CHAPTER I
INTRODUCTION

I.1 Background

In the case of the Faculty Of Industrial Engineering, an integrating an operating system within a given practical lesson significantly improves understanding of basic engineering principles as well as industrial simulations. For modern educational methodologies in the Era of Industry 4.0, which includes sophisticated learning techniques, adapting more advanced applications becomes imperative (Kamaruzaman et al., 2019). Furthermore, these new innovative technologies like virtualization and infrastructure management used in industrial training require operating systems as their backbone architecture (Borkar & Singh, 2019).

The integration of Linux-operating systems into industrial engineering education has positively impacted the development of companies' modern-specific skills. Students can modify Linux systems to meet certain project and educational requirements, which improves experiential learning since it is an open-source platform (Gaspar & Armitage, 2023). In addition, the kernel part of Linux systems supervises basic tasks such as memory allocation, process scheduling, and communication with hardware devices. These operations are essential in both academic and commercial settings (Mishra et al., 2023).

Linux-based operating systems provide remarkable security and stability, which are important in the learning environments that require technical simulation and experimentation. Linux promotes smooth operations in educational settings because high stability minimizes system halting interruptions. In modern industrial-focused digital learning environments, mitigations like the Linux kernel's effective permissions management aid in protecting systems from possible security threats (Heinrich et al., 2024; Wang et al., 2024).

Linux-based systems provide students with practical understanding of operating system design and enable them to learn kernel programming skills . This experience is invaluable for industrial engineering students that may develop or work with industrial applications software. Linux kernel can actually be a used as a platform for students to acquire relevant skills for system optimization and to encounter technological problems in a real setting (Ge et al, 2024; Wu, 2023).

Kali Linux, Fedora, and Rocky Linux each provide unique advantages as operating systems for industrial engineering education. The prominence of Kali Linux in penetration testing and cyber security serves to make it more useful to students interested in securing industrial systems (Wasson & Decker, 2022). Fedora is known to be a reliable platform that integrates the latest developments in software and has a strong development community, which makes it suitable for technical educational needs, is backed by Red Hat, the leading enterprise open source company (Hitchcock 2022). As a CentOS replacement, Rocky Linux is a system that can be relied on for an educational infrastructure as it provides long-term stability and enterprise compatibility (Sathya & Chithra, 2022).

Compatible with the Education 4.0 concept, the use of these operating systems within a practicum‘-environment enhances a simulation-based learning, apart from a technical training . They also help project-based learning and help develop important problem-solving skills critical in today’s business environment (Pacheco-Velazquez & Rodes-Paragarino, 2024). Virtualized software models also provide schools with a method for practical experience without hardware risks, as they represent a safe and lower cost means of training in technology education (De Almeida & Pochmann, 2023).

This study aims to compare Kali Linux, Fedora, and Rocky Linux based on their effectiveness, efficiency, and suitability to help in practicum activities at the Faculty of Industrial Engineering. Selecting the correct operating system is an imperative component in enhancing the educational process and in creating a

stable learning environment. Ultimately, this option prepares students to face industry challenges where efficiency of systems and technical proficiency is key, (Wasson & Decker, 2022; Hitchcock, 2022).

The purpose of this study is to give academic institutions useful information for choosing the best operating systems to improve the standard of instruction in engineering practicums. This study helps decision-makers create more resilient and efficient educational frameworks, which are essential for sustainable industrial engineering practices, by emphasizing resource optimization and sustainable technology utilization (Khanmohammadi et al., 2024; Ngubane, 2024).

I.2 Problem Statement

Based on the background that has been described, there are several problems that need to be resolved regarding the selection of the optimal operating system to support practicum activities in basic operating system courses at the Faculty of Industrial Engineering. The following is the formulation of this research problem:

1. How is the status of practicums in the Information Systems Department in terms of, for example, operating systems in different labs?
2. What is the ideal operating system to be used to support all practicum engagements within the Information Systems Department in terms of tools compatibility, system set-up, user experience, and performance?
3. How can the practicum and laboratory management implementation be bettered by choosing the right operating system?

I.3 Research Objectives

This research has several main objectives related to the analysis and comparison of operating systems for basic operating system practicum activities at the Faculty of Industrial Engineering, namely:

1. Identify and assess the state of the art practicum as it is being implemented at the Department of Information Systems, in particular, with a focus on the technical aspect and adequacy of the operating system being used.
2. Decide which operating system should be employed with each practicum activity, considering issues related to tools, system defaults, usability, and performance.
3. Advise laboratory managers on which OS works better in the context of supporting teaching and learning activities and technical laboratory management.

I.4 Research Scopes

1. Use of these operating systems like Kali Linux, Fedora and Rocky Linux were the focus of the analysis specific to this study.
2. The study focuses on the Application Architecture and Technology dimension investigating areas such as compatibility and tool support, defaults, usability, performance.
3. This study only focuses on providing a recommendation for which operating system is best to support the practicum activities according to certain identified criteria.

I.5 Research Benefit

The advantages of this research in analyzing and comparing operating systems of IS Department practicum activities at Faculty of Industrial Engineering among others are:

1. Assisting the development of curriculum and teaching by assisting in the selection of the most appropriate Operating System (be it Kali Linux, Fedora or Rocky Linux) for an effective Information Systems Department practicum activities on the Industry Engineering lab.

2. Contributing in a useful way to the Information Systems Department of the Faculty of Industrial Engineering so that they can make smart choices about which operating system to use in order to improve laboratory resources and get better operational and cost efficiency.
3. Obtaining a more effective system for managing a laboratory by finding one that has less technical problems, works more smoothly, and provides a better quality of experience for students in practicum.
4. Enhancing student learning outcomes by providing a stable and efficient OS environment to enable students to focus on learning Operating Systems concepts and not having their learning disrupted by technical issues.

I.6 Systematization of Writing

This research is described with the following systematic writing:

Chapter I. Introduction

The problem of the study is articulated in this chapter, including background information, objectives, the scope and significance of the research, as well as the structure of the writing .

Chapter II. Literature Review

In this chapter you learned what an operating system is, the various types of operating systems and a brief overview of the history of Linux. It also briefly describes Kali Linux, Fedora and Rocky Linux, the three operating systems this research study is a comparison of, considering educational needs, lab management and industry. At the conclusion of the chapter are works similar to it in order to highlight where my research comes in.

Chapter III. Methods

This chapter explains the methodology applied in this research, which is Determining the score for each criterion in the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) method using the direct

rating approach, a method of providing weights based on logical subjective judgments that fit within the context of the implementation of operating systems in the Faculty of Industrial Engineering. This is done by taking in consideration the first hand experience of the researcher with the practicum module and the actual requirements for managing the operating system in a lab setting when evaluating each Operating System. A conceptual framework and systematization of problem solving is also presented in this chapter.

Chapter IV. Results and Discussion

In this chapter information is provided on the specifications of the host machine as well as those of each operating system. This chapter also details the profile that the study case will have and the scope that will be tested by the 3 operating systems. Lastly I will explain the TOPSIS scale and how the experiment will be carried out.

Chapter V. Evaluation

All operating system findings will be presented in this chapter. All of these will then be summarized and processed through a TOPSIS analysis, similar to a “best fit” analysis to determine which operating system would be best for the Information Systems Department practicum.

Chapter VI. Conclusion and Suggestion

Last but not least, this chapter will also provide conclusion in regard with the research objective and also suggest some point based on the research limitation to provide an idea for future researcher in case they want to continue this research further.