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Short Communication

Adoption of classification and cataloging techniques in the maintenance industry

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ABSTRACT

In this article, the author attempts to implement and adopt the idea of library classification and cataloging tools and spares in the maintenance sector To open unexplored sectors of usage and operations. The maintenance sector is crucial in keeping and maintaining equipment, comprehending the various techniques and procedures to ensure the smooth functioning of assets or equipment. Understand different types of servicing and examine the material, tools, and testers' requirements for various repair and maintenance activities. To understand the level of library method implementation in multiple aspects and study the infusion results with relevant examples. Understand the implementation, modification, and adoption of Dewy Decimal Classification and the applicability of library methods in the maintenance sector.

1. Introduction

In automobile and aviation maintenance, upkeep and ensuring the proper functioning of vehicles and airplanes is paramount. The maintenance of such systems requires a substantial amount of spare parts, tools, and strategic planning. Throughout this procedure, the maintainer must utilise and separate the necessary tools and replacement parts at various stages of upkeep. To efficiently carry out the maintenance tasks, the maintainer must effectively organise and separate the essential tools and spare parts at multiple maintenance stages. Placing these tools and spare parts is crucial in promptly completing the planned tasks. Throughout the maintenance process, the maintainer and storekeeper must coordinate to ensure the required spare parts are procured and made readily available at the appropriate time.

There is no standardised or universally accepted protocol for categorising and classifying spare parts and tools in maintenance. Any prescribed rules or regulations do not govern tool storage, retrieval, usage, and placement. The complexity of the working system leads to an exponential increase in the number of spare parts required, thereby making the management of tools and spare parts an even more challenging task.

In this paper, the author proposes implementing the library classification and cataloging concept in the maintenance industry, specifically for spares and tools. The author suggests that by correlating these two concepts, the maintenance industry can benefit from a more organised and efficient approach to managing spare parts and tools.

2. Materials and Methods

Throughout this study, we will attempt to discover an appropriate application of classifying and categorising in the maintenance field in various practical situations. In this present investigation, we aim to comprehend the diverse forms of repairs and fixes in the maintenance sector and analyse the concepts of repair, rectification, preventative maintenance, and servicing. We are researching alternative approaches to incorporating library cataloging

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and classification into a different domain. A potential resolution involves adopting the most fitting approach. In this article, we will strive to execute the probable result of separation in any exemplary model or instance.

3. Literature Review

The author says that This study aims to analyse practical maintenance management approaches in the industry, focusing on proactive and progressive strategies. Deficient maintenance management can negatively impact an organisation's competitiveness, reducing throughput, inventory, and poor performance. Companies are replacing reactive strategies with proactive and progressive approaches, requiring increased training, resources, and integration. A survey was conducted to determine the relationship between maintenance and production methods.[1] The manufacturing industry faces challenges due to global market growth and competitiveness, requiring high-equipment effectiveness and flexible systems. Maintenance operations are crucial for minimising unplanned downtime, ensuring product quality, and maintaining competitiveness. Intelligent maintenance systems (IMS) help optimise maintenance operations, providing decision support tools and smart prognostic and health management tools. This article reviews recent advancements in maintenance methods, identifies research challenges, and outlines future research directions.[2] illustrated by the author.

4. Discussion

4.1. Study of maintenance industry

In the maintenance industry, Machinery and Equipment are any mechanical, electrical, or electronic device intended and used to carry out a specific function and generate a particular outcome.[3] Maintenance refers to collecting all activities to preserve a system in a state where it can fulfil its function. Frequently, these systems are production systems. Some maintenance tasks can be performed concurrently with production, while others can be carried out during regular production interruptions such as evenings, weekends, and holidays. However, in many instances, production units must be temporarily shut down for maintenance. This situation may result in management challenges between a company's production and maintenance departments. On one hand, the production department relies on maintenance to ensure the long-term performance of its equipment. To enhance and ensure the smooth operation of any industry, it is necessary to periodically maintain the machinery and equipment through scheduled preventive maintenance or any necessary repairs.

4.1.1. Management of tools

The practical and smooth functioning of maintenance relies heavily on managing tools, which can be periodic or in response to breakdowns. Proper organisation of tools and testers for targeted servicing is crucial to completing tasks within the scheduled timeframe. Using the appropriate tool for each job reduces unnecessary complications and potential damage to the system. Providing the maintainer with easy access to the necessary tools minimises physical effort and maximises output. Planning tools' availability and time-sensitive management are essential for successfully carrying out any maintenance activity. The systematic arrangement of tools and utilities in any maintenance-related task ensures that the work is done correctly and efficiently illustrated.Figure 1

"Tool management involves two main aspects: documentation (master data) and logistics (transaction data). Documentation includes all the information necessary for a smooth and understandable production process. It allows for managing spare parts, experiences in production, and associated data. Various functions are available to manage, process, print, and integrate this data with other applications."[4] Unlike spare parts, tools must be returned after maintenance tasks and placed in their designated storage location daily. Different industries employ various methods such as Radio Frequency Identification, QR scanners, or barcodes to ensure the tracking and proper handling of tool transactions and storage.

4.1.2. Management of spare parts

Let's delve into Aviation and Automobile maintenance; they follow primarily two types of servicing provided to their customers. Preventive maintenance and Breakdown maintenance (Snag rectification). In preventative maintenance, planned activity is coordinated according to the guidelines and standard operating procedures (SOP) with a list of tools and replacement parts. Specifically, we observe that the replacement parts are once again divided into mandatory and non-mandatory during the planned servicing, as the parts are to be replaced after meeting certain conditions specified by the manuals or SOPs. But in contrast, snag rectification is an entirely different approach. During the rectification, if the part or component that needs to be repaired is more intricate or interconnected with other parts or systems, the maintainer needs to detach and reattach it back into the system after rectifying the snag-induced components.[5] In Snag rectification, the consumables are once again categorised by mandatory and non-mandatory parts required for affected parts and necessary replacement parts and lubricants such as rubber seals, safety pins, grease, lubricating oils, and other disposable components required for other components involved during the disassembly process need to be replaced.

The management of tools also plays a significant role in the efficient and smooth functioning of maintenance, whether it be periodic or breakdown maintenance. Proper cataloging of tools for targeted servicing is crucial to completing tasks within the scheduled timeline. Having the right tool for the job reduces unnecessary complications and prevents damage to the system. This allows maintainers to exert less physical effort while achieving maximum output. Planning the position order and time-sensitive management of tools is necessary to carry out complicated and complex maintenance tasks. The sequential arrangement of tools and utilities in any maintenance-related task ensures proper and efficient execution.

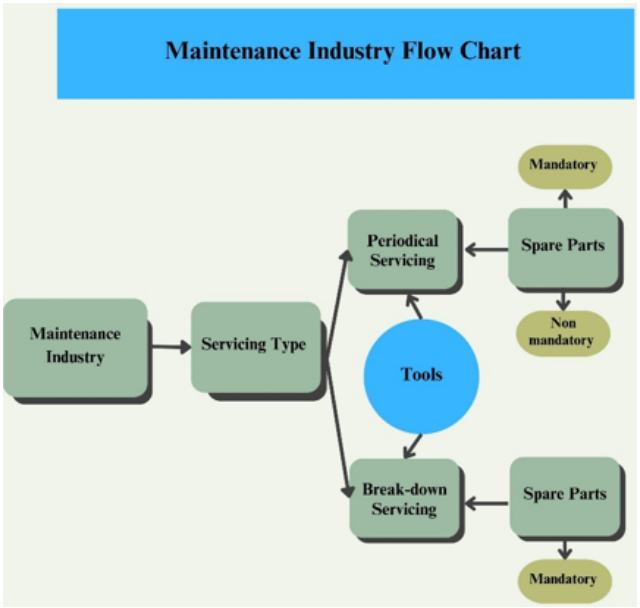

Figure 1: Flow chart of Typical Maintenance Industry

5. Results

5.1. The Implication of classification and Cataloging

Cataloging and classification are simply ways of organising library materials so that retrieval will not be difficult for library users. Therefore, there is a strong need to organise library collections for easy access for users because the collections will be useless. The foundation of any library to operate and function. Let's examine the integration of this fundamental discipline system into the disorganised, inconsistent system of overseeing tools and replacement parts.

To investigate the potential of incorporating a classification and cataloging system in the management of tools and replacement parts. We will attempt to introduce two distinct systems, tools and replacement components.

5.1.1. Adoption in management of tools

In the management of tools, for each assignment or rectification, tools are necessary. They must be transitioned daily from the tool bay after finishing maintenance to clean the work zone and machinery. This procedure is implemented to guarantee the reduction of human error and unintentionally forgetting tools in operational equipment. For this, we must examine a wide range of various kinds of tools required for any sort of task. To execute this, we need to know the specifics of the total number of tools and testers present in the inventory of any organisation, and they need to be listed and recorded according to the type and quantity. To comprehend the purpose, we will simulate a list of tools, discuss the categorisation concepts' implementation, and then catalog. Let's observe the various types of tools utilised in the typical maintenance servicing of an automobile. As per Table 1, tools are categorised using name, dimension, type, and identification number, and with the company's name.

As the inventory of tools is explained for typical maintenance in Table 1, we will examine and analyse it to comprehend the implementation of the concept of tool management. For the processing of categorising tools, there is a need to categorise broadly based on the type of tools. Then, we will explore the further classification of tools by considering the size of the tools. Additionally, information about the manufacturer of the tools and their identification can also be included. Grouping the tools according to a broad spectrum makes it easier for the user to locate the individual tool. The tools are planned so that tools of the same type are placed together and labelled clearly. Positioning tools of the same type in one place will assist the maintainer in utilising the resources efficiently and ensuring proper placement. In Figure 2, an attempt is made to classify tools by focusing on a single type of tool and concentrating on only one kind of tool, the 'open-end wrench'.

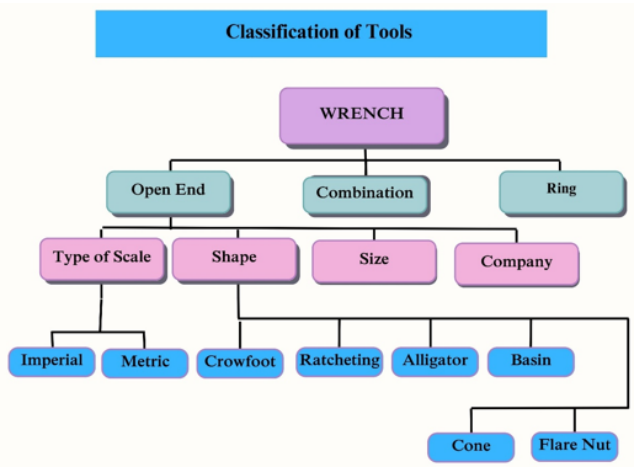

Figure 2: Classification of tools: Wrench

Table 1: List of tools for typical servicing of automobile

Sl.no	Tools name	Size	Company	Type	Qty	Tool Identification No
1	Combination Wrenches	10mm	Bahco	Wrench	1	111M-10
2	Combination Wrenches	11mm	Bahco	Wrench	1	111M-11
3	Combination Wrenches	12mm	Bahco	Wrench	2	111M-12
4	Combination Wrenches	13mm	Bahco	Wrench	1	111M-13
5	Combination Wrenches	14mm	Bahco	Wrench	1	111M-14
6	Combination Wrenches	15mm	Bahco	Wrench	1	111M-15
7	Combination Wrenches	16mm	Bahco	Wrench	2	111M-16
8	Combination Wrenches	17mm	Bahco	Wrench	1	111M-17
9	Combination Wrenches	18mm	Bahco	Wrench	2	111M-18
10	Adjustable Wrenches	28mm	Bahco	Wrench	1	9071 PC
11	Socket set 91 PCs	5-32mm	Bahco	Socket	1	SW91
12	Torque Wrench	$\frac{1}{4}$ "	Bahco	Wrench	1	TAWM1412M
13	Socket Driver for Philips head screw	5.5 mm	Bahco	Socket	5	6709PH-1
14	Socket Driver for slotted head screw	5.5 mm	Bahco	Socket	5	6709F-8
15	Flat Tipped Screwdrivers5.5 mm	5.5 mm	Bahco	Screwdriver	1	BE-8158
16	Phillips Screwdrivers	PH 1	Bahco	Screwdriver	1	E-8610
17	Metric Hex L-Keys set	Set	Bahco	L keys	1	1998M/8T
18	Cutting Pliers	4.0 mm	Bahco	plier	1	2101GC-180IP
19	Combination Pliers	2mm	Bahco	plier		2628 G-180IP
20	Square Drive Cordless Impact Wrench Kit	1/4"	Bahco	Drill Machine	1	BCL31IW1K1
21	Power Washer	1400W	Falcon	Washer	1	HIJET-2013
22	Strap pliers	170mm	Bahco	plier	1	BE251200
23	Pressurised Evacuation Drain Tank	26 Gal	Lincoln Industrial	Drain Tray	1	26-Gal tray

Table 2: List of spare parts for typical servicing of automobile system

Sl.no	Spare Part	Spare part No	Type of Spare type	Qty	Company
1	Belt-V	272-7881	Belt	2	Cat
2	Cabin Air Filter	207-0105	Filter	1	Cat
3	Oil Filter	10000-51233	Filter	1	Olympus
4	Standard Efficiency Fuel Filter	067-6987	Filter	1	Cat
5	Hydraulic Hammer Paste Pail (5 Kg)	133-8807	Grease	1	Cat
6	Light Duty Lithium Complex Grease	108-8611	Grease	1	Cat
7	Bulb	270-4055	Light	10	Cat
8	Dome Lamp Assembly	7X-6399	Light	3	Cat
9	Red LED	116-5270	Light	4	Cat
10	Engine Oil	SAE15W-40	Oil	25	Cat
11	Saeo Sae 40 (1 G)	170-5261	Oil	15	Cat
12	Fuel System Seal	179-8128	O-ring	2	Cat
13	O-Ring	373-6317	O-ring	2	Cat
14	O-Ring	237-5000	O-ring	2	Cat
15	Seal	9F-3384	O-ring	1	Cat
16	Orange Rectangular Reflector	6C-5712	Reflector	4	Cat
17	Red Rectangular Reflector	227-9859	Reflector	4	Cat
18	Active Dual Hall Effect Speed Sensor	204-6204	Sensor	1	Cat
19	ELC Premix	238-8648	Sensor	1	Cat
20	Pressure Sensor (5 kHz PWM)	153-3962	Sensor	1	Cat
21	Sealing Washer	095-2039	Washer	5	Cat
22	Sealing Washer	096-1625	Washer	5	Cat

5.1.2. Adoption in management of spares

"Service parts management is the primary element of a comprehensive strategic service management process that companies use to ensure that the appropriate spare part and resources are in the correct location at the correct time".[6] The correct spare part is available at the right time and location for the smooth functioning and operation of maintenance activity. Identifying the spare parts is challenging as not everyone on the service floor can locate the parts through visual inspection. These spare parts must be identified using careful labelling or part numbers. In spare parts management, we do not return the spares as they are used during maintenance activity, except for a few exceptions. To understand the extent of adoption in spare parts management, we need to examine the typical servicing of a vehicle. This process will help us better understand the number of different types of spares involved in maintenance activity, as shown in Table 2.

Implementing the library classification and cataloging concept is similar to what we have adopted in tools. However, when it comes to spare parts, we must consider their usage and the quantity we have on hand. In the case of spare parts used, inventory will not be returned to the store as they are consumed in the task. In spare parts management, various subcategories of tools will be within a broader category. For example, if we take the instance of a 'Filter' type of spare part, we may have different types of filters in the store, such as air filters, oil filters, hydraulic filters, and so on. Understanding the significance of this classification and the cataloging system is essential as it allows the storekeeper and maintainer to easily and systematically provide the required spares for a specific task. By maintaining a well-structured management system, the organisation can monitor the usage and consumption of spare parts, anticipate future needs, and order fast-moving items.

During regular maintenance, consumables and tools are clearly understood for the same task. When classifying the inventory, we can create a single entry that includes a comprehensive list of spare parts, testers, and tools required for the maintenance task. In the case of breakdown servicing, we can predict the requirements based on the affected area or the type of issue identified. This allows us to retrieve the necessary items from the store and quickly assemble the breakdown equipment.

6. Modification in Classification

Dewey Decimal System (DDS) would be preferable to apply in this scenario, as it can easily identify the subject with clear boundaries. We can utilise the principles of the DDS to develop a suitable and sustainable system for implementation in the maintenance sector. This system is a progressive step towards organising the maintenance industry's storage, retrieval, and utilisation of tools and spare parts. It is the first instance where the library's approach is being discussed in the context of the maintenance field. There is a broader opportunity to adopt a system that will streamline the classification and categorisation of tools and spare parts in a unified format, benefiting customers, maintainers, and manufacturing companies in achieving mutual understanding.

When we correlate the DDC for this vertical, we can state that it can categorise a simple tool for expressing the extent of application. The wide division of tool 'wrench' has been further classified based on various kinds of wrench and combinations. In Figure 2, the author attempts to illustrate a single example of an 'open end spanner'. Let's examine this tool's classification level in detail in Table 3.

Table 3: Level of classification

Sl.no	Level of Classification	Level of Details
1	First Level of classification	Wrench
2	Second Level of classification	Open End Wrench
3	Third Level of classification	Shape, Size, Type of measurement, Brand
4	Fourth Level of classification	*Shape* - Crowfoot, Alligator, Cone, etc *Type of measurement* - Metric, Imperial *Brand*- Firefox, Stanley, etc

In my study, I have discovered that implementing this method helps me categorise different kinds of tools systematically and in an orderly way. Because of classification, it is easy to catalog the item without any complications. Safety and inspection of the tools are of utmost importance in the aviation and automobile maintenance industry. Leaving behind removed parts, used tools, and other cleaning materials can create problems. These items can cause malfunctions when the equipment is in operation, obstruct the workflow, or even damage the components, ultimately compromising the equipment's integrity.

7. Scope of Future Research

Implementing library classification and cataloging in different facets will create further research and exploration opportunities. This will enable the improvement and enhancement of various systems more effectively and efficiently.

8. Compliance with Ethical Standards

This article contains no studies of human and animal participants performed by authors. I have not used AI-based software to generate the data published in my manuscript.

9. Ethical Conduct

Have not used any AI-based software to generate the data published in my manuscript

10. Data Availability Statements

Nil data is held with the author; my manuscript already publishes all required data.

11. Source of Funding

There is nil funding for any organisation.

12. Conflict of Interest

Nil Conflict of Interest with any other person.

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