BACHELOR'S THESIS IN COMPUTER SCIENCE AND INDUSTRIAL ECONOMICS

UNDERGRADUATE LEVEL 15 CREDITS

A Comparative Evaluation of Open-Source Digital Asset Management Systems

Exploring Organizational and Marketing Criteria for Process and Marketing Innovation in SMEs

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Abstract

(Författare, 2025)

• What is the topic area? (optional) Introduces the subject area for the project. • Short problem statement • Why was this problem worth a Master's thesis project? (i.e., why is the problem both significant and of a suitable degree of difficulty for a Master's thesis project? Why has no one else solved it yet?) • How did you solve the problem? What was your method/insight? • Results/Conclusions/Consequences/Impact: What are your key results/conclusions? What will others do based upon your results? What can be done now that you have finished - that could not be done before your thesis project was completed?

Keywords:
Digital Asset Management (DAM), Version Control, Metadata Management, Access Control, SMEs, Workflow Optimization

Sammanfattning

Nyckelord:

Acknowledgments

I would like to thank xxxx for having yyyy.

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List of Acronyms and Abbreviations

AI	Artificial Intelligence
DAM	Digital Asset Management
DSR	Design Science Research
ERP	Enterprise Resource Planning
IT	Information Technology
MCS	Management Control Systems
MDM	Metadata Management
RBAC	Role-based access control
RBV	Resource-Based View
SME	Small and Medium-sized Enterprises
UX	User Experience
VRIN	Valuable, Rare, Inimitable, Non-substitutable
YOLO	You Only Look Once

1 Introduction

This chapter describes the specific problem that this thesis addresses, the context of the problem, the goals of this thesis project, and outlines the structure of the thesis. Give a general introduction to the area. (Remember to use appropriate references in this and all other sections.)

The first paragraph after a heading is not indented, all of the subsequent paragraphs have their first line indented.

1.1 Backgorund

The concept of Digital Asset Management emerged in the late 1990s as organizations began to grapple with the increasing volume of digital content. In the early 2000s, DAM systems evolved from on-premises solutions to cloud-based platforms, offering greater scalability and accessibility (McCain et al., 2021) The integration of AI and machine learning technologies in DAM systems began in the mid-2010s, marking a significant advancement in automating asset tagging and improving search capabilitie This technology leverages advanced computer vision techniques to analyze and tag images automatically, reducing manual effort and enhancing the accuracy of asset categorization

Present the background for the area. Set the context for your project – so that your reader can understand both your project and this thesis. (Give detailed background information in Chapter 2 - together with related work.) Sometimes it is useful to insert a system diagram here so that the reader knows what are the different elements and their relationship to each other. This also introduces the names/terms/... that you are going to use throughout your thesis (be consistent). This figure will also help you later delimit what you are going to do and what others have done or will do. As one can find in RFC 1235 [1] multicast is useful for xxxx

1.2 Problem

As companies scale, managing digital assets efficiently—ranging from product images and marketing materials to technical documentation—becomes essential for maintaining brand consistency and operational efficiency. However, existing DAM solutions, particularly open-source systems, often lack specialized automation for high-end manufacturing contexts, making adoption and maintenance difficult for SMEs with limited IT infrastructure.

A core function of DAM is image tagging, sorting, and categorization, directly influencing asset retrievability and structural organization. Although AI has been integrated into some DAM solutions, these implementations typically rely on large pre-trained models that offer broad object classification rather than domain-specific tagging and vocabulary. In premium manufacturing, where products may be visually similar yet functionally distinct, this lack of tailored recognition can lead to misclassification and inefficient asset management.

Recent advancements in computer vision, particularly through algorithms like YOLO (You Only Look Once), offer an opportunity to overcome these limitations. However, deploying a YOLO-powered system in this domain requires adapting the model to the specific features and vocabulary of the manufacturing sector. Rather than training a YOLO model from scratch—a process that demands extensive annotated data and computational resources—a more feasible approach is to fine-tune a pre-trained model using company-specific data. This raises key challenges: Can fine-tuning effectively capture the subtle distinctions of assets?

1.3 Purpose

The primary aim of this thesis is to assess the feasibility and impact of a YOLO-powered DAM system that has been fine-tuned on company-specific data to address the unique needs of premium manufacturing SMEs. The research will benchmark the performance of this fine-tuned system against a conventional open-source DAM platform (ResourceSpace), focusing on improvements in asset categorization accuracy and retrieval efficiency.

1.3.1 Anticipated Benefits and Implications

This study is structured around a systematic process encompassing data collection, model fine-tuning, and system testing. These phases represent essential steps that a company would need to undertake. By addressing both the positive impacts and the possible challenges, the aim is to to inform stakeholders about whether the benefits of adopting this AI-based solution justify the necessary investments and efforts The project's outcomes are expected to contribute to academic knowledge in the field of AI-powered asset management, fostering further innovation.

1.3.2 Ethical considerations

Ethically, the project will investigate issues related to data privacy, transparency, and bias, which are critical in ensuring that automated systems operate fairly and without unintended consequences. These concerns are highlighted in the literature on AI ethics, which emphasizes the need for clear guidelines to mitigate risks associated with autonomous decision-making. (Jobin et al., 2019)

1.3.3 Sustainability, and social considerations

From a sustainability perspective, this research contributes to the United Nations Sustainable Development Goals (SDGs), specifically SDG 9, Industry, Innovation, and Infrastructure, and SDG 12, Responsible Consumption and Production, (United Nations, 2015). In relation to SDG 9, and more precisely target 9.5 as seen in Figure 1-1, the project seeks to enhance scientific research and upgrade the technological capa-

Figure 1-1: Sustainable Development Target 9.5 and 12.6

bilities within industrial sectors. Similarly, under SDG 12 target 12.6 also shown in 1-1, this project supports sustainable business practices by optimizing digital asset management. By enhancing asset categorization and retrieval, the system makes it easier for companies to track and store metrics. This dual focus ensures that the technological advancements proposed are not only efficient and innovative but also ethically sound and socially beneficial.

Further reflection will be revisited in Section 6.4.

1.4 Goals

The primary goal is evaluating the feasibility of a YOLO-powered DAM system that has been fine-tuned using company-specific data, in comparison to the open-source solution RecourceSpace. To achieve this, the project has been divided into the following three sub-goals:

1. **Dataset Development and Annotation:** Develop a robust methodology for collecting a domain-specific dataset that accurately captures the visual and functional nuances of digital assets in premium manufacturing. The annotation process will involve:
    - Using bounding boxes to precisely delineate asset regions.
    - Assigning appropriate class labels using a standardized labeling schema to ensure consistency and

relevance to the manufacturing domain.

This dataset will serve as the foundation for model fine-tuning.

2. **Model Fine-Tuning and Optimization:** Fine-tune a pre-trained YOLO model on the annotated dataset. The objective is to enhance the model's accuracy in tagging, sorting, and categorizing.
   - Adjusting hyperparameters and leveraging transfer learning techniques.
   - Implementing regularization and validation strategies.
3. **Performance Benchmarking and Comparative Analysis:** Benchmark the performance of the fine-tuned YOLO-based DAM system against a conventional open-source DAM called ResourceSpace. Evaluation metrics will include:
   - Asset categorization accuracy.
   - Retrieval efficiency.
   - Overall system usability.

A comparative analysis will be conducted to assess whether the customized system offers significant improvements over traditional solutions. Resulting in practical recommendations and guidelines for manufacturing SMEs considering the adoption of AI-powered DAM solutions

1.5 Research Methodology

The methodology is designed to address both technical performance and stakeholder perspectives by integrating quantitative and qualitative approaches.

1.5.1 Design Science Approach

This research is grounded in a pragmatic philosophy that emphasizes practical impact and utility, aligning well with the design science research (DSR) paradigm. DSR is particularly suited for technology-driven projects as it promotes the iterative design, development, and evaluation of artifacts to solve real-world problems

At the core of this project is a design science research (DSR) approach. This approach supports the iterative development and refinement of the YOLO-powered DAM system while simultaneously providing a framework for its evaluation. By designing, implementing, and empirically testing the system, the study aims to generate actionable knowledge that bridges theory and practice.

Introduce your choice of methodology/methodologies and method/methods – and the reason why you chose them. Contrast them with and explain why you did not choose other methodologies or methods. (The details of the actual methodology and method you have chosen will be given in Chapter 3. Note that in Chapter 3, the focus could be research strategies, data collection, data analysis, and quality assurance.) In this section you should present your philosophical assumption(s), research method(s), and research approach(es).

(footnote?)

1.6 Delimitations

Describe the boundary/limits of your thesis project and what you are explicitly not going to do. This will help you bound your efforts – as you have clearly defined what is out of the scope of this thesis project. Explain the delimitations. These are all the things that could affect the study if they were examined and included in the degree project.

1.7 Structure of the thesis

Chapter 2 presents relevant background information about xxx. Chapter 3 presents the methodology and method used to solve the problem. . . .

Exclude the first chapter , references, and appendix/appendices.

2 Background

This chapter provides basic background information about xxx. Additionally, this chapter describes xxx. The chapter also describes related work xxxx. What does a reader (another x student – where x is your study line) need to know to understand your report? What have others already done? (This is the "related work".) Explain what and how prior work / prior research will be applied on or used in the degree project /work (described in this thesis). Explain why and what is not used in the degree project and give valid reasons for rejecting the work/research.

When you do your literature study, you should have a nearly complete Chapters 1, 2.

You may also find it convenient to introduce the future work section into your report early – so that you can put things that you think about but decide not to do now into this section.

Note that later you can move things between this future work section and what you have done as you may change your mind about what to do now versus what to put off to future work.

2.1 Digital Asset Management

Krogh (2009) presents DAM as an essential system for managing digital photography in a way that prioritizes protection, accessibility, and longevity. While the components of a DAM system are deeply interwoven, the guiding principles remain consistent: images must be preserved, findable, and future-proofed(Krogh, 2009).

By structuring digital archives with careful attention to metadata, file formats, and workflow efficiency, he argues photographers and organizations can ensure that their collections remain valuable and usable over time. The primary stages of DAM can be categorized into five stages as illustrated in Figure 2-1.

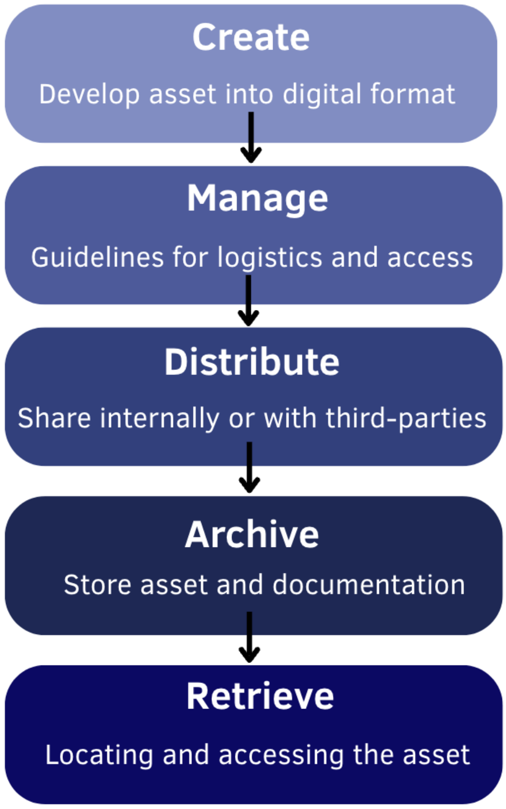

Figure 2-1: Illustrating the main stages of digital asset management.

2.1.1 Technology Alone is Not Enough

Love and Matthews (2019) demonstrated through a series of case studies that the promise of DAM is not unlocked simply by adopting new technology but only when companies embrace two fundamental principles.

First, that technology alone does not create value but must be accompanied by organizational process reengineering, and second, that the benefits of DAM are maximized only through continuous strategic governance to monitor and sustain its impact.

The first principle is a recognition that technology does not automatically create value. Rather, its benefits are realized only when organizations actively re-engineer their processes and align them with strategic governance (Love and Matthews, 2019).

Building on these insights, Peppard (2016) argued that technology benefits cannot be achieved without organizational change, and change efforts must produce tangible benefits to be sustainable. He emphasized the need for strategic oversight to keep DAM systems adaptable and aligned with business needs rather than letting them become static and ineffective(Love and Matthews, 2019).

Building on these insights, Peppard (2016) argued that the realization of technology benefits is inseparable from organizational transformation, stating that "benefits are unable to be delivered without change, and change without benefits cannot be sustained." He underscored the necessity of strategic oversight to ensure that DAM systems evolve alongside business needs rather than remaining static implementations

What about the benefits? A missing perspective in software engineering There are xxx characteristics that distinguish yyy from other information and communication technology (ICT) system, as shown in Figure 2-1. Table 2.1 summarizes these characteristics.

Figure 2-2: An example figure in Section 2.1.

Column 1	Column 2
Data 1	Data 2
Data 3	Data 4

Table 2.1: An example table in Section 2.1.

2-2 is an image 2.1 is a table

2.1.2 Major background area#1#1

Recent studies have demonstrated the effectiveness of various AI techniques in image tagging. Zhang et al. (2019) showcased the application of convolutional neural networks (CNNs) for automatic image classification in DAM systems, achieving an accuracy of 92% on a diverse dataset of digital assets

This work was further extended by Li and Chen (2020), who integrated attention mechanisms into CNNs, improving the model's ability to focus on salient features and increasing tagging accuracy to 95%

The YOLO (You Only Look Once) algorithm has also been applied successfully in DAM contexts. Wang et al. (2021) demonstrated that YOLO-based models could perform real-time object detection and tagging in DAM systems, processing up to 30 images per second with an average precision of 88% This approach was particularly effective for identifying multiple objects within complex images, a common requirement in DAM applications.

Transformer-based models have recently gained traction in image tagging for DAM systems. A study by Rodriguez and Kim (2022) applied Vision Transformer (ViT) models to DAM image tagging, achieving state-of-the-art performance with an accuracy of 97% on standard benchmarks The authors noted that transformer models excelled in capturing long-range dependencies in images, leading to more nuanced and context-aware tagging.

While AI-powered image tagging offers significant benefits, it also presents several challenges. Data requirements pose a significant hurdle, as highlighted by Brown et al. (2020), who found that AI models required at least 10,000 labeled images per category for optimal performance in domain-specific DAM applications

Error rates and handling domain-specific content remain ongoing challenges. A comprehensive study by Thompson et al. (2021) analyzed error patterns in AI-powered image tagging across various industries, revealing that error rates increased significantly (up to 25%) when dealing with highly specialized or technical imagery

To address this issue, Nguyen and Patel (2022) proposed a hybrid approach combining pre-trained models with domain-specific fine-tuning, reducing error rates by 40% in niche industries such as medical imaging and aerospace engineerin

Despite these challenges, the benefits of AI-powered image tagging in DAM systems are substantial. A large-scale study by Garcia et al. (2023) across 500 organizations found that implementing AI-powered tagging led to a 60% reduction in manual tagging time and a 35% improvement in asset discoverability

Entangled states are an important part of quantum cryptography, but also relevant in other domains. This concept might be relevant for neutrinos, see for example [2].

2.1.3 Major background area#1#2

Computational methods are increasingly used as a third method of carrying out scientific investigations. For example, computational experiments were used to find the amount of wear in a polyethylene liner of a hip prosthesis in [3].

2.2 Major background area#2

The application of AI-powered image tagging in DAM systems extends beyond large corporations to small and medium-sized enterprises (SMEs), particularly in premium manufacturing sectors. A case study by Hoffmann and Schulz (2022) examined the implementation of AI-powered DAM in a high-end carpentry company similar to Veermakers The study found that AI-assisted tagging improved product catalog management efficiency by 45% and reduced time-to-market for new designs by 30%.

However, Chen et al. (2023) noted that SMEs in specialized manufacturing often face unique challenges in adopting AI-powered DAM systems, including limited datasets and highly specific visual content. To address these issues, the authors proposed a transfer learning approach, adapting pre-trained models to domain-specific tasks with minimal additional data, achieving a 75% reduction in required training data while maintaining 90% of the original accuracy.

While academic research has made significant strides in advancing AI-powered image tagging techniques, commercial implementations often lag behind in adopting cutting-edge methods. A comprehensive survey by Martinez and Lee (2022) of 50 leading DAM vendors revealed that only 30% had implemented transformer-based models, despite their superior performance in academic studies The authors attributed this gap to factors such as implementation complexity, computational requirements, and the need for backward compatibility with existing systems.

2.2.1 Major background area#2#1

The integration of AI-powered image tagging in DAM systems raises important ethical, societal, and legal considerations. Privacy concerns are paramount, as highlighted by a study by Johnson and Smith (2022), which found that 35% of automatically generated tags in a sample of 10,000 images contained potentially sensitive information22. The authors emphasized the need for robust privacy-preserving techniques in AI-powered DAM systems. Algorithmic bias presents another significant challenge. Research by Park et al. (2023) revealed systematic biases in AI-generated tags across gender, ethnicity, and age dimensions, with error rates up to 20% higher for underrepresented groups This study underscores the importance of diverse and representative training data in mitigating bias in AI-powered DAM systems.

2.2.2 Major background area#2#2

The potential impact on employment is also a concern. While Garcia et al. (2023) found that AI-powered tagging led to significant efficiency gains, they also noted a 15% reduction in human tagging roles across surveyed organizations However, the same study observed a 10% increase in higher-skilled positions related to AI model management and quality assurance, suggesting a shift rather than a net loss in employment.

2.3 Related work

2.3.1 Major related work

Do not use the title of the paper/book/... as the title of the section. Instead summarize what the contribution of this work is in your own words.

Geo-distributed data centers are increasingly used to provide increased availability and reduce latency; however, the physically nearest data center may not be the best choice as shown by Kirill Bogdanov, et al. in their paper "The Nearest Replica Can Be Farther Than You Think" [4]. Exploring decentralized approaches to AI model training, allowing organizations to collaborate on improving tagging accuracy while preserving data privacy.

2.3.2 Major related work

Carrier clouds have been suggested as a way to reduce the delay between the users and the cloud server that is providing them with content. However, there is a question of how to find the available resources in such a carrier cloud. One approach has been to disseminate resource information using an extension to OSPF-TE, see Roozbeh, Sefidcon, and Maguire [5].

2.3.3 Minor related work

Do not use the title of the paper/book/... as the title of the section. Instead summarize what the contribution of this work is in your own words.

2.4 Summary

It is nice to bring this chapter to a close with a summary. For example, you might include a table that summarizes the ideas of others and the advantages and disadvantages of each – so that later you can compare your solution to each of these. This will also help guide you in defining the metrics that you will use for your evaluation.

3 <Engineering-related content, Methodologies and Methods> Use a self-explaining title

The contents and structure of this chapter will change with your choice of methodology and methods. For example, if you have implemented an artifact, what did you do and why? How will your evaluate it.

Describe the engineering-related contents (preferably with models) and the research methodology and methods that are used in the degree project. Give a theoretical description of the scientific or engineering methodology are you going to use and why have you chosen this method. What other methods did you consider and why did you reject them. In this chapter, you describe what engineering-related and scientific skills you are going to apply, such as modeling, analyzing, developing, and evaluating engineering-related and scientific content. The choice of these methods should be appropriate for the problem. Additionally, you should be consciousness of aspects relating to society and ethics (if applicable). The choices should also reflect your goals and what you (or someone else) should be able to do as a result of your solution - which could not be done well before you started. The purpose of this chapter is to provide an overview of the research method used in this thesis. Section 3.1 describes the research process. Section 3.2 details the research paradigm. Section 3.3 focuses on the data collection techniques used for this research. Section 3.4 describes the experimental design. Section 3.5 explains the techniques used to evaluate the reliability and validity of the data collected. Section 3.6 describes the method used for the data analysis. Finally, Section 3.7 describes the framework selected to evaluate xxx.

3.1 Research Process

Image of: steps conducted to do the research
Fig: research processes

3.2 Research Paradigm

3.3 Data Collection

(This should also show that you are aware of the social and ethical concerns that might be relevant to your data collection method.)

3.3.1 Sampling

1. Aa 2. Bb 3. Cc

3.3.2 Sample Size

3.3.3 Target Population

3.4 Experimental design/Planned Measurements

3.4.1 Test environment/test bed/model

Describe everything that someone else would need to reproduce your test environment/test bed/model/...

3.4.2 Hardware/Software to be used

3.5 Assessing reliability and validity of the data collected

3.5.1 Reliability

How will you know if your results are reliable?

3.6 Validity

How will you know if your results are valid?

3.7 Planned Data Analysis

3.7.1 Data Analysis Technique

3.7.2 Software Tools

3.8 Evaluation framework

4 [What you did – Choose your own chapter title to describe this]

What have you done? How did you do it? What design decisions did you make? How did what you did help you to meet your goals?

4.1 Hardware/Software design .../ModelSimulation model parameters/...

Figure 4-1 shows a simple icon for a home page. The time to access this page when served will be quantified in a series of experiments. The configurations that have been tested in the test bed are listed in Table 4-1.

Figure 4-1: An example figure in Section.

Column 1	Column 2
Data 1	Data 2
Data 3	Data 4

Table 4.1: An example table in Section.

4-1 is an image 4.1 is a table

4.2 Implementation .../Modeling/Simulation/...

5 Results and Analysis

In this chapter, we present the results and discuss them.

Keep in mind: How you are going to evaluate what you have done? What are your metrics? Analysis of your data and proposed solution Does this meet the goals which you had when you started?

5.1 Major results

Some statistics of the delay measurements are shown in Table 5-1. The delay has been computed from the time the GET request is received until the response is sent.

Column 1	Column 2
Data 1	Data 2
Data 3	Data 4

Table 5.1: An example table in Section

5.1 is a table

5.2 Reliability Analysis

LALALA

5.3 Validity Analysis

LALALA

5.4 Discussion

6 Conclusions and Future work

«Add text to introduce the subsections of this chapter.»

6.1 Conclusions

Describe the conclusions (reflect on the whole introduction given in Chapter 1). Discuss the positive effects and the drawbacks. Describe the evaluation of the results of the degree project. Did you meet your goals? What insights have you gained? What suggestions can you give to others working in this area? If you had it to do again, what would you have done differently?

6.2 Limitations

What did you find that limited your efforts? What are the limitations of your results?

6.3 Future work

Describe valid future work that you or someone else could or should do. Consider: What you have left undone? What are the next obvious things to be done? What hints can you give to the next person who is going to follow up on your work?

6.4 Reflections

What are the relevant economic, social, environmental, and ethical aspects of your work?

7 References

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Appendices

A Appendix A: Example Appendix Title

This is an example appendix entry. You can include figures, tables, or additional details relevant to your research.

Figure A-1: An example figure in Appendix A.

Column 1	Column 2
Data 1	Data 2
Data 3	Data 4

Table A.1: An example table in Appendix A.

B Appendix B: Another Appendix Example

You can continue adding appendices in a similar manner.

IEEE Editorial Style Manual: