Faculty of Mechanical & Manufacturing Engineering Technology

ENVIRONMENTAL IMPACT ASSESSMENT OF NON - TRADITIONAL MACHINING

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Bachelor of Manufacturing Engineering Technology (Process and Technology) with Honours.

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To my beloved father, Mohamad Hadzir bin Rasid

To my appreciated mother, Zainah binti Saidi

and to all my friends for giving me moral support, money, cooperation, encouragement and also understandings

Thank You

ABSTRACT

Environmental impact assessment is a systematic procedure intended to recognize and foresee the potential impacts of human movement on the biophysical and human condition. It additionally works as an environmental administration tool to identify measures to stay away from, moderate or adjust for those impacts. Problem statement for this study is about the point of machine use such as electricity consumption, type of material, parameters usage, lubricant, production of chip and how they impact the environment. Environmental impact assessment is expected to be an iterative procedure to follow-up to decide genuine environmental results, interpret and investigate data about those results and analyses the opportunities for enhanced task environmental execution. In the other hand, the Non-Traditional Machining (NTM) use in this study are EDM Wirecut, Laser cut machine, EDM Die sinking and CNC Milling 5 axis and based on a variety of thermal, chemical, electrical and mechanical material removal processes which have been produced because of lack of proficiency of the traditional machining processes to create a complex and intricate shapes in materials with 'high strength to-weight' ratio. So, this project were analyse the environmental impact assessment of Non-Traditional Machining which focus on how the machining process take place during experiment can affect many factor regarding environmental impact assessment issues. The impact will be output during the experimental with a specimen provided using Non-Traditional machine. This experiment was held by using Gabi software to determine the output of every machine that had been set up.

ABSTRAK

Penilaian kesan alam sekitar adalah prosedur sistematik yang bertujuan untuk mengenali dan meramalkan kesan potensi pergerakan manusia terhadap keadaan biopis dan manusia. Ia juga berfungsi sebagai alat pengawal alam sekitar untuk mengenal pasti langkah-langkah untuk menghindar daripada kesan tersebut. Pernyataan masalah bagi kajian ini adalah mengenai hasil penggunaan mesin seperti penggunaan elektrik, jenis bahan, penggunaan parameter, pelincir, pengeluaran cip dan bagaimana ia mempengaruhi alam sekitar. Penilaian impak alam sekitar dijangka menjadi prosedur berulang untuk membuat susulan untuk menentukan keputusan alam sekitar yang tulen, mentafsir dan menyiasat data tentang hasil tersebut dan menganalisis peluang untuk pelaksanaan tugas yang disempurnakan oleh alam sekitar. Sebaliknya, penggunaan Non-Traditional Machining (NTM) dalam kajian ini adalah EDM Wirecut, mesin pemotong laser, sinkron EDM Die dan paksi CNC Milling 5 dan berdasarkan pelbagai proses penyingkiran bahan terma, kimia, elektrik dan mekanikal yang mana telah dihasilkan kerana kekurangan keahlian proses pemesinan tradisional untuk menghasilkan bentuk yang rumit dan rumit dalam bahan dengan nisbah 'kekuatan tinggi untuk berat'. Oleh itu, projek ini menganalisis penilaian impak alam sekitar Mesin Bukan Tradisional yang menumpukan kepada bagaimana proses pemesinan berlaku semasa eksperimen boleh mempengaruhi banyak faktor mengenai isu penilaian kesan alam sekitar. Kesannya akan dihasilkan semasa eksperimen dengan spesimen yang disediakan menggunakan mesin Bukan Tradisional. Eksperimen ini diadakan dengan menggunakan perisian Gabi untuk menentukan output setiap mesin yang telah ditetapkan.

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CHAPTER 1

INTRODUCTION

1.0 Background

In the eighteenth century, the word machinist engineer means a man who constructed or repaired machines. This person individual's work was done generally by hand, utilizing processes, for example, as the carving of wood and the hand-forging and hand-filing of metal. At the time, millwrights and developers of new sorts of motors (which means, pretty much, machines of any sort, for example, James Watt or John Wilkinson, would fit the definition. The thing machine tool and the verb to machine (machined, machining) still not exist.

Around the centre of the nineteenth century, the last words were coined, the concept that they described the developed widespread presence. Therefore, amid the Machine Age, machining alluded to (what we today may call) the "traditional" machining processes, for example, turning, boring, drilling, milling, broaching, sawing, shaping, planning, reaming, and tapping. To accomplish a desired geometry in these "traditional" or "non-traditional" machining processes, machine tools, for example lathes, processing machines, penetrate presses or others are utilized with a sharp cutting tool to evacuate material. A developing augment in the application of progressed and hard-to-machine materials in aerospace, nuclear, missile, turbine, automobile, tool and die making industries has resulted in the rapid development of a newer class of machining processes known as non-traditional machining

(NTM) processes. Regular edged cutting tool machining processes are uneconomical for such applications as the achievable level of precision and surface complete are very poor.

The NTM processes turn to be highly critical in the locale of micro- and Nano-where high accuracy and superior surface finish are often desirable which can just be accomplished using these processes where the material is evacuated in the form of atoms or molecules individually or in groups. These processes are presently being broadly used to create intricate and highly precise shapes in the workpiece areas which are inaccessible for the traditional machining methods. As the NTM procedure choice is regularly troublesome requiring human skill and being influenced by a few criteria, there is dependably a requirement for an organized approach for proper NTM process determination for a given machining application. The presence of a large number of available alternative NTM processes, uncertainties with respect to the process capabilities, lack of versatility and shortage of the experienced planners make the selection of the NTM processes to be more difficult and challenging.

Since the appearance of new innovations in the post– World War II time, for example, electrical discharge machining, electrochemical machining, electron beam machining, photochemical machining, and ultrasonic machining, the retronym "conventional machining" can be utilized to separate those technology headway from the more latest ones. In current usage, the term "machining" without capability for the most part, recommends the conventional processes for machining.

During 2010s, additives manufacturing (AM) developed past its prior research center and rapid prototyping settings and started to end up basic all through all periods of manufacturing, usually subtractive manufacturing ended up normal retronymously in logical differently in relation to AM, covering basically any removal processes additionally already secured by the term machining.

1.1 Problem Statement

Manufacturing processes in various industries particularly the chemical, automotive, electronics, pulp and paper industries create bad environmental impacts for example waste generation, energy consumption, and the discharged of hazardous substances. It also generate large amounts of various solid, liquid, and gaseous wastes. The manufacturing process also is considered to be an energy intensive activity, which also indirectly influences the environment. The process of assessing environmental impacts that may arise from proposed projects or development (industries) taking into account socio-economic, cultural and human-related interactions. In industries, various factors need to be considered to produce a product because various machines give many environmental impact. Examples from the point of machine use:-

- **Electricity consumption** - charcoal used for producing electricity, high electricity consumption causes high material requirements to produce electricity and will cause material reductions.
- **Material** - if using toxic substances, harmful gases will be released, if the substance used cannot be recycled, it can cause the product of the substance cannot be reconverted.
- **Parameters** - when the input setting does not meet the standard, it will result in wastage of raw materials that will become waste. It is mostly caused by many machining parameters, such as side cutting edge angle, cutting speed, feed rate, depth of cut, and machining time.
- **Lubricant**- Lubricant is a material that reduces friction between the mutual contact surfaces and improves the smoothness, with the movement of one surface over other. Lubricant transfers the forces, transporting foreign particles, cooling or heating the surfaces. Reducing the friction is known as

slipperiness or lubricity. Need of the use for correct lubricant is important or the lubricant will not work - the main functions of a lubricant in most cases are (as) lubrication (allowing movement), (b) cooling, (c) protection from damages and (d) sustaining moving parts clean. If the wrong lubricant is applied or used, the functions cannot be carried out effectively which can result in seizure, overheating and damage.

- **Environment**- Pollution is the introduction of contaminants into the natural environment that cause adverse change. Pollution can take the form of chemical substances or energy such as noise, heat or light. Pollutants, the components of pollution, can be either foreign substances/energies or naturally occurring contaminants.
- **Chips**- When metals are finished in manufacturing industries through machining process than metal chips are produced. When discontinuous chips are formed in the ductile materials, the workpiece result in poor surface finish and excessive wear and tear of the tool takes place.

Application based on some parametric requirements like material type, shape feature, process economy and other process capabilities like material removal rate, surface finish, surface damage depth, tolerance, machining medium contamination and efficiency need to be analysed because the effect of these factor can cause environmental impact assessment due to its function. This study is focusing on the most effective method to identify and analyze the environmental impact assessment from Non-Traditional Machines.

1.2 Objective

The objectives of this experiment are to:

1. To investigate the environmental impacts generated at the use phase of the machine tools which is Non Traditional Machining.
2. To conduct observation for the environmental impact analysis to find out parameters that can influence the results.
3. To analyse the type of energy consumption been taken during NTM process take place affect the environmental impact.

1.3 Scope

This project is an analysis on the environmental impact assessment of Non-Traditional Machining such as EDM Wirecut machining, EDM Die Sinking, Laser Cut Machining and CNC Milling Machine characteristics which focus on how the machining process take place during experiment can affect many factor regarding environmental issues. The project was focus on how the energy supply, resources, consumables, and waste handling been taken from the machining process when produce a product that been made using mild as a type of material. This project also aim to identify the problem occur during machining process and the most effective methods to analyze the environmental impact using various steps that been obtain from the research facts. Using Gabi software, analysis were conducted which has aided to recognize the crucial aspects of the machine.

CHAPTER 2

LITERATURE REVIEW

This chapter discuss about the principle of Environmental impact assessment for four non-traditional machines which are EDM Wirecut machining, EDM Die Sinking, Laser Cut Machining and CNC Milling Machine characteristics. Here, it will also discuss about electricity consumption, cutting speed, type of material, lubricant, machine tool, and process parameters. Besides, summary of the previous journal is also included at the end of this chapter.

Literature review was carried out in order to gain knowledge and to know the skills for completing this project. The main sources for this project are from the previous project and thesis that is related to this project. Other than that, the sources were obtained from books, journals, and articles from internet. Therefore, in literature review, it discusses the projects and theses related to this project. This chapter also discusses a related researches that had been conducted. Hence, by analysing the project that had been done by other researchers, there is a possibility to know what features are lack in their project. It is very important to improve and to develop a successful project.

2.1 Manufacturing and Machining

Technology for manufacturing has been continually develop to accomplish high efficiency at low cost. Reducing the environmental burden is required nowadays. Environmental factors are turning into a developing measurement in manufacturing process

because of progressively stringent regulation on health and safety, the significance of manufacturing waste on the product life cycle, rising global benchmarks on performance of environment, and a developing consumer inclination for green products. In this way, it is trusted that issues regarding environment will be dealt with an indistinguishable path from manufacturing cost in not so distant future. In reality, DfE (Design for environment) and LCA (Life Cycle Assessment) tools are frequently utilized as a part of manufacturing fields.

Inside manufacturing forms, machining is generally utilized. Machining can be characterized as the way toward removing material from a workpiece as chips. The 'metal cutting' term is utilized when removing metallic material.

As far as costs, machining in manufacturing process is really important. Most machining has less set-up cost compare with forming, moulding, and casting forms. Moreover, machining is significantly high cost for high volumes. For machining, the important part is where the tight tolerances on dimension and finishes are needed. For the conventional machining, the work study are separated by drilling, turning, milling and grinding classifications (Figure 2.1 to Figure 2.4 accordingly):

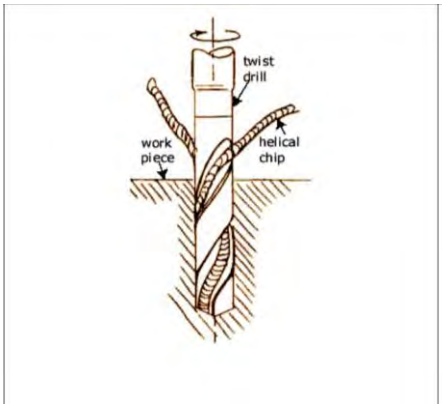

Figure 2. 1: Drilling Process

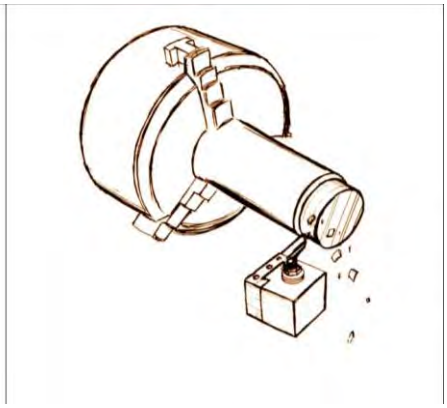

Figure 2. 2: Turning Process