**Literature Review**

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Fatin Amirah Ahmed Shukri, R. M. (2013). An overview of teh fleet maintenance and operating cost: Key components and methods. *International journal of commerce,business and management*.

(Fatin Amirah Ahmed Shukri, 2013)The cost of operation comprises mainly of the defense vehicles maintenance. The study looked at the Malaysian military department. The management of the vehicles is supposed to be a long term complete cycle that has to be carefully managed. There exists a variety of statistical techniques used to analyze transport data. The study looked deeply into the factors directly affecting the operating costs of defense vehicles. The factors studied include the fuel, overhauling, wear and tear, tires and maintenance. This included a specific type of equipment only, the 3 ton 4x4. The authors emphasized all the aspects of costs should be considered while estimating the maintenance and operating cost of the fleet vehicles. The study gathered the past data and implemented the key characteristics to the present study. The authors developed two models, one of which shows the components of life cycle cost. The second model showed the regression analysis between the total maintenance and operating cost and the factors that affect these costs. The mechanistic model was used to analyze the data. The equipment life cycle is seen as a combination of four phases, concept, acquisition, service and disposal. All these phases have their own distinct strategies to be implemented. If this combination of phase and strategy is broken, this will affect the organization adversely. The maintenance costs can be controlled by controlling the truck related costs.

Tan, D. F. (2012). Review of vehicle operting costs and road roughness:past, current and future. *Shaping the future: linking policy, research and outcomes.* Perth: ARRB group ltd. Australia.

(Tan, 2012) reviewed the implication of the roughness of road with respect to the cost of running the vehicles. Various studies in different countries have been examined by the authors to examine the various aspects of the issue. In this regard the studies in America and New Zealand have been observed. The mechanistic models are better than the regression models. The regression models were published before the availability of the International roughness index. The regression models are less robust as compared to the mechanistic models. Further there is a problem when the regression models are applied to some modern vehicles. NIMPAC and HDM III models have been used to analyze the data. The variable named vehicle operating cost has been operationalized in terms of fuel consumption cost. This variable is then further divided into sub variables like engine efficiency adjustment etc. The roughness is considered to be affecting the rolling resistance. The findings depicted that the road roughness has an impact on the operational cost of the vehicle. If the speed is not altered, certain studies have shown that the roughness and fuel consumption are positively correlated. The results are consistent across the countries.

Momcilovic, V. &. (2017). Influence of an integrated maintenance managementon the vehicle fleetenergy efficiency. *Thermal Science*. doi:10.2298/TSCI170209122V

(Momcilovic, 2017)Took the transportation process into account to better manage the maintenance of vehicles. Various requirements were defined in order to establish an operational plan. These are some of the requirements that the fleet will have to accomplish in a specified period of time. The process based maintenance system is used in the study. The maintenance measurement requires that all the variables are defined precisely with respect to the specified measures. There has to be a state of management defined so that we can refer to it when required. The fleet is constructed according to a construction- operation setup. The variables included were start time, reaching time, quantity of weight to be carried on. The next part is the making of integrated maintenance management conditions. In this regard, the number of transport machines, the number of vehicles that can be kept in not ready for operations with respect to time are defined. Next the variables are to be analyzed against the criteria set by the top management. The comparison of achieved and threshold values will give the managers insights into the situations. The results suggested that the company under consideration has become more efficient when considering the vehicle management. Theyanalyzed the effects of road roughness on traffic speed and road safety. The roughness was analyzed in detail. Factors affecting road safety and speeds of vehicles were analyzed. Data were collected on crashes, crash rates and roughness of roads were calculated. Heavy vehicles were also considered while studying crash data. The profiling devices were used to ascertain the roughness of roads. The smooth travel exposure was used as a statistical measure for road roughness. The roughness data was collected with the help of road data asset request form. This data was compared against the given or laid standards. The roads were generally adhering to the given standards. The speed data was collected through the traffic analysis and reporting system. Various statistical methods are applied to this data to analyze it. A large range of information has been collected regarding the crash data. The conclusion was made that the road condition does have an impact on the speed and crash data. In all cases of various crashes, the road situation is directly proportional to the number of accidents happening. The study also shows that the speeds at which the drivers go are affected adversely by the road quality. The time delays caused by the adverse conditions of the roads are especially detrimental to the trucking industry. The integrated maintenance management is found to contribute in increasing the energy efficiency of the vehicles. The same kind of research can be implemented in some public organizations.

 Zemourri, S. D. (2019, March 16). *http://publications.lib.chalmers.se/records/fulltext/239190/239190.pdf.* Retrieved from http://publications.lib.chalmers.se: http://publications.lib.chalmers.se/records/fulltext/239190/239190.pdf

(Zemourri, 2019) analyzed the maintenance management process to analyze the value of vehicle maintenance activities. In this regard, the maintenance management is analyzed at first. The authors suggested that the department of maintenance should be added to the basic hierarchy of an organization. This department should work in coherence with all other departments in order to achieve the organizational goals effectively. The maintenance management comprises of two parts, namely the strategy formulation and the strategy implementation. The definition of strategy objectives comprises an important part for the making of strategy. The definition of the maintenance strategy has to be taken from the business plan directly. The service delivered to the customer is a criterion for the evaluation of implementation of strategy. Thus a properly defined maintenance strategy will save the organization many indirect expenses in the terms of customer dissatisfaction etc. The data analysis used the truck OEM model which comprises of either corrective or preventive maintenance measures. The preventive maintenance is used on the account of operations. This kind of maintenance can be prevented. The corrective maintenance is generally concerned with the repairs. The authors have used three times to study the data. The first stage studies the time taken by the vehicle for going to a place and coming back to the same point. The second part is the time taken by the vehicle to add some value to the chain. The last aspect is the overall value added by the whole process. There was considerable time wastage and the bulk of that was due to the tools positioning and revision of schedules. The writers suggest that the cost benefit analysis of all options should be carried out in order to ascertain the best alternative to manage maintenance. Estimated the costs associated with the vehicle maintenance, the author studied the support that has to be forwarded for maintenance to be applied successfully. The help is forwarded to the maintenance managers to ascertain, control and decrease the maintenance costs. Various elements of the cost have been studied. After considerable short listing, the authors selected 28 companies for which comprehensive data was collected.

The total costs were divided into operational, maintenance and general administration budgets. The costs were broken down into various elements like labor, repair etc. Finally the maintenance costs were distributed by functional areas like corrective maintenance etc.

The study found that the larger organizations keep full time employees for the maintenance department. All costs have to be stated clearly so that corrective actions are easier to manage. Information systems and technology also has an important part to play in this scenario. The study suggest that not all the components of the costs are easy to affect. Thus the maintenance managers should keep an eye on the cost components that are easier to influence. After choosing the cost components, the managers then should work out the appropriate tools available for the cost measurement and control. Larger fleet sizes were having more costs, both variable and fixed. The findings presented in the study are applicable all across the country. A manager can control certain factors affecting the discussed topic. Some differences in the other areas as compared to California. The overall percentage contribution to the total cost may not vary significantly. They further analyzed the concept used in various business models. The basic elements of any business model can be identified as technology, market offer and network design. Each element has been broken down into a number of sub elements. The theory and methods have been connected. Thus the developed set is used to ascertain the changes in the music industry for the last three centuries. The start, development and the final structure of the business model is shown over time. The business models are said to be powerful if they are able to make out some actions and also suggest how these actions are joined together. The connections between small level and large level factors have been established. The practical implications of these models are also considered. The study suggested that the business models should be used as a set of overlapping things. Thus various parts of business models should be brought together to form various viable options.

Deshmukh, G. &. (2006). Maintenance management: literature review and directions. *Journal of Quality in maintenance engineering*. doi:10.1108/13552510610685075

(Deshmukh, 2006) reviewed the literature regarding the management of maintenance. The overall literature is divided into maintenance optimization models, ways to maintain, the time span of maintenance, how to measure the output regarding the maintenance, the information technology aspects of the maintenance, policies formed to look after the maintenance. The models can be numerical as well as non-numerical. The general model shows a technical system, its working and its necessity. If the system is not performing well enough then the reasons should be pointed out clearly. How can management act to the problem? The problem and solution should be balance to each other. Making the maintenance schedule is a difficult activity. The performance of the maintenance department should be measured as a feedback of performance.

Some problems existed in the application of numerical models and techniques. The models are least applicable to the industry. The innovation in IT has helped in publication of a large number of papers. The models are mere quantitative researches. So far no practical application has come up in the form of a case study. The person who is originally facing the problem should be included in the formation of the model. Thus there should be a combination of quantitative and qualitative work. They used the analytic network procedure and a fuzzy set theory to analyze the transportation in Saipa Tehran. Various factors have been considered and are broken into several sub factors. The problem is clearly defined in the first step. The factors are broken down into various sub factors and the management is asked to weight these elements according to their relative importance. A super matrix is formed out of the relationship matrix. The matrix is super weighted and these weights are divided by the number of column inputs. We opt for the best based on the weights obtained. The writers came up with the conclusion that security, cost, added value and feasibility are the main factors affecting the subject under consideration i.e. Saipa company in Tehran.

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