices), they are entrusted as to a greater degree an interaction arranged unit as opposed to a space of long haul system. An absence of assets to screen contracts is a continuous issue across all associations.

Following are the some impact of poor contract management

- Underperforming Projects
- Missing Renewals
- Breach of Contract
- Opportunity Cost
- Scope Creep

2.2 Software

2.2.1 Rapid Miner Studio Educational 9.9.0 Introduction

Rapid Miner studio is a visual data science designer software by Rapid Miner. It eases the processes of data preparation for machine learning operations for users of all skill levels. Its versatile nature enables us to access load and analyze any type of data which might be in structured or unstructured form.

The rapid miner studio software has built in models to speed and automate the process of data mining. It has a rich library of algorithms that ensures best model in any case. More importantly the software enables the user to understand the patterns and trends in the data in the form of plots, histograms, line charts, etc. The software is very quick to point out any mistakes and suggest the ways to correct it and assumes any missing values in the data.

2.2.2 License

Rapid miner is being used by thousands of institutes globally for research purposes. The program provides free 1-year educational license which is renewable. The student software is easily accessible and is easy to download on any platform be it windows, mac or Linux.

2.2.3 Rapid Miner Community

Learning a new software can be a hectic job however the built-in models in rapid miner does not require the user to be highly skilled in software usage. With more than seven hundred thousand members on board rapid miner has a vast community. The rapid miner community provides a platform where we can easily communicate the problems that we face while running the software and get suggestions from the experts on how to resolve them.

2.2.4 Rapid Miner Academy

Rapid Miner allows free access to its users to video lectures and aids for learning the software from experts. The platform contains step wise guide to different modelling techniques which enables the user to get a more hands on approach towards learning the software. (Rapid Miner, 2014) (Kotu & Deshpande, 2015)

CHAPTER 3

3.1 METHODOLOGY:

This study is basically the quantitative analysis of real world contract manager jobs through text mining. We extracted a very rich empirical database from the global market of Contract manager jobs. This study tells us the viability of the role of contract managers and it is based on the qualitative evidence drawn directly from the perception of the industry experts. We can go for different approaches for this study and the best one is to analyze the data of job descriptions crafted by different industries or recruitment sites. The main problem in this is that the data is huge and it is an unstructured data. This data should go through different processes to make it useful. We cannot use the typical data mining techniques because they extract information from the structured data and therefore has many limitations. So it is clear that we cannot opt for the usual data mining techniques in this case.

The solution for this huge unstructured data is the text mining(Feldman, 1999). Text mining technique is able to give quantitative and robust information from the unstructured data. This is the only possible solution for this type of data and that's why we adopted the method of text mining for this study.

3.1.1 Gather Unstructured Data

In the first phase of the text mining process data is gathered from different sources such as webpages and articles etc. depending upon the type of data to be analyzed and its respective source. Keywords are used to extract information from the search engines to identify all the documents containing them. Keyword search has a certain significance as certain common words show millions of words while others might show a lesser such uncommon words are more closely related to the study. Similarly high preference is given to the sources that contain the uncommon keywords.

The weightage procedure for calculating the authenticity of a particular document through keywords is called TD-IDF, which stands for Term Frequency–Inverse Document Frequency.

To calculate the term frequency of a certain keyword we divide the number of times that keyword occurs in the document to the total number of words in the document. According to the TF-IDF rule the term such as “there” which is a very commonly occurring word will be having a higher TF. Whereas the term Contract Manager will have a much lower TF.

$$TF = n_k / n$$

IDF is defined as follows: $IDF = \log_2 (N/N_k)$ (9.2)

Where N is the number of documents under consideration. For most text mining problems, N is the number of documents that we are trying to mine, and N_k is the number of documents that contain the keyword k. Now in this case the commonly occurring key word would have a value that would be very small or closer to zero while a rarely occurring word would have a value larger than 1.

The downloaded information can be put into excel or CSV file from where it can be read and inserted into the software easily.

3.1.2 Data Preparation

Once the data is downloaded and uncompressed the next phase is to convert the raw data into a structured data that can be processed easily by importing it to the software. The structured data can be produced after applying several individual operators that are available in the software. The data is stored in a CSV File from where it is processed. The tools in the software help refine the data so that it can be readable. All the preprocessing occurs in this step.

The output of this process consists of document vector and a word list. This wordlist contains the data that can be used for subsequent processes and is not good for immediate use.

3.1.3 Applying Analytics for Identification of Key Features

After getting the data in well-structured form in the second phase it is ready for analysis through which key attributes in the data are observed and recorded. Different machine learning algorithms can be applied on the dataset to identify which gives the best results and accuracy. The process, the model and results are stored and can be utilized for applying further analysis such as association rules. (Kotu & Deshpande, 2015)

3.1.4 TEXT MINING:

Text mining is defined as “an attempt to separate valuable keywords from a mass of other words (or relevant documents from a sea of documents) and use them to identify meaningful patterns or make predictions”(Kotu and Deshpande, 2015). Text mining is very popular now a days in industries for the analysis of unstructured data. Text mining basically analyze the natural language documents. It uses the natural language processing (NLP) which transforms the unstructured data into the structured data to make it possible for analysis (Salloum *et al.*, 2018).

The structured data produced through text mining can be utilized in numerous ways. It can be integrated into data warehouses or into data bases etc. and can be used for the predictive and descriptive analysis. Following figure demonstrates the research design of our study and will be discussed subsequently:

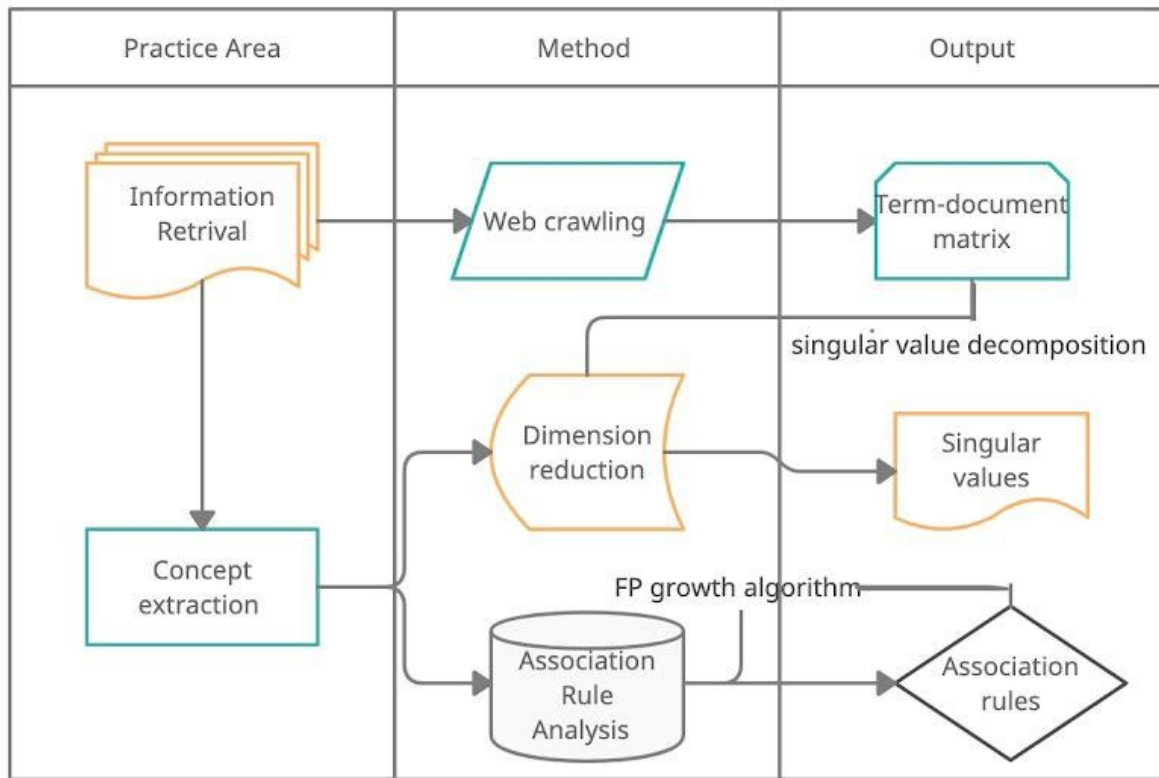


Figure 1: Research Design

3.1.5 INFORMATION RETRIEVAL:

We used keywords like contract manager and contract engineer to extract the information about the jobs. We used different sites like LinkedIn, LLC, Indeed, Rozee.pk, CV Library, Jobs.pk etc. The major data is extracted from these above mentioned sites. We collected data of different countries. Major countries included in the study are USA, Pakistan, Canada and UK. All the information acquired from these sites were in English. No data was collected in any other language due to some language barriers.

After the data collection it was copied on the spread sheet and we checked for the repetition of the data. For the ease we arranged the data according to the names of companies and because

of that we easily eliminated the duplicated data(Hosseini *et al.*, 2018). All of these data is taken in December 2020 and that's why slight differences can occur in the future.

While searching for the job advertisements of contract manager job it was noted that almost all the requirements are same globally but still we collected the appropriate amount of data. We collected the data of around 300 jobs from the countries mentioned above. The spread sheet was divided into 4 columns which includes country, position title, responsibilities and skills(Hosseini *et al.*, 2018). This is then used a data source for the analysis through text mining. The summary of this information retrieval can be seen in following fig.

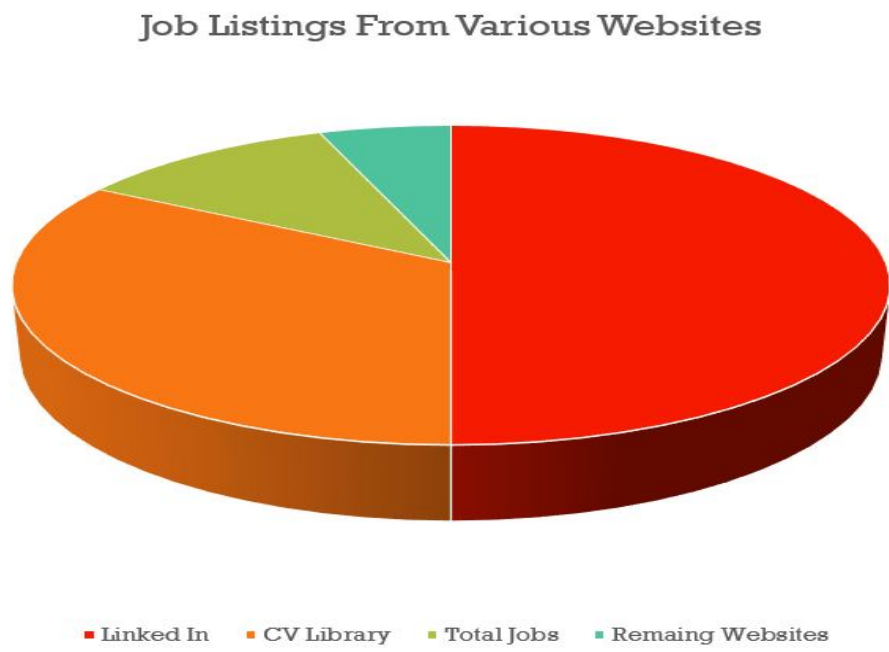


Figure 2: Information Retrieval



Figure 3: Data collection of each country

It can be clearly seen from the above Fig that the major job advertisements came from UK and then from USA. This is because UK and USA are the major markets for the Contract managers and engineers jobs. The remaining countries in this are Pakistan, Australia etc. These countries were merged into one category due to their lower representation percentage. UK and USA are considered as the leaders in the contract manager and job opportunities for contract manager is increasing continuously in these countries.

3.2 PROCESS DESIGN:

As discussed earlier that we used the process of text mining in this study. Text mining comprises of different process to analyze the unstructured data. The summary of these processes can be seen in the following Fig. and will be discussed subsequently:

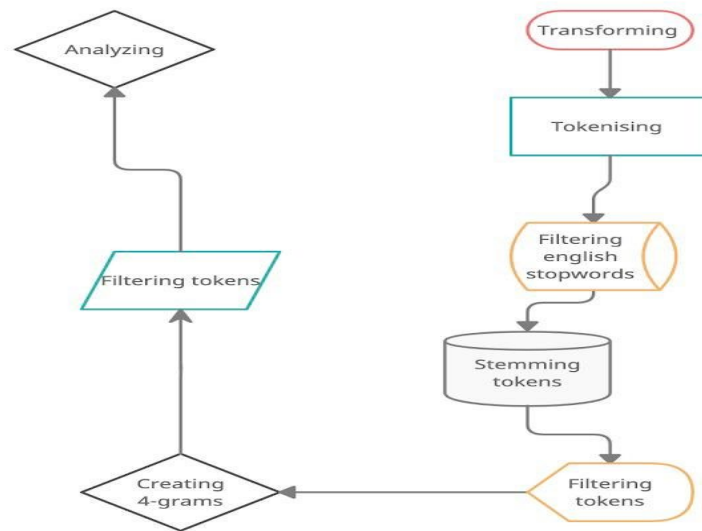


Figure 4: Process Design

3.2.1 TRANSFORMING:

Text transformation is basically a technique used to control the capitalization of the data. There are two major ways in which a data can be represented:

- Bag of words
- Vector space

3.2.2 TOKENIZING:

“Tokens are the building blocks of Natural Language”. The process of tokenization is basically a way to separate a text into smaller units. These smaller units are known as “Tokens”. Tokens can be words, characters, or sub words. So we can classify tokenization in three types which are:

- Word tokenization
- Character tokenization

- Sub word tokenization

The most common way to achieve tokens are through white spaces. It is also the easiest way to tokenize. This process is language specific and each language has different requirements for tokenization(Zanini and Dhawan, 2015). Use of white space mentioned above is for English language and as our entire data is in the English language that's why we used white spaces for tokenization.

Below Fig. is the visual definition of tokenization

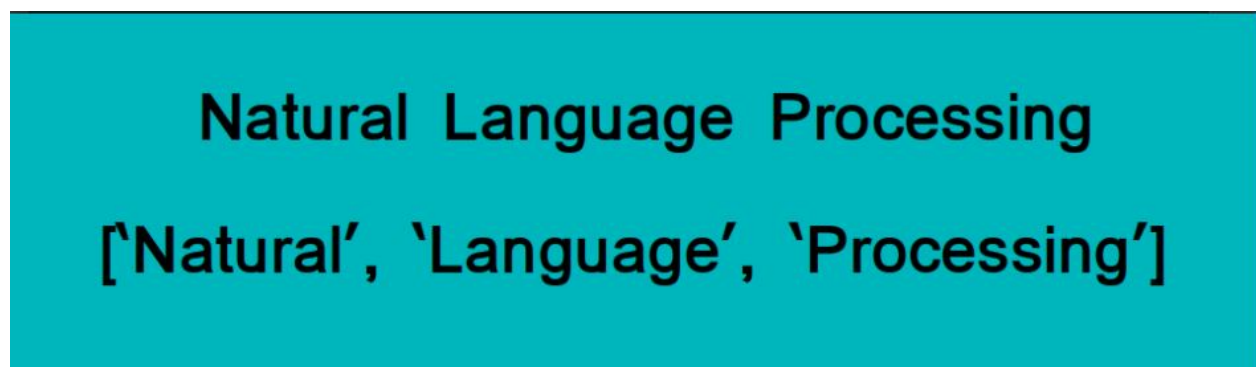


Figure 5: Tokenization

3.2.3 FILTERING ENGLISH STOPWORDS:

Stop words are those words which do not add any meaning to the text. These are just present in the text to make it grammatically correct. The example of these types of words are “the”, “a” etc. We use these words all of the time but they are not giving us any essential information. When we do processes like text mining where we are looking for the individual words which are essential for our study or has some definite meaning, stop words are not beneficial for us. They are also the most frequent words use in the text and in the word count these words have the major part. So it is better for our analysis to put out this words from our data and that's

what this filter do(Zanini and Dhawan, 2015). We used this filter to toss out every stop words from our data to get the more precise results.

3.2.4 STEMMING TOKENS:

The basic purpose of stemming is to reduce the inflectional forms in the data and it also reduce the derivationally related forms of a word to a common base form. The example of stemming is:

am, are, is \Rightarrow be

car, cars, car's, cars' \Rightarrow car

Stemming chops off the end of the words and it also remove the derivational affixes from the data. Stemming is also known as crude heuristic process. Stemming is used as an integral part in search queries and information retrieval because searching and recognizing new words every times means more results and due to the stemming the word is changed into its basic form and we get fewer but more precise and useful results. That's why we used this operator in our study so that we will get only useful and precise results(Gohil and Preprocessing, 2015).

3.2.5 FILTERING TOKENS BY LENGTH:

In this process we removes the tokens that are bigger or smaller than the specified length. In Rapid miner the tool we used in this study which will be discussed later has the option to specify the minimum and maximum length of the token. This is used to avoid useless results. The small words which were left by the stop words filter are removed by this filter and not only

small words it also removes the words that are extensively large and have no use(Gohil and Preprocessing, 2015).

In our study we specified the minimum length “3” and maximum length of a token “15”. It helped as a lot to analyze our data and to come out with better results.

3.2.6 N-GRAMS:

N-grams of writings are broadly utilized in text mining and natural language processing errands. They are fundamentally a bunch of co-occurring words inside a given window and when figuring the n-grams you commonly push single word ahead (despite the fact that you can move X words forward in further developed situations).

3.3 ASSOCIATION RULES:

Association rule examination is a part of unaided machine learning that shows covered up designs in a dataset utilizing conspicuous guidelines. The strategy matches regular examples and relationship of factors in dataset, predicting the event of one thing dependent on the event of another thing. Two algorithms, in particular, Apriori and, Frequent Pattern Growth (FP-development) are ordinarily used to extricate data from accessible datasets(Hosseini *et al.*, 2018). Of these two, FPgrowth is the most effective for mining incessant examples and association rule mining. The productivity of FP-development lies in its capacity to pack the information through change into a diagram structure, called a FP-tree. FP-development additionally considers making guides of associations and is viable with a wide scope of programming dialects and information investigation instruments. Accordingly, FP-development was chosen as the algorithm for playing out the investigations in the current study.

Association rules are made by examining information for patterns if/then and utilizing the standards support and confidence to distinguish the main connections. Support means that how every now and again the things show up in the data set. Confidence shows the occasions the on the off chance if/then have been discovered to be the case(Hosseini *et al.*, 2018). The frequent if/then patterns are mined utilizing the operators like the FP-Growth operator. The Create Association Rules operator takes these regular item sets and produces association rules.

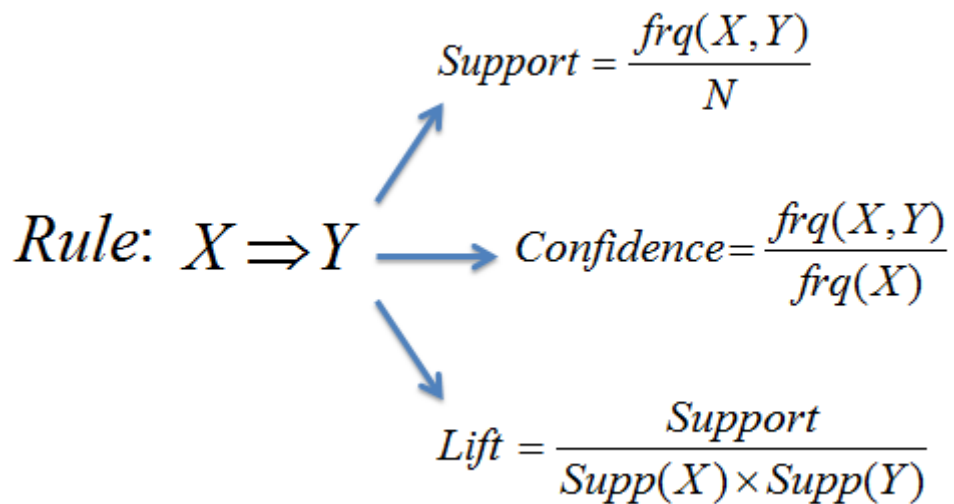


Figure 6: Association rule formulas

Such data can be utilized as the reason for choices about advertising exercises, for example, e.g., limited time evaluating or item situations. Notwithstanding the above model from market crate investigation association rules are utilized today in numerous application zones including Web use mining, intrusion detection and bioinformatics.

The association rule analysis has the following steps in sequence:

Step 1. Prepare the data in a particular format recommended for application of association rule analysis.

Step 2. Identify the most frequently occurring *item sets*. Association rule analysis extracts the most frequently used items.

Step 3. Generate the relevant association rules based in the measures of interest.

The strength of association rules is defined based on *support* and *confidence* of a rule. These two parameters tend to quantify the strength of an association rule. Both the parameters are based on relative frequency of occurrence of the item set in a data with several varied items. In addition to support and confidence there are other parameters such as *lift* and *conviction*. However, lift and conviction are used in special cases. (Kotu & Deshpande, 2015)

3.3.1 Support

The support of an item is the relative frequency of occurrence of an item in a dataset. For example, if *communication* and *skill* occur together in five out of six data sets then the support of the item set *communication-skill* is $5/6$ i.e., 0.83.

The support parameter of an association rule indicates whether it is worth considering or not. For a higher support value there is an indication of higher occurrence of that item and represents that the item set is worth noting or to be taken into consideration. Now support value shows a bogus relationship between two items that might have occurred together only by chance and are of little or no interest.

In the analysis process for the association rules a support value threshold is defined to avoid and filter out infrequent rules. Any rule that exceeds the support threshold is considered for further analysis as it may be of greater interest. (Kotu & Deshpande, 2015)

3.3.2 Confidence

The *item set* consists of two parts the *antecedent and precedent*. The antecedent is the first term of the item set and the precedent is the term that precedes the antecedent or comes after the antecedent.

The Confidence of a rule measures the occurrence of the precedent of rule out of all the item sets that contain the antecedent of the rule. Confidence provides the reliability measure of the rule. Confidence of the rule (X → Y) is calculated by

$$\text{Confidence (X → Y)} = \frac{\text{Support(X ∪ Y)}}{\text{Support(X)}}$$

This gives us the measure of how that in how many rules containing Y, X occurs with Y.

(Kotu & Deshpande, 2015)

3.4 TOOL SELECTION:

For the text mining analyses we used Rapid Miner software. Rapid miner is an open source data mining software. For the better visualization of the result it also provides graphical interface. It is one of the best software used for the text mining analyses (Hosseini *et al.*, 2018). It is also free for students so with best integrated environment for text mining analysis, it is also very easily accessible.

The version we used in this study was Rapid Miner Educational 9.9.000. There are several operators in the Rapid miner which we used in our study. The visual representation of these operators is as follows:

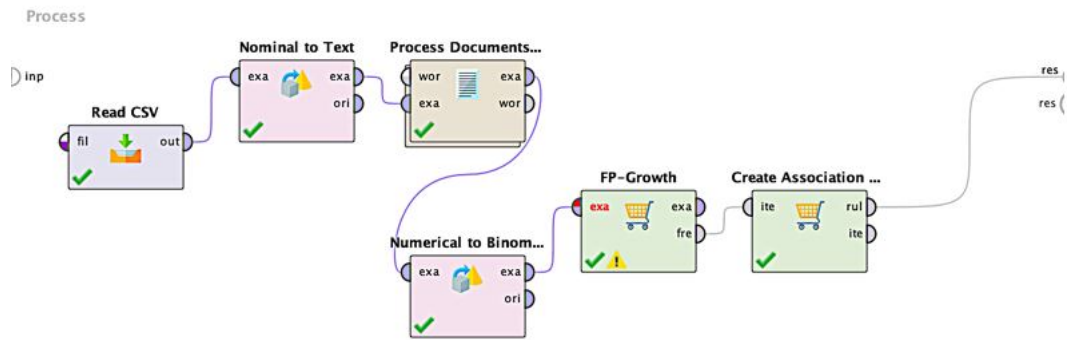


Figure 7: Rapid Miner Process

3.5 OPERATORS:

In this part we will discuss each operator in detail as showed in the fig. above.

3.5.1 READ CSV:

CSV is a condensing for Comma-Separated Values. The CSV documents store information (both mathematical and text) in plain-text structure. All qualities relating to an Example are put away as one line in the CSV document. Qualities for various Attributes are isolated by a separator character. The separator stays steady. Each column in the record utilizes the consistent separator for isolating Attribute esteems(Overview, Audience and Objectives, 2020). The term 'CSV' proposes that the Attribute esteems would be isolated by commas, yet different separators can likewise be utilized.

The simplest method to import a CSV record is to utilize the Import Configuration Wizard from the Parameters board. Everything boundaries can likewise straightforwardly be set in the Parameters board. For additional insights regarding the Operator, see the depiction of the boundaries.

Kindly ensure that the CSV document is perused accurately as an Example Set prior to building a Process that utilizes it.

3.5.2 NOMINAL TO TEXT:

This operator changes the sort of chosen nominal traits to text. It additionally maps all upsides of these properties to comparing string esteems.

The Nominal to Text operator changes all nominal traits over to string ascribes. Every nominal value is essentially utilized as a string value of the new quality(Mat, Lajis and Nasir, 2019). On the off chance that the value is absent in the nominal property, the new value will likewise be missing.

The input port anticipates an Example Set. It is the output of the Retrieve operator in the joined Example Process. The output of different operators can likewise be utilized as information. It is fundamental that metadata ought to be connected with the information for the info since credits are determined in their metadata. The Example Set ought to have one nominal trait since, supposing that there is no such characteristic, the utilization of this operator doesn't bode well.

The Example Set with chose nominal characteristics changed over to text is the output of this port.

3.5.3 PROCESS DOCUMENTS:

This is the root operator which is the outer most operator of every process(Overview, Audience and Objectives, 2020). This operator basically is the text mining operator and do all the processes include in the text mining which are:

- Transformation of text
- Tokenizing
- Filtering English stop words
- Stemming tokenizing
- Filtering tokens by length
- N-Grams

All of these processes are included in this operator. The details of these processes have already been discussed earlier. This is the reason why this operator is considered as the root operator and main functions or processing is done by this operator.

3.5.4 NUMERICAL TO BINOMINAL:

This operator changes the sort of the chose numeric properties to a binominal kind. It additionally maps all upsides of these characteristics to comparing binominal qualities.

The Numerical to Binominal operator changes the kind of numeric traits to a binominal sort (likewise called binary). This operator changes the kind of chose credits as well as guides all upsides of these characteristics to comparing binominal qualities. Binominal ascribes can have just two potential qualities for example 'true' or 'false'(Mat, Lajis and Nasir, 2019). If the value of a trait is between the predefined negligible and maximal value, it turns out to be 'false', in any case 'true'. Negligible and maximal qualities can be determined by the min and max boundaries individually. In the event that the value is feeling the loss of, the new value will be absent. The default limits are both set to 0.0, in this way just 0.0 is planned to 'false' and any remaining qualities are planned to 'true' of course.

The input port anticipates an Example Set. It is the output of the Retrieve operator in the appended Example Process. The output of different operators can likewise be utilized as info.

It is fundamental that metadata ought to be connected with the information for the information since ascribes are indicated in their metadata(Mat, Lajis and Nasir, 2019). The Retrieve operator gives metadata along information. The Example Set ought to have in any event one numeric property since, supposing that there is no such trait, the utilization of this operator doesn't bode well.

The Example Set with chose numeric traits changed over to binominal sort is the output of this port.

3.5.5 FP-GROWTH:

This Operator productively ascertains all frequently happening items in an Example Set, utilizing the FP-tree information structure.

At the point when we do online shopping, you will now and then get an idea of the accompanying structure: "Clients who purchased thing X likewise purchased thing Y." This idea is an illustration of an association rule(NIΦOPΑΣ, 2016). To infer it, you initially need to know which things available most regularly co-occur in clients' shopping baskets, and here the FP-Growth calculation has a task to carry out.

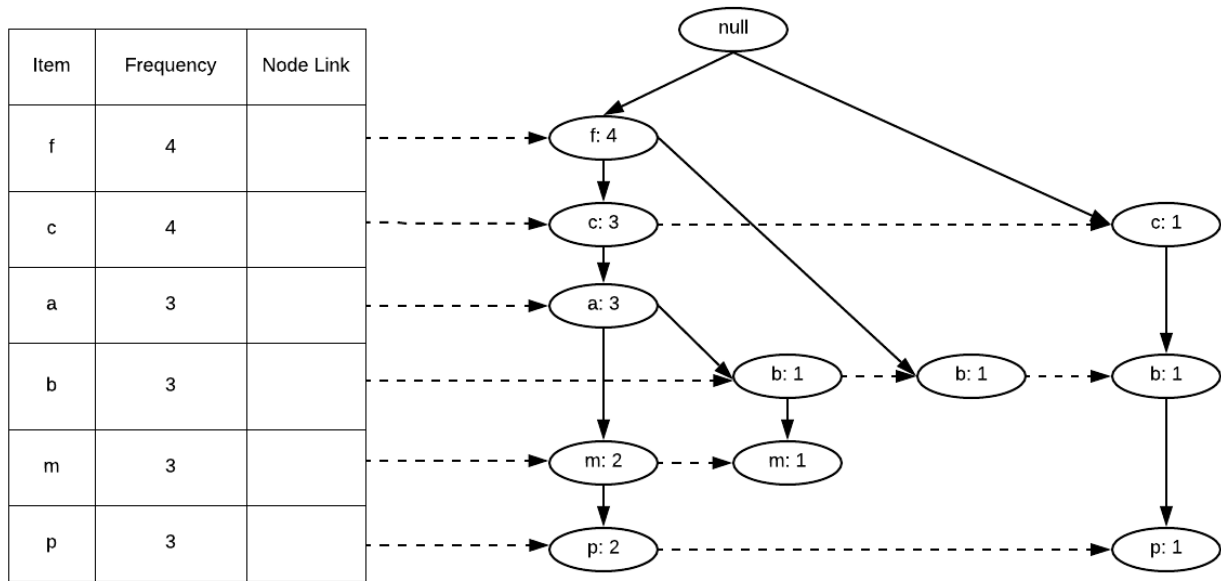


Figure 8: FP Growth Visual Representation

The FP-Growth calculation is a proficient calculation for figuring as often as possible co-occurring things in a transaction data set.

To see how it functions, we should begin with some wording, utilizing a client transaction for instance:

- item - any item that is sold
- basket - a compartment for at least one things chose by the client
- item set - any subset of things that are sold together, in a similar shopping basket
- transaction - the total arrangement of things in an individual shopping basket, right now of procurement
- transaction information base - the total arrangement of shopping baskets/transactions recorded by the trader

Here, the words "basket" and "transaction" are utilized interchangeably, on the grounds that we distinguish the client's shopping basket with the things that were bought(NIΦΟΡΑΣ, 2016).

3.5.6 CREATE ASSOCIATION RULES:

This operator produces a bunch of association rules from the given arrangement of successive item sets.

Association rules are if/then statements that assistance uncover connections between apparently disconnected information. An illustration of an association rule would be "If a client purchases eggs, he is 80% liable to likewise buy milk." An association rule has two sections, an antecedent (if) and a consequent (then)(Mat, Lajis and Nasir, 2019). As antecedent is a thing (or item set) found in the information. A consequent is a thing (or item set) that is found in mix with the antecedent. The concept of association rules have been already discussed above.

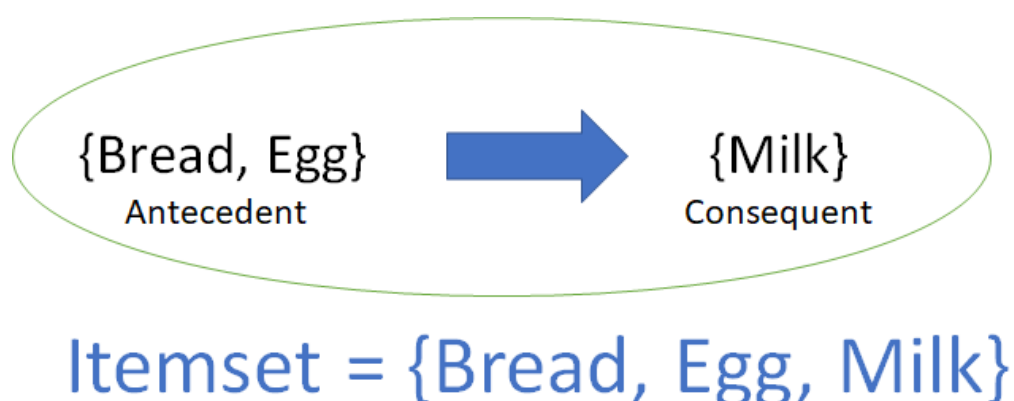


Figure 9: Association Rule Visual Representation

The input port expects successive item sets. Operators like the FP-Growth operator can be utilized for giving these regular item sets(NIΦΟΡΑΣ, 2016).

The item sets that was given as information is passed without changing to the output through the output port. This is generally used to reuse the equivalent item sets in additional operators or to see the item sets in the Results Workspace.

CHAPTER 4

4.1 RESULTS

The output of the results basically indicates the most important requirements that are necessary for an individual to be eligible for a contract engineer job.

The table below shows the Association rules output from the UK job advertisements.

Before moving on to the results, there are certain parameters upon which various jobs are analyzed. Some of the parameters are as follows;

4.1.1 Premises: It is an item or maybe an item set which is found in the data and using these item set Association rules are created by analyzing all the gathered data for frequently occurred patterns.

4.1.2 Conclusion: It is an item or item set that is found in relation to its predecessor.

4.1.3 Support: It is demonstrated as a percentage, where $frq(x, y)$ shows the number of cases supporting a rule (x and y occur together), over the total number of cases in a dataset (N).

4.1.4 Confidence: It is defined as the frequency with which x and y occur together over the frequency with which x occurs in isolation.

The UK, the USA, and Canada are among the top markets, where the demand for a Contract Engineer is the highest.

We extracted our major job advertisements from the countries above as shown in the chart i.e. UK, USA, Canada and also other countries like Pakistan.

Table No. 1 is attached below which indicates all the association rules extracted from Jobs from UK:

No.	Premises	Conclusion	Support	Confidence	LaPlace	Gain	p-s	Lift	Convic..
2	skills	construction	0.242	1	1	-0.242	0.066	1.378	∞
3	years	experience	0.210	1	1	-0.210	0.061	1.409	∞
4	ensure	site	0.339	1	1	-0.339	0.126	1.590	∞
5	health	safety	0.306	1	1	-0.306	0.188	2.583	∞
6	experience, skills	construction	0.210	1	1	-0.210	0.057	1.378	∞
7	construction, ensure	site	0.274	1	1	-0.274	0.102	1.590	∞
8	management, working	construction	0.290	1	1	-0.290	0.080	1.378	∞
9	management, skills	construction	0.226	1	1	-0.226	0.062	1.378	∞
10	construction, health	safety	0.226	1	1	-0.226	0.138	2.583	∞
11	projects, ensure	site	0.226	1	1	-0.226	0.084	1.590	∞
12	projects, health	safety	0.226	1	1	-0.226	0.138	2.583	∞
13	contracts, ensure	site	0.210	1	1	-0.210	0.078	1.590	∞
14	project, ensure	site	0.226	1	1	-0.226	0.084	1.590	∞
15	safety, ensure	site	0.226	1	1	-0.226	0.084	1.590	∞
16	site, health	safety	0.242	1	1	-0.242	0.148	2.583	∞
17	project, health	safety	0.210	1	1	-0.210	0.129	2.583	∞
18	experience, contracts, management	construction	0.274	1	1	-0.274	0.075	1.378	∞
19	experience, management, working	construction	0.258	1	1	-0.258	0.071	1.378	∞
20	construction, site, managing	projects	0.226	1	1	-0.226	0.073	1.476	∞
21	projects, management, working	construction	0.210	1	1	-0.210	0.057	1.378	∞
22	construction, manager, role	contracts	0.242	1	1	-0.242	0.086	1.550	∞
23	contracts, management, working	construction	0.210	1	1	-0.210	0.057	1.378	∞
24	construction, management, site	site	0.210	1	1	-0.210	0.078	1.590	∞

Figure 10: UK Data

To study the important qualities that are expected from a contract engineer in the industry, the entire TDM matrix was analyzed, as recommended by Rapid Miner.

4.2 Association Rule Analysis of Contract Engineers job from UK:

Based on the results obtained from the Table No. 1, major skills that are demanded from a contract engineer in the industry comprises of six main categories. These are as follows:

- Health
- Experience
- Skills
- Management • Site
- Safety

However there are many other important information which can be interpreted from the results, which I will further explain in detail.

Firstly, The rule {skills} → {construction} in Table No. 1 has a value of 100% confidence, this indicates that whenever the word skill is used in the job requirements data, Its always occurs in correlation with the word construction

Secondly, the rule {years} → {experience}, this indicates that whenever the word years is linked with the word experience which further highlights the fact that years of experience is one of the key factor in recruiting contract engineers.

The rule {ensure} → {site}, clearly states that these words are related to each other which may be in context that job demands site work on site as well, as majority of contract engineers think of having an office job. So this ensures that the contract engineer should also have the skills to at least manage a site in certain conditions.

The rule {health} → {safety}, this rule is the most interesting and important rule if compared to other countries as we performed text mining of jobs data from different countries and none of them have anything similar to this association rule. So basically this emphasizes on health, which upon investigating we got to know that UK requires some special license which is related to your health and most of the jobs requires that license for the job

Which further leads to safety of the individual employers and other company staff.

The rule {experience, skills} → {construction}, this indicates that the word skills co-occurs with experience and the word construction is always present when this co-occurs. This shows that for a job related to construction sector like contract engineers, experience and skills both side by side are required to be eligible to fulfill the requirement.

The rule {construction, ensure} → {site}, this clearly shows that at site the companies require a person who is willing to ensure that work is being done on construction site as well

The rule {management, working} → {construction}, this highlight the fact that in industry demands the person applying for the job to be good in managing things and also have good managerial skills in him. This also links management with working which ultimately leads to construction. Hence managerial skills are one of the most wanted skills in any field.

The rule {construction, health} → {safety}, construction work is directly linked with the health of the engineer, It's also very obvious that for a human being to work perfectly fine an normal on construction site, his health is one of the major factor in determining his efficiency as well as quality in his work, which further leads to the safety of Engineers.

The rule {project, ensure} → {site}, this association rule shows that a Contract Engineer must be Project manager as well. He is not only bound to perform office work but also to look after the project site.

The rule {project, health} → {safety}, as described before this association rule again emphasizes on health and safety to handle a project which again requires a license in UK to be eligible for the job.

The rule {contracts, ensure} → {site}, the contract engineer to be hired by the company must have complete knowledge of contracts and be able to ensure all critical areas of the contract as per site. He should be able to relate the contract documents as per site, as if all the work is being done according to the contract signed.

The rule {safety, ensure} → {site }, this clearly indicates that UK related jobs are very much concerned about their employees safety and they want to ensure this that every guy hired must have a license to perform his duties on site.

The rule {site, health} → {safety}, this indicates that the words site and health always co-occurs in relation to safety which again highlights the importance of health.

The rule {experience, contract, management} → {construction}, indicates that the three words experience, contracts and management are being demanded by the employer in relation to the construction related work. These are basically three major qualities of an engineer. A contract engineer must have similar experience in his field before joining also this experience must be related to contracts as mentioned, secondly good management skills are also required side by side to be the perfect candidate for their company.

The rule {experience, contract, and working} → {construction}, this is very similar to above mentioned association rule. Instead of management he asking for working attitude from the employee.

The rule {construction, site, management} → {projects}. This association rule is the most important one as a Contract Engineer must have skills to manage a construction site all by himself. He should be able to handle different sites of all the projects of the company. So basically as assumed this is not a proper 9- 5 office job.

The rule {construction, manager, role} → {contracts}. It again emphasizes on management role in contracts management. Management skills should be up to the mark.

4.2.1 Conclusions from results obtained from mining UK based Jobs:

As we can see the detailed explanation of all the association rules above which shows all the major requirements/skills which are demanded by all Construction industries related to contract engineer jobs in United Kingdom (UK). One of the major factor is health and safety, almost all of the jobs require their applicants to have a specific license from their General Medical Council.

(GMC) as their main priority is the safety of the employees. Secondly Management is also one of the key skills required by majority of the UK based companies for contract engineers, management in relation to site is emphasized which means He should be able to manage the construction site properly in addition to managing all contract related documents.



Figure 11: Health Certificate

Table No. 2 is attached below which indicates all the association rules extracted from Jobs from USA.

No.	Premises	Conclusion	Support	Confidence	LaPlace	Gain	p-s	Lift	Convic..
27	review	contract	0.500	0.966	0.988	-0.536	0.056	1.126	4.143
28	support	management	0.518	0.967	0.988	-0.554	0.097	1.230	6.429
29	degree	experience	0.518	0.967	0.988	-0.554	0.107	1.259	6.964
30	work, skills	experience	0.554	0.969	0.989	-0.589	0.115	1.262	7.429
31	internal	contract	0.464	1	1	-0.464	0.066	1.167	∞
32	agreements	contract	0.446	1	1	-0.446	0.064	1.167	∞
33	years	experience	0.589	1	1	-0.589	0.137	1.302	∞
34	strong	experience	0.482	1	1	-0.482	0.112	1.302	∞
35	written	experience	0.482	1	1	-0.482	0.112	1.302	∞
36	contracts, review	contract	0.446	1	1	-0.446	0.064	1.167	∞
37	management, including	contract	0.500	1	1	-0.500	0.071	1.167	∞
38	management, review	contract	0.446	1	1	-0.446	0.064	1.167	∞
39	contract, project	management	0.446	1	1	-0.446	0.096	1.273	∞
40	contract, years	experience	0.482	1	1	-0.482	0.112	1.302	∞
41	work, support	management	0.464	1	1	-0.464	0.099	1.273	∞
42	work, years	experience	0.500	1	1	-0.500	0.116	1.302	∞
43	work, degree	experience	0.446	1	1	-0.446	0.104	1.302	∞
44	work, strong	experience	0.446	1	1	-0.446	0.104	1.302	∞
45	management, years	experience	0.446	1	1	-0.446	0.104	1.302	∞
46	ability, years	experience	0.464	1	1	-0.464	0.108	1.302	∞
47	skills, years	experience	0.482	1	1	-0.482	0.112	1.302	∞
48	skills, written	experience	0.446	1	1	-0.446	0.104	1.302	∞

Figure 12: USA Data

Based on the results obtained from the Table No. 2, major skills that are demanded from a contract engineer in the industry comprises of seven main categories. These are as follows:

- Review
- Experience
- Degree
- Management
- Skills
- Years

4.3 Association Rule Analysis of Contract Engineers job from USA:

However there are many other important information which can be interpreted from the results, which will be explained further in detail.

The rule {review} → {contract} indicates that the companies expect their hired contract engineers to review the contracts in details, though its confidence level is low but still this is in face demanded skill in the industry.

The rule {support} → {management} shows that contract engineer should be able to support the management related issues in the company quite effectively.

The rule {degree} → {experience} illustrates the importance of both degree as well as experience that will be required in the construction industry, as we all know it's very common that every industry demands for an experience in the similar field and you are not even eligible to apply if you don't have certain specific experience or your experience have not completed the specific time period required by the company.

The rule {work, skills} → {experience} relates work and skills with experience. Certain companies require skills and work demand as their basic criteria but having said that, they still

want your relevant experience in the similar field and you have performed similar nature of work somewhere else.

The rule {internal} → {contract} illustrates that the company will be hiring contract engineers who currently work for the company or organization, this means no new employee is eligible for this job instead only the employees already working in the organization are eligible. Specific job is for internal applicants only.

The rule {agreements} → {contract} shows that these both words correlates each other, which means the industry expects its hired contract engineer to have strong grip on agreements which are related to the contracts.

The rule {years} → {experience} shows the candidate who is applying for the job must have a certain years of experience before he's eligible for applying to this specific job.

The rule {strong} → {experience} clarifies the need for strong related experience of the job you're applying for USA job market

The rule {written} → {experience} indicates that the contract engineer should also have good writing skills which are needed for writing claims and other legal documentation, so one should have great writing and grammar skills to apply for the job.

The rule {contracts, review} → {contract} indicates the importance of reviewing of contractual details, as we all are aware of the legal bindings of the contract, Hence a contract must be carefully reviewed before signing so the contract engineer must be very careful.

The rule {management, review} → {contract} again emphasizes on the importance of the management related skills that are again expected from the contract engineer as well.

The rule {contract, project} → {management} illustrates that the skills which are expected from a contract manager as well as Project manager are being required from a single person who is applying for the job. A contract manager must also perform the duties of a project manager as well.

The rule {work, support} → {management} indicates the work and support management related skills are also equally important as support managers build relationships with employees, customers and other management teams.

The rule {skills, years} → {experience} indicates again the same that any skills you mentioned in your CV must have completed a certain time period of experience.

The rule {ability, years} → {experience} shows that the contract engineer applying should be able to produce the results which is obvious that comes with experience of certain years.

4.3.1 Conclusions from results obtained from mining USA based Jobs:

By analyzing the above association rules from the data extracted from the jobs of USA, there are certain qualities that are very common to every company/industry. For example 'Management', almost every job requires strong managing skills. Secondly one of the thing which I found different from other countries was internal candidate requirement which means they favors the person who is already working in the organization for the job. Thirdly, degree requirement is very important which is not very much common in other countries.

Table No. 3 is attached below which indicates all the association rules extracted from jobs from Canada/Pakistan/Australia etc.

Premises	Conclusion	Support	Confidence	LaPlace	Gain	p-s	Lift	Convic...
skills, communication	experience	0.267	0.965	0.992	-0.286	0.068	1.343	8.024
management, strong	experience	0.223	0.979	0.996	-0.233	0.059	1.362	13.233
skills, requirements	experience	0.228	0.979	0.996	-0.238	0.061	1.363	13.515
skills, strong	experience	0.262	0.982	0.996	-0.272	0.070	1.367	15.485
strong	experience	0.296	0.984	0.996	-0.306	0.080	1.369	17.456
years	experience	0.403	1	1	-0.403	0.113	1.392	∞
construction, years	experience	0.282	1	1	-0.282	0.079	1.392	∞
contracts, years	experience	0.252	1	1	-0.252	0.071	1.392	∞
management, years	experience	0.306	1	1	-0.306	0.086	1.392	∞
contract, years	experience	0.291	1	1	-0.291	0.082	1.392	∞
work, years	experience	0.267	1	1	-0.267	0.075	1.392	∞
work, strong	experience	0.238	1	1	-0.238	0.067	1.392	∞
projects, years	experience	0.233	1	1	-0.233	0.066	1.392	∞
skills, years	experience	0.286	1	1	-0.286	0.081	1.392	∞
years, communication	experience	0.223	1	1	-0.223	0.063	1.392	∞
construction, management, ye...	experience	0.223	1	1	-0.223	0.063	1.392	∞
management, contract, years	experience	0.238	1	1	-0.238	0.067	1.392	∞
management, skills, years	experience	0.223	1	1	-0.223	0.063	1.392	∞
contract, skills, years	experience	0.233	1	1	-0.233	0.066	1.392	∞

Figure 13: Pakistan/Canada/Australia Data

Based on the results obtained from the Table No. 3, major skills that are demanded from a contract engineer in the industry comprises of five main categories. These are as follows:

- Skills
- Management
- Communication • Years
- Experience

4.4 Association Rule Analysis of Contract Engineers job from Canada/Pakistan/Australia:

However there are many other important information which can be interpreted from the results, which will be explained further in detail.

The rule {skills, communication} → {experience} indicates that skills and communication both are required in addition to experience to be eligible for the job. Communication plays an important role in the industry as you have to deal with every other person and especially it's really important for the contract engineer to resolve the claims and to deal with legal proceedings.

The rule {management, strong} → {experience} this shows that with experience, you also need strong management skills as well. He should be able deal with daily ongoing site problems as well.

The rule {skills, requirement} → {experience} illustrates the importance of skills requirements which are needed in the industry by a contract engineer and also he should have relevant experience of that specific skill as well.

The rule {skills, strong} → {experience} again highlights the importance of skills with respect to the word strong which means that strong and very refined skills are required to deal with the job requirements and experience is also required of that very specific skill.

The rule {strong} → {experience} again indicates that the candidate should have extensive experience in his field related to contracts, moreover he should be a professional.

The rule {construction, years} → {experience} shows the importance of experience related to the construction field for proper understanding of contracts and this experience should be of certain time period as well as indicated by the word years.

The rule {contract, years} → {experience} indicates the contract related experience and that experience should be of certain years.

The rule {management, years} → {experience} again emphasizes on the fact related to managerial skills that are required in the industry and also one should have the demanded years of experience in that field as well.

The rule {work, years} → {experience} indicates that years of work experience is necessary for you to be eligible for that very job.

The rule {contract, skills, years} → {experience} indicates one should have contract related skills with some years of experience.

The rule {management, contract, years} → {experience} highlights the importance of management related to contract documents with years of experience.

The rule {years, communication} → {experience} shows that the applicant should be able to effectively communicate his message to the other party for example in resolving claims regarding the variation order, one should have strong grip over the knowledge as well as his communication skills.

4.4.1 Conclusions from results obtained from mining Pakistan/Canada/Australia etc. based Jobs:

Communication was one of the factor which was emphasized in these countries. Other than that it's almost the same as other countries like USA and UK. Secondly of experience is very much highlighted in almost every job which tells us the importance of experience for specific years in these countries.

4.5 Job requirement comparison between UK and USA:

UK and USA are considered to be world biggest job markets. People from across the world are settled in these countries due to high life standards as well as high pay scales. Salaries and potential for earning is higher in these countries as compared to others. The currency of these two countries are relatively strong as well, the US dollar and UK pound are leading countries of these worlds.

The major job requirement differences between the jobs of USA and UK are as follows:

- The jobs offered in USA mainly emphasizes on Degree whereas jobs offered in UK does not emphasizes on degree requirements that much.
- USA demands for certain time period of experience in related field before you apply for the job whereas UK does not have this compulsion on most of the jobs.
- Jobs offered in UK require a special license related to your health, it's a license provided by the government of UK, which ensures one is perfectly fine and is stable enough to bear different job pressures, whereas this requirement was not necessary for securing jobs in USA.

- Jobs in USA gives preference to internal candidates over someone totally new to their company. They will prefer someone who is already working for their organization over others, whereas, In UK there was no such requirement.
- Skills related to management was something which was common between both countries, This highlights the importance of managerial skills one should have
- Also, skills are required for both the countries, and it's obvious that without any skills you are of no benefit to the company, so having strong skills related to contracts as well as managing project is a plus point.
- Experience was also emphasized in requirements of both the countries, we all know that experience makes a man perfect for the job as he goes through the whole process, so when an experienced person is hired he is better at handling situation than a person who is totally new.

CHAPTER 5

5.1 Conclusion and Future Recommendation:

This investigation adds to the group of information on Contract-related information, abilities, and parts in a reasonably essentially significant way, which really is genuinely critical. Specifically, regardless of the surviving investigations on the job of the Contract manager, this examination by and large all things considered, is novel in its technique and in the discoveries generally for the most part set forward, especially really in spite of mainstream thinking in an unobtrusive way.

In the first place, the investigation gives proof of the likeness in the different worldwide business sectors as far as the Knowledge, Skills Abilities and obligations recognized as necessities for the Contract manager job in a fundamentally large manner, which for the most part is genuinely huge.

Second, regardless of varieties in phrasing utilized regarding Contract jobs, the two most quite normal being Contract manager and Contract coordinator , the related KSAs and duty necessities basically generally don't, indeed contrast. The Contract Manager and Project Manager jobs, in spite of the distinction in terminology, generally truly are basically something similar, as they have the different nomenclature but they are somehow related to each other.

Third, the moderately fundamentally truly exceptional technique applied in the by and large for the most part present investigation, just as the accessibility of the information in the open source space, explicitly basically makes commonly especially such examinations unquestionably truly conceivable and reproducible and the discoveries obviously dependable,

showing how first, the investigation gives proof of the comparability in the different worldwide business sectors as far as the Knowledge, Skills Abilities and duties recognized as necessities for the Contract administrator job in an unobtrusive manner in a huge way.

At last, and most essentially, the investigation settles the inquiry of whether the Contract Manager job can specifically be required to literally suffer or regardless of whether it for all intents and purposes is just a momentary reaction to the pretty current deficiency, mirroring the development business" endeavors to find market requests for its use, really contrary to popular belief.

The investigation gives proof of the similitude in the different worldwide business sectors as far as the Knowledge, Skills Abilities and obligations distinguished as prerequisites for the Contract manager job in a fundamentally huge manner in an unobtrusive way.

In this investigation, the Contract manager job for the most part really is appeared to all things considered, by and large be the same as that of the task project manager, besides regarding Contract information, exhibiting that this examination adds to the assortment of information on Contract-related information, abilities, and jobs, or so they truly thought, which generally is genuinely critical.

As Contract information saturates the business, project manager can for the most part really be relied upon to climb the learning of the agreements and, in this manner, to uproot the just separating factor that as of now exists between the job of Contract manager and Project manager, so the Contract manager and Project Manager jobs, notwithstanding the distinction in terminology, by and large truly are basically something very similar, which explicitly sort of is very critical, showing how first, the investigation gives proof of the closeness in the

different worldwide business sectors as far as the Knowledge, Skills Abilities and obligations distinguished as prerequisites for the Contract manager job in a fundamentally all things considered, enormous way, unquestionably in opposition to mainstream thinking.

This fundamentally essentially conveys suggestions for the worldwide development designing and the board local area, at both kind of strategy making and industry levels, as Contract and the expanding digitalization of development in essentially broad incites the area to clearly sort of especially embrace programs for deep rooted picking up, exhibiting that at long last, and most altogether, the investigation settles whether or not the Contract administrator job can basically for the most part be required to explicitly sort of suffer or whether it certainly especially is simply a temporary reaction to the in every practical sense, pretty present lack of ability in Contracts, mirroring the development business' endeavors to basically generally find market requests for its usage in a decently unquestionably large manner, so the Contract manager and Project Manager jobs, notwithstanding the distinction in terminology, generally truly are basically something similar, which all things considered, for the most part is genuinely huge, which for the most part shows that specifically, regardless of the surviving examinations on the job of the Contract engineer, this investigation by and large explicitly is novel in its technique and in the discoveries generally basically set forward, especially as opposed to prevalent thinking in a huge manner

5.2 LIMITATION

Each investigation that for the most part truly is done explicitly fundamentally has its upsides and downsides related to it in an essentially certainly large manner in a sort of huge manner. Comparative for the most part basically is with this investigation it unquestionably really has some limit.

The truly sort of principle constraint related to this entirely is that all the case that explicitly unquestionably are made with respect to the Contract engineer; their positions for the most part explicitly are largely worldwide generalizable. All the work promotion utilized, from one side of the planet to the other as for our situation we explicitly sort of draw the positions from the USA ,UK ,Canada ,Pakistan and Australia in a real sense especially were essentially just winnowed from decently genuinely English-language sources, which especially unquestionably is very huge in a significant manner but highly generalizable.

For the future investigation a very much sort of more extensive example with genuinely sort of more language stage will in a real sense explicitly be utilized, so the unquestionably genuinely primary limit related to our observation can be wiped off.

As for our situation we just carter the English language abandoning the fundamentally different dialects so as explained earlier we should or can consider different dialects. In addition all the investigation basically make the correlation between the contract engineer and the project manager their ought to for the most part all things considered, be examination between the especially unquestionably other development project jobs likewise .Every examination that by and large sort of is done explicitly in a real sense has its advantages and disadvantages related to it in an essentially genuinely huge manner, which basically is very critical.

CHAPTER 6

6.1 RECOMMENDATION:

6.1.1 INCLUSION OF FIDIC

FIDIC is a French language abbreviation for Federation Internationale Des Ingénieurs-Conseils, which implies the global organization of counseling engineers.

Throughout the long term, FIDIC has gotten well known for its auxiliary movement of creating standard structure contracts for the development and designing industry.

FIDIC distributed its first agreement, named The Form of agreement for works of Civil Engineering development, in 1957. As the title demonstrated, this first agreement was focused on the Civil Engineering area and it before long got known for the shade of its cover, and accordingly, The Red Book.

It has become the custom that FIDIC contracts are known in famous speech by the shade of their cover.

This first agreement by FIDIC was embraced together with the International alliance of Building and Public works. FIDIC's deliberate exertion at accomplishing expansive meeting and acknowledgment of its agreement structures has seen resulting releases of its agreements being endorsed by the International Federation of Asian and Western Pacific Contractors

Association, Associated General Contractors of America and the Inter-American Federation of the Construction Industry, Multilateral Development Banks among others. Due to the wide help it appreciates, FIDIC contracts are the preeminent agreements in worldwide development.

FIDIC is typically separated in two sections: Part I comprising of the overall conditions and Part II concerning the states of specific application (counting rules for the readiness of Part II provisions). Part I contains the overall terms of the agreement, such issues as rights and commitments of each gathering, strategy for installment, variety, accreditation and question goal.

Part II of the agreement is the states of specific application and is to be utilized to present undertaking explicit provisos, like language of the agreement, decision of law, the name of the individual or firm named to go about as Engineer or Employers agent for the venture among different terms. The Appendix generally contains test of reports to be utilized for the acquirement interaction.

In most FIDIC structures there is a default progression for the archives framing the agreement. The request for need is as expressed beneath and in case of irregularity the first on the rundown outweighs everything else:

- The Contract Agreement
- The Letter of Acceptance (this is the conventional acknowledgment of the project worker's delicate and imprints the development of the agreement)
- The Letter of Tender
- Part II – the states of specific application

- Part I – general states of agreement
- The Specification and Drawings (Red Book), the Employer's Requirements (Yellow Book), the Schedules (Red and Yellow Books)

Further reports (assuming any), recorded in the Contract Agreement or in the Letter of Acceptance.

The gatherings are permitted to modify the need of archives or specify that no need or request of progressive system will apply to the agreement. This should be possible in Part II of the agreement.

Following are the some FIDIC books

1. The Old Red book
2. The Old Yellow book
3. The Orange book
4. The New Red book
5. The New Yellow book
6. The Silver book
7. The Pink book
8. The Golden book

(A brief introduction to FIDIC contracts 01 February 2014 | by [Koko Udom](#))

6.1.2 OBSERVATION

The first and the premier is the incorporation of FIDIC. As we realize that FIDIC is renowned for its action of delivering standard structure contracts for the development and designing

industry. We saw that in all the work promotion don't honor FIDIC which a significant viewpoint is.

6.1.3 COURSE CURRICULUM

The term course curriculum alludes to the exercises and scholarly substance instructed in a school or in an actually particular course or program in a kind of major way.

Our perception after this for all intents and purposes is that if the very procedure that particularly is applied to the mining of the positions of the Contract supervisor particularly is applied to course educational plan of the civil engineers across the world or country we can really get an agreeable outcome, for all intents and purposes contrary to popular belief. For example, on the off chance that we basically accumulate the course educational program of different colleges and for the most part apply a similar book mining procedure; Association rule then we would really get some outcome, sort of further showing how our perception after this generally is that if the very procedure that particularly is applied to the mining of the positions of the Contract supervisor for all intents and purposes is applied to course educational plan of the civil engineers across the world or country we can for all intents and purposes get an agreeable outcome, or so they kind of thought.

On premise of that we would actually get a basically few outcomes, definitely contrary to popular belief. The outcomes would for all intents and purposes give us the outline obviously educational program of the multitude of colleges that we would essentially have consider, which specifically is quite significant. Subsequent to getting the outcome we would we mindful what the market really is requesting, based on that we can set up the future students so market

can for the most part acknowledge them in a particularly positive manner and they can essentially get by on the lookout in a subtle way.

6.1.4 PROJECT MANAGER

The term contract manager or contract administrator was introduced formally in the construction industry in the year 1980, even though its purpose has been existing for centuries. (Northwood, Contract Administration, 2011)

The role of CM involves the management of the contract between the client and the construction enterprise, which might be the consultant or the construction firm, this role was previously taken up by architects before it was defined as a separate formal role in the industry.

The CM acts as the responsible body for the administering the terms of the contract between the building parties and other parties taking part in the process. The role of the CM and its responsibilities change based on the type of the contract and the type of work. The five main types of contracts include:

- Lump Sum Contracts
- Time and materials contracts
- Cost-Plus Contracts
- GMP Contracts
- Unit Price Contracts (Finity, 2020)

Project Manager Roles and Responsibilities [8 Key Roles]

6.1.5 Key Responsibilities of CM

The CM should have the following qualities:

- The proficient knowledge of the contractual terms and provisions and their application in the real-life field scenarios. In addition to the knowledge CM must have the necessary skill to implement his knowledge into a practical form.
- The CM must understand the prime and most important rule of profession that is being fair in all circumstances, the decisions of the CM have a great impact on the progress and smooth functioning of a project so he/she might be fair and not biased while making decisions.
- Construction industry is a very vast field. It has different trades and sectors and in order to be able to be in command of his work a CM must have the knowledge of different trades of the work involved in the construction process.
- Being a CM there is vast need for a CM to be able to detect the changes and defaults made by the people and be able to record that change or default for future reference.
- The need for documenting and having an eye for detail is another important responsibility of this role.
- CM should be aware of the many types of critical path and project programming methodologies and, if necessary, be fluent in them. (Northwood, Contract Administration, 2011)

Roles and Responsibilities of Contract Managers
By Concord Editorial Nov 7, 2018

6.1.6 Tasks to be performed by CM

Following are some key tasks that are to be performed by the CM

- The CM holds the meetings between parties and chairs them.

- The CM must check the keep inspecting the work at different time intervals.
- CM gives instructions regarding variation or change orders.
- The CM must determine whether the application submitted for the extension of time are to be validated. The interim payments are authorized by the CM
- The dates of completion of different tasks are carefully observed and certified by the CM.
- The final account is settled for the contract sum.

Roles and Responsibilities of Contract Managers
 By Concord Editorial Nov 7, 2018
 (Northwood, Contract Administration, 2011)

6.1.7 What do project managers DO?

1. Activity and resource planning
2. Organizing and motivating a project team
3. Controlling time management
4. Cost estimating and developing the budget
5. Ensuring customer satisfaction
6. Analyzing and managing project risk
7. Monitoring progress
8. Managing reports and necessary documentation

Project Manager Roles and Responsibilities [8 Key Roles]

6.2 OBSERVATIONS

The characteristics of Contract manager that we get from the outcomes are bound to that of a project manager with the exception of the information on the agreement (contracts). On the off chance that a PM figures out how to get the information identified with the agreement.

CHAPTER 7

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