



CAPSTONE PROJECT

INFO8687

GROUP 1

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Title: Final Report



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Executive Summary

This project presents a cutting-edge AI-powered image search engine designed specifically for Canadian Tire's online shops, mobile apps, and gift registry service. Using cutting-edge artificial intelligence (AI) capabilities, the solution seeks to improve customer satisfaction and product discovery while revolutionizing the shopping experience.

The proposed system uses state-of-the-art image recognition technology, allowing users to upload or take pictures and easily search for products. By removing the requirement for conventional keyword-based searches and accommodating a wide range of user preferences, this user-friendly feature enhances accessibility and convenience.

This initiative's primary goals are as follows:

- **Improving the Customer Experience:** Making finding products on Canadian Tire's platforms easier, especially the gift registry service, will guarantee quicker and more precise search results.
- **Driving E-commerce Growth:** Increasing omnichannel capabilities through alignment with the larger digital transformation plan of Canadian Tire.
- **Enhancing Operational Efficiency:** Using AI to improve product suggestions, inventory management, supply chain, and customer interaction.

The implementation is consistent with Canadian Tire's dedication to customer-centricity and technical innovation. By integrating this technology, the company hopes to increase online engagement, generate revenue growth, and strengthen its competitive position in the retail industry. This initiative represents a strategic step toward meeting evolving consumer expectations and harnessing the power of AI to redefine the retail landscape.

List of Team Members and Responses

Team Members	Roles	Response
Abisola Anuoluwapo Daini	Market Analyst	Conducts market research and competitive analysis.
Akeem Oluwatosin Amusa	Financial Analyst	Leads financial analysis tasks to evaluate project viability.
Chimezie Victor Chime		
Oluwasegun Ogunrinde	Project Manager	Oversees project progress and ensures timely completion of milestones.
Nayan Gurung	Business Strategist	Responsible for SWOT analysis and evaluating competitive insights.
Jacob Smith Rajendran	Data Analyst	Analyzes and interprets data to guide decisions and improve outcomes



Overview of Selected Company

The well-known Canadian retail corporation Canadian Tire Corporation, Limited was founded in 1922 by brothers J.W. and A.J. Billes and had its main office in Toronto, Ontario. The company offers a wide selection of goods and services suited to the Canadian way of life through its extensive network of more than 1,700 retail locations nationwide.

Key Retail Banners:

- Retail Canadian Tire: The leading brand sells hardware, home goods, sports and leisure gear, and automobiles.
- SportChek: Serves sports fans with a focus on athletic wear and gear.
- Mark's: Provides business and casual attire, emphasizing everyday wear and workwear.
- Helly Hansen: Purchased in 2018, this company sells high-performance workplace and outdoor apparel.

Financial Services:

Canadian Tire Financial Services provides various financial services like insurance, credit cards, and in-store financing. The business founded Canadian Tire Bank in 2003 to improve its financial services capabilities.

Loyalty Program:

The Triangle Rewards™ program allows customers to collect and redeem Canadian Tire Money® across various banners, enhancing customer engagement and loyalty.

Recent Developments:

In May 2018, Canadian Tire expanded into the clothing market by acquiring Helly Hansen, a Norway-based outdoor brand. As of December 2021, the company operates 667 Canadian Tire stores, 397 SportChek stores, and 381 Mark's stores. The current President and CEO is Greg Hicks. Canadian Tire's commitment to innovation and customer satisfaction has solidified its position as a leading retailer in Canada, continually adapting to meet the evolving needs of Canadian consumers.

Competitive Analysis Findings

Canadian Tire Corporation faces fierce competition from domestic and foreign businesses in its highly competitive retail sector. The market position and strategic potential of Canadian Tire are revealed by a thorough examination of its main rivals, Loblaw Companies Limited, Walmart Inc., and The Home Depot.

SWOT Analysis:

SWOT Analysis for CANADIAN TIRE CORPORATION

S	Strengths	W	Weakness
1	Brand Heritage and Recognition: Canadian Tire is a well-known and enduring brand that has garnered the respect and allegiance of Canadian customers throughout the years. Being recognized is a big help in drawing in and keeping clients. (Canadian Tire SWOT Analysis, 2024)	1	Geographic Concentration: Canadian Tire is vulnerable to economic downturns in Canada due to its reliance on the home market.
2	Product Variety: Canadian Tire provides an extensive range of goods to meet the needs of a wide range of clients and minimize dependency on any one area.	2	Competitors: Canadian Tire's market share and profitability are threatened by fierce competition from domestic and foreign retailers, including online platforms.
3	Broad Retail Network: Canadian Tire operates numerous sites that are easily accessible to customers nationwide, including SportChek, Helly Hansen, and other stores.	3	Operational Complexity: Managing several service and product lines under different banners adds to the complexity of operations and may reduce agility.
4	Financial Services: Canadian Tire increases customer loyalty and diversifies its revenue streams outside of retail by providing insurance, financing options, and branded credit cards.	4	Vulnerabilities in the Supply Chain: Impacts on Inventory and Product Availability: Supply chain disruptions can hurt inventory levels and customer satisfaction.
5	Technology and Digital Method: Canadian Tire is enhancing its digital capabilities by strongly emphasizing e-commerce, mobile apps, and digital marketing in response to shifting consumer preferences.	5	Digital Presence: Canadian Tire needs help competing with internet merchants that provide more convenience and cheaper rates. (Canadian Tire SWOT Analysis, 2024)
6	Loyalty Program: The Triangle Rewards program, available for all Canadian Tire brands, encourages repeat business and cultivates consumer loyalty.		
7	Real Estate Holdings: Canadian Tire has stability, control over operating expenses, and the possibility to generate rental income from owning a sizeable portion of its retail and distribution buildings.		
8	Supply Chain Integration: Canadian Tire's supply chain improvements boost productivity, cut expenses, and guarantee on-time product delivery to uphold high customer satisfaction. (Canadian Tire SWOT Analysis, 2024)	4	
O	Opportunities	T	Threats

1	E-commerce Growth: By strengthening its web infrastructure and establishing a smooth omnichannel experience, Canadian Tire can become more competitive in the expanding e-commerce space.
2	Market diversification: Reaching out to foreign markets can bring in additional money and lessen dependency on the
3	Sustainable Products: Growing environmentally friendly products satisfies consumer demand for environmental responsibility and sustainability.
4	Growth of Private Label: By growing its label brands, such as Mastercraft and Motomaster, Canadian Tire may increase profit margins and set itself apart from rivals.
5	Technological Innovations: Investing in IoT and AI can improve customer service, inventory control, and operational effectiveness.
6	Acquisitions with a strategic focus: Canadian Tire can expand its consumer base and product offerings by acquiring comparable companies. (Canadian Tire SWOT Analysis, 2024)

1	Intense Competition: Big-box stores, specialized businesses, and internet merchants like Amazon frequently use aggressive pricing and marketing methods, which pose a severe threat to Canadian Tire.
2	Economic Fluctuations: Economic downturns directly impact Canadian Tire's sales and performance, increasing unemployment and decreasing consumer spending.
3	Changing Customer Preferences: Canadian Tire must continually adjust to changing consumer behaviors, such as the growing desire for online shopping and sustainable products to remain competitive.
4	Disruptions to the Global Supply Chain: Events like pandemics or natural disasters can cause global supply chain problems, resulting in product shortages and higher costs for Canadian Tire.
5	Regulations: New labor, trade, or environmental laws that raise operating expenses may impact Canadian Tire's profitability.
6	Currency fluctuations: Canadian Tire's profit margins are squeezed by higher import expenses brought on by a declining Canadian currency. (Canadian Tire SWOT Analysis, 2024)

SWOT ANALYSIS FOR LOBLAW

S Strengths		W Weakness	
1	Innovation History: Loblaw always maintains its leadership position in the market by demonstrating excellence in consumer-driven innovation. (EMBA Pro, 2022)	1	Declining Market Share: Loblaw's market share is declining despite rising revenues as the supermarket industry expands faster than the company. (EMBA Pro, 2022)
2	Broad product offering: Its wide range of items facilitates the company's ability to serve different grocery industry consumer segments. (EMBA Pro, 2022)	2	Low Customer Service Investment: Competitors may obtain an edge from low customer service investment, underscoring the need for more R&D in this area. (EMBA Pro, 2022)
3	Specific Client Segments: Loblaw can reach various demographics and diversify its income sources due to its range of products. (EMBA Pro, 2022)	3	Supplier Loyalty: Loblaw's supply chain's regular price reductions hurt relationships and caused it to struggle with supplier loyalty. (EMBA Pro, 2022)
4	Widespread Geographic Presence: Loblaw offers good customer service and adeptly handles competitive issues due to its extensive dealer and associate network.	4	High Employee Turnover: Higher costs to retain talent result from high employee turnover at lower levels. (EMBA Pro, 2022)
5	Strong Brand Recognition: Loblaw can charge premium pricing in the supermarket industry thanks to its well-known brands. (EMBA Pro, 2022)	5	Expensive Supply Chain Redesign: As e-commerce and artificial intelligence become more prevalent, a new supply chain must be heavily invested in, raising operating expenses. (EMBA Pro, 2022)
6	First-Mover Advantage: Loblaw's rapid market share growth in the highly competitive supermarket industry results from its early entry into the market. (EMBA Pro, 2022)		Reliance on Knowledge Base: Loblaw would face significant expenses and challenges in replacing essential personnel with expertise. (EMBA Pro, 2022)
O Opportunities		T Threats	
1	Growing Customer Base: Loblaw can attract new clients in lower market segments with cost-effective services as the industry transitions to licensed operators. (EMBA Pro, 2022)	1	Changing Demographics: Loblaw may have short-term gains following the retirement of baby boomers, but it will face long-term issues as younger consumers are less brand loyal. (EMBA Pro, 2022)
2	Transition to Premium Products: As consumers migrate toward more expensive goods, Loblaw can take advantage of its well-known brand in the premium sector. (EMBA Pro, 2022)	2	Competitive Pressures: Loblaw's vast customer base makes it more difficult to react quickly to requests from specific markets, and the supermarket industry's quicker manufacturing cycles enhance the competitive pressure. (EMBA Pro, 2022)
3	3. US Market Expansion: Loblaw may use its operational expertise to enter this competitive market as the US economy grows. (EMBA Pro, 2022)	3	Competitors Rallying: Despite being a pioneer in innovation, Loblaw is seeing increased competition from domestic and foreign companies. (EMBA Pro, 2022)
4	4. Low Inflation: Lower credit costs and a low inflation rate can encourage consumers to spend more on Loblaw products. (EMBA Pro, 2022)	4	Skilled Worker Shortage: A shortage of qualified workers may arise soon due to high employee turnover and an increased reliance on innovation. (EMBA Pro, 2022)
5	5. Stricter Rules for Competitors: The updated regulations increase the difficulty for unorganized players to compete, which gives Loblaw more chances to expand its customer base. (EMBA Pro, 2022)		
6	6. Adapting to Shifting Customer Preferences: Loblaw can take advantage of the rapidly evolving consumer preferences brought forth by rising disposable income and more product testing. (EMBA Pro, 2022)		

SWOT Analysis for Walmart

Strengths	W	Weakness
Strong Brand Recognition: Walmart is a well-known household name for its convenience and affordable costs due to its widespread brand recognition and persistent marketing initiatives. Walmart gains a competitive edge by attracting and keeping budget-conscious customers with the support of its strong brand. (Pereira, 2023).	1	Overdependence on the U.S. Market Despite its global reach, Walmart is highly dependent on U.S. revenues, which leaves it open to fluctuations in the country's economy. This over-reliance raises vulnerability to market swings and restricts expansion opportunities. (Pereira, 2023).
Efficient Supply Chain Management: Walmart uses RFID technology and a centralized distribution system to improve operations, cut costs, and boost productivity. Walmart can maintain product availability and reduce costs. (Pereira, 2023).	2	Labor Practices: Walmart has been under fire for its low pay and unpleasant working conditions, leading to negative publicity and a high percentage of employee turnover. These issues could damage the company's reputation and sap employee morale. (Pereira, 2023).
Diverse Revenue Streams: Walmart has several revenue streams from its broad product offering and forays into sectors like healthcare and finance. This diversity enhances financial stability by lowering reliance on any one market area. (Pereira, 2023).	3	Limited E-commerce Presence: Walmart cannot fully capitalize on the burgeoning online buying market since its e-commerce platform, despite its growth, still lags, and it needs to catch up with Amazon. This makes it harder to draw in tech-savvy customers. (Pereira, 2023).
Economies of Scale: Walmart's extensive worldwide operations enable them to spread expenses over more products and bargain with suppliers for lower prices. This supports investments in cutting-edge technology and keeps costs low. (Pereira, 2023).	4	Inconsistent Customer Service: Walmart's customer service differs depending on the area; long wait times and unclean stores are among the complaints. Customer dissatisfaction and reputational damage can result from inconsistent service. (Pereira, 2023).
Solid Customer Base: Walmart has millions of devoted customers around the globe, which brings in a consistent flow of income and valuable consumer information. This consumer loyalty bolsters long-term success and market position (Pereira, 2023).	5	Thin Profit Margins: Walmart's low-cost business model leaves them with narrow profit margins, making significant sales volumes necessary to stay profitable. Due to this vulnerability, the company is vulnerable to labor and raw material cost changes. (Pereira, 2023).

Opportunities	T	Threats
Global Expansion: Walmart has the potential to penetrate the worldwide market further, given its presence in 27 nations. By entering other markets, a company can diversify its revenue sources and reduce its need in the US market. (Pereira, 2023).	1	Intense Competition: Walmart's profit margins are negatively impacted by the fierce competition it receives from major retailers such as Amazon, Target, and Costco. This also compels Walmart to innovate and invest in enhancing consumer experiences consistently. (Pereira, 2023).
E-commerce Growth: Walmart's online grocery delivery and pickup services are strategically positioned to increase its market share, considering the growing demand for e-commerce worldwide. Walmart's competitive advantage over Amazon is further strengthened by its strategic acquisitions and Walmart+ membership program. (Pereira, 2023).	2	Economic Downturns: Consumer spending declines during recessions, and consumers may shop at discount stores or for less expensive goods. Walmart needs to modify its product offerings and pricing to stay competitive in these markets. (Pereira, 2023).

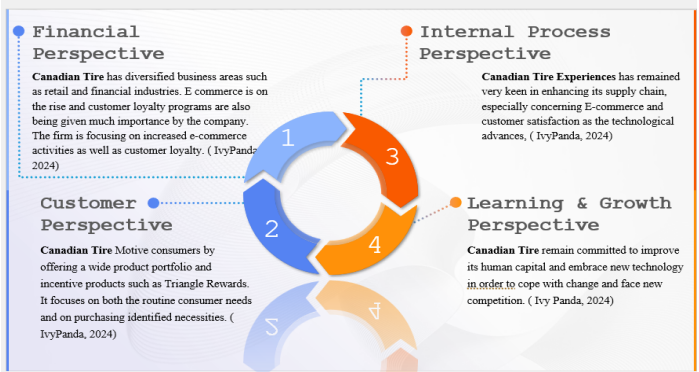
<p>Demand for Environmentally: Walmart has the potential to fulfill the growing demand from consumers for sustainable items by endorsing eco-friendly initiatives and capitalizing on its supplier relationships. Expanding its sustainability initiatives boosts brand recognition and attracts eco-aware clients. (Pereira, 2023).</p>	<p>3 Changing Consumer Preferences: Walmart may need to adjust to changes in consumer behavior, such as a desire for eco-friendly products or a rise in internet shopping. To provide relevant items and experiences, Walmart must keep up with the latest trends. (Pereira, 2023).</p>
<p>Diversification: By reducing reliance on retail alone, Walmart can grow by increasing the range of financial and healthcare services. This diversification creates new revenue streams in high-demand industries while enhancing consumer loyalty. (Pereira, 2023).</p>	<p>4 Increasing regulatory scrutiny: Government-imposed taxes, tariffs, and labor laws are just a few of the increasing regulatory challenges Walmart faces that may restrict its activities. Regular legal investigations into labor practices could harm the business's standing and result in expensive fines. (Pereira, 2023).</p>
<p>Technological Advancements: Walmart can enhance customer experience and optimize supply chain management by allocating resources towards artificial intelligence, data analytics, and automation. In the changing retail market, Walmart will benefit from technological developments to maintain its competitiveness. (Pereira, 2023).</p>	<p>5 Litigation: Every year, Walmart is dragged into thousands of lawsuits that can cost the company money in settlements and legal bills. The company's reputation and relationships with stakeholders, including employees and customers, may suffer due to this litigation. (Pereira, 2023).</p>

SWOT ANALYSIS FOR HOME DEPOT

S	Strengths	W	Weakness
1	Helpful Staff: Skilled employees offer knowledgeable guidance, enhancing customer loyalty and satisfaction. (Pereira, 2023).	1	Inadequate store layout: Customers' shopping experiences need to be improved by more apparent layouts that make it easier to find things. (Pereira, 2023).
2	Online Shopping Experience: Convenience is increased with an easy-to-use platform that offers comprehensive information and a variety of delivery options. (Pereira, 2023).	2	Long checkout lines: Customer dissatisfaction results from lengthy peak-hour wait times. (Pereira, 2023).
3	Convenient Store Locations: Stores are positioned for maximum convenience throughout North America. (Pereira, 2023).	3	High prices: Price-conscious consumers seek better offers from rival businesses due to higher prices. (Pereira, 2023).
4	Innovation and Technological Advancements: Cutting-edge technologies like augmented reality and smart home solutions enhance the consumer experience. (Pereira, 2023).	4	Inconsistent customer service: Customers need clarification and irritation due to location-specific differences in service quality. (Pereira, 2023).
5	Corporate Social Responsibility: Home Depot improves its reputation by helping communities through charitable giving and disaster relief. (Pereira, 2023).	5	Environmental concerns: Home Depot's appeal to environmentally sensitive consumers is harmed by criticism of its sustainability policies. (Pereira, 2023).
6	Pro Services for Contractors Specialized services for contractors include dedicated representatives and bulk procurement. (Pereira, 2023).	6	Limited product selection: Customers might shop elsewhere if niche products are less available than in specialized stores. (Pereira, 2023).
7	Strong Supplier Relationships: Good supplier relationships guarantee product availability and affordable prices (Pereira, 2023).	7	Stiff competition: Home Depot is continually forced to innovate and compete on pricing due to fierce competition from Lowe's (Pereira, 2023).
O	Opportunities	T	Threats
1	Home renovation market: Growing demand for renovations enables Home Depot to provide comprehensive solutions and increase sales. (Pereira, 2023).	1	Shifting consumer preferences: Trends toward minimalism and sustainability could reduce the market for conventional goods. (Pereira, 2023).
2	DIY culture: Home Depot can interact with customers by offering workshops and tutorials through DIY projects. (Pereira, 2023).	2	Increasing raw material costs: Rising material prices could jeopardize profit margins if expenses are not passed on to customers. (Pereira, 2023).
3	Home automation and innovative technology: Innovative technology presents an opportunity to broaden product and service offerings in response to the growing demand for smart home appliances. (Pereira, 2023).	3	Changing housing market: Variations in the housing market lower demand for products related to renovation (Pereira, 2023).
4	Expansion into new markets: Reaching undiscovered clientele and fostering growth can be achieved by venturing into new markets (Pereira, 2023).	4	Online retailers: Amazon's convenient and competitive pricing threatens Home Depot's market share. (Pereira, 2023).
		5	Regulatory changes: Trade laws and regulation modifications may increase expenses and operational difficulties. (Pereira, 2023).

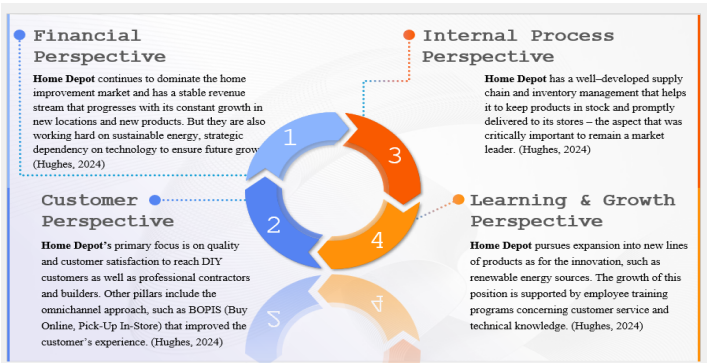
Balance Scorecard

BALANCE SCORECARD FOR CANADIAN



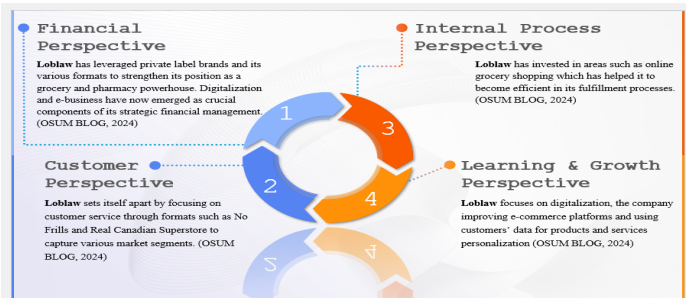
(Patterson, 2024) (IvyPanda, 2024) Image version:4.0

BALANCED SCORECARD FOR HOME DEPOT.



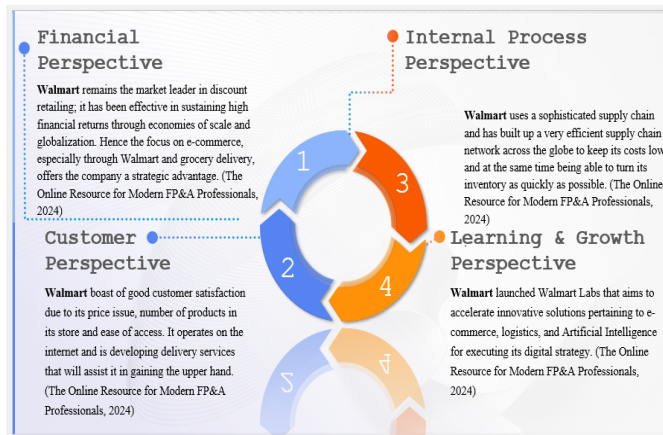
(Hughes, 2024) (Patterson, 2024) Image version:4.1

BALANCED SCORECARD FOR LOBLAW.



(Patterson, 2024) (OSUM BLOG, 2024) Image version:4.

BALANCED SCORECARD FOR WALMART.



(Patterson, 2024) (The Online Resource for Modern FP&A Professionals, 2024) *Image version:4.*

Pestel Analysis

PESTLE ANALYSIS FOR HOME DEPOT



(template, 2008) (PESTLEanalysis Team, 2020) (S&P

SWOT & PESTLE.com, 2023) *Image version:4.4*

PESTLE ANALYSIS FOR LOBLAW:



(template, 2008) (PESTLEanalysis Team, 2020) (S&P SWOT & PESTLE.com, 2023) *Image version:4.*

PESTEL ANALYSIS FOR CANADIAN TIRE:

P	E	S	T	E	L
<ul style="list-style-type: none"> Impact from US-China trade war on business operations (S&P, 2023). Canadian economy affected by low oil prices (S&P, 2023). 	<ul style="list-style-type: none"> Currency fluctuations affecting sourcing from third-party suppliers (S&P, 2023). Shift in customer preference from offline to e-commerce (S&P, 2023). Growing trend of electric and hybrid vehicle use (S&P, 2023). 	<ul style="list-style-type: none"> Consumers increasingly switching to online shopping (S&P, 2023). Interest in electric and hybrid vehicles (S&P, 2023). 	<ul style="list-style-type: none"> Introduction of smart technology in performance and safety apparel/footwear (S&P, 2023). Leveraging e-commerce solutions to enhance customer experience (S&P, 2023). Installation of fast-charging networks for electric vehicles (S&P, 2023). 	<ul style="list-style-type: none"> Commitment to a zero-carbon future with the adoption of electric vehicles (S&P, 2023). Focus on efficient chemical management for products (S&P, 2023). 	<ul style="list-style-type: none"> Petroleum segment faces numerous federal and provincial regulations (S&P, 2023).

(PESTLEanalysis Team, 2020) (S&P SWOT & PESTLE.com, 2023) (template, 2008) *Image version:4.6*

PESTEL ANALYSIS FOR WALMART:

P	E	S	T	E	L
<ol style="list-style-type: none"> Walmart must abide by laws everywhere it goes; political instability, like in China, can cause business interruptions. Like the \$15/hour bill, raising the minimum wage increases pressure on profitability (PESTLEanalysis Team, 2020, para. 55). 	<ol style="list-style-type: none"> Consumer spending declines during economic downturns impact Walmart's low-price strategy. Taxes and interest rates vary by region, which affects pricing and profitability (PESTLEanalysis Team, 2020.8) 	<ol style="list-style-type: none"> Walmart may suffer losses if it doesn't adjust to local markets, as demonstrated in Germany. The growing desire for organic and healthy goods has impacted Walmart's selection. While improving, online shopping still needs to catch up to Amazon to meet customer needs (PESTLEanalysis Team, 2020) 	<ol style="list-style-type: none"> Walmart improves operations and order fulfillment by using automation and robotics. The business must contend with fierce competition despite increasing internet presence (PESTLEanalysis Team, 2020). 	<ol style="list-style-type: none"> Labor rules, such as those in California, were broken, resulting in a \$65 million settlement. Compliance with legal requirements is necessary to prevent penalties and business interruptions (PESTLEanalysis Team, 2020). 	<ol style="list-style-type: none"> Walmart started Project Gigaton to reduce emissions while facing criticism for its environmental practices. Falling short of sustainability targets could harm the company's standing among environmentally sensitive consumers (PESTLEanalysis Team, 2020).

(PESTLEanalysis Team, 2020) (S&P SWOT &

PESTLE.com, 2023) (template, 2008) *Image version:4*

Description of the Problem to Be Solved

Canadian Tire faces a growing challenge in maintaining its competitive edge within the evolving e-commerce landscape. Despite offering robust traditional search functionalities like barcode scanning, the company lacks advanced digital tools to address modern customer expectations for convenience and speed. The current limitations in product discovery hinder the customer experience, particularly in areas like the Gift Registry and Watchlist, where users demand seamless and intuitive interactions.

Customers often struggle with finding products due to:

- Text-Only Search Limitations:** The reliance on text-based queries makes it difficult for customers to locate items, especially when they lack precise product descriptions or names.
- Rising Customer Expectations:** With industry leaders like Amazon adopting AI-powered technologies, Canadian Tire risks falling behind in delivering personalized and innovative shopping experiences.
- Competitive Pressure:** The absence of advanced search functionalities negatively impacts Canadian Tire's ability to compete with more agile e-commerce players offering enhanced customer-centric tools.

4. **Lack of Integration Across Platforms:** Gift Registries and Watchlists rely heavily on manual additions and limited search features, creating friction for users managing their lists.

Selected Project

AI-Powered Image Search Initiative

This project proposes the implementation of an **AI-powered image search feature** across Canadian Tire's digital platforms, including the Gift Registry, Watchlist, and mobile app. This solution addresses the outlined challenges by enabling customers to upload images of products they wish to find, streamlining the discovery and selection process.

Key Components of the Project

Advanced Image Recognition Technology: Leveraging AI and machine learning to identify and match products from uploaded images.

1. **Seamless Integration:** Ensuring the feature integrates smoothly with Canadian Tire's existing e-commerce platforms, Gift Registry, and Watchlist.
2. **Enhanced User Interface (UI):** Designing a simple and intuitive interface for customers to upload images and explore search results.
3. **Security and Compliance:** Adhering to privacy regulations such as PIPEDA by anonymizing and encrypting user-uploaded images during processing.

Goals of the Project

- **Improve Customer Experience:** Provide a faster, more intuitive search option that caters to modern consumer behaviors.
- **Increase Engagement:** Simplify interactions with Gift Registries and Watchlists, encouraging higher user participation.
- **Boost Sales:** Reduce search friction, leading to higher conversion rates and overall revenue growth.
- **Strengthen Competitive Position:** Establish Canadian Tire as a forward-thinking retailer capable of rivalling major e-commerce competitors.

Business Requirements

The business requirements outline the fundamental needs and objectives to ensure the project's success. These requirements focus on delivering value by addressing current challenges, enhancing efficiency, and meeting stakeholder expectations.



Business Requirements Document

Company Name	Date
AJACON IT Solution	9/25/2024
Project Name	Created by
Initiative Proposal for (Canadian Tire Corporation)	Business Analysis Team

Need Statements

Canadian Tire faces inefficiencies with its barcode scan search feature, limited to in-store products. To meet the growing consumer demand for convenience, innovation, and online integration, it is essential to introduce AI-powered image search functionality across its Gift Registry, Watchlist, and other digital platforms.

This feature will enable users to upload images for seamless product discovery, enhancing their ability to find and manage items effortlessly across digital touchpoints.

Business Objectives (BO)

ID	Statement
BO-01	Implement an advanced image-based search to enhance product search accuracy by 15% within six months of project initiation.
BO-02	Improve product discovery by offering recommendations based on best-selling products, competitive pricing, and customer ratings within six months post-launch.
BO-03	Increase sales by 10% through up-selling related items based on image search results within one year of the image-based search implementation.
BO-04	Ensure user privacy and security by not storing uploaded images in the database from the first release of the product feature.

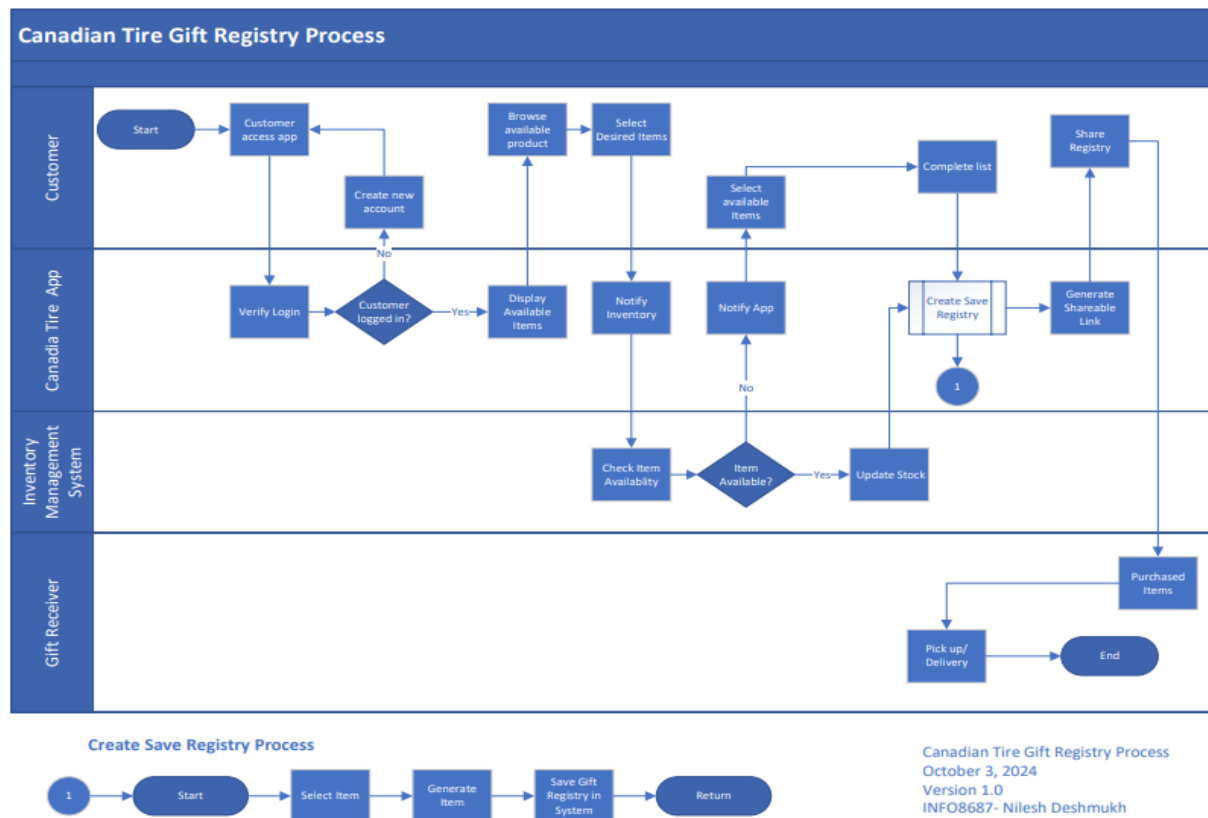
Functional Requirement

ID	Statement	Priority	Stakeholder Response	Status
FR-01	The system shall allow users to input images of the supported formats, including JPEG, PNG, and PDF, to support product search within the gift registry and the e-commerce platform.	Critical	Approved	Resolved
FR-02	The system shall be able to search based on the image uploaded and recommend suitable products with a high turnover rate and a low price and have received many compliments from customers.	Critical	Approved	Resolved
FR-03	The system shall employ strict security measures, including the authentication of the users and the encryption of the data to ensure that no one intrudes into the system, mainly through image uploads and search options.	Critical	Approved	Resolved
FR-04	The system shall incorporate a filtering mechanism to detect and block explicit or inappropriate content in user-uploaded images, ensuring a safe and user-friendly experience.	Critical	Approved	Resolved
FR-05	The system shall offer the users the price comparison of the matched product and suggest the lowest-priced product available.	Critical	Approved	Resolved
FR-06	The system should suggest upselling products based on user-uploaded images and their preferences. The system shall suggest other related or higher-category items depending on uploaded pictures and the user's behavior when browsing or purchasing items online.	High	Approved	Resolved
FR-06	The system shall first return more relevant products with higher customer reviews and ratings to increase the system's credibility with the users.	High	Approved	Resolved
FR-07	The system shall allow users to filter the search results, enabling them to view products within their desired budget range.	High	Approved	Resolved

FR-08	The system shall automatically detect and block explicit or inappropriate content in user-uploaded images to ensure a safe and compliant platform environment.	High	Approved	Resolved
FR-09	The system shall allow users to upload images in a single supported format.	Medium	Approved	Resolved
FR-10	The system shall be able to search products using the catalog, and the most reviewed and highest-rated products will sort the results.	Medium	Approved	Resolved
FR-11	The system shall offer an interface for presenting search results in a simple and navigational form to allow users to see images, prices, and product ratings.	Low	Approved	Resolved
FR-12	The system shall enable users to filter search results by categories, price range, and customer ratings, enabling a more specialized and compelling shopping experience.	Low	Approved	Resolved

As-Is Process Flow

The As-Is Process Flow illustrates the current operations, highlighting any gaps or obstacles in the system. This analysis serves as a foundation for developing improved workflows.



Overview of the Current Process

The current process involves multiple manual tasks, leading to inefficiencies and a higher likelihood of errors. Additionally, stakeholders engage with various disconnected systems, resulting in delays and inconsistent outcomes.

Challenges Identified:

1. Redundancies:

- Repeated data entry across several platforms.
- Lack of integration between platforms.

2. Manual Requirements:

- Routine tasks heavily depend on human intervention, increasing the likelihood of mistakes.

3. Gaps in Communication:






- Limited visibility for stakeholders regarding the status of processes.
- Inadequate feedback systems.

4. Delays in Time:



Prolonged turnaround times resulting from disjointed workflows.

Solution Requirements for the AI-Based Image Search System







Functional Requirements

Section	Requirement Identifying Number	Requirement Description	Requirement prioritization (H, M, L)	Traceability
Image Upload	FR-01	The system shall allow users to input images of the supported formats, including JPEG, PNG, and PDF, to support product search within the gift registry and the e-commerce platform.	High 	NFR-06
Product Search	FR-02	The system shall be able to search based on the image uploaded and recommend suitable products with a high turnover rate and a low price and have received many compliments from customers.	High 	NFR-01, NFR-02
Security	FR-03	The system shall employ strict security measures, including the authentication of the users and the encryption of the data to ensure that no one intrudes into the system, mainly through image uploads and search options.	High 	NFR-03
Content Filtering	FR-04	The system shall incorporate a filtering mechanism to detect and block explicit or inappropriate content in user-uploaded images, ensuring a safe and user-friendly experience.	High 	NFR-05
Price Comparison	FR-05	The system shall offer the users the price comparison of the matched product and suggest the lowest-priced product available.	High 	NFR-01

Upselling Suggestions	FR-06	<p>The system should suggest upselling products based on user-uploaded images and their preferences.</p> <p>The system shall suggest other related or higher-category items depending on uploaded pictures and the user's behavior when browsing or purchasing items online.</p>	High		NFR-01, NFR-04
Product Review	FR-07	The system shall first return more relevant products with higher customer reviews and ratings to increase the system's credibility with the users.	High		NFR-01
Budget Filtering	FR-08	The system shall allow users to filter the search results, enabling them to view products within their desired budget range.	High		NFR-05
Content Filtering	FR-09	The system shall automatically detect and block explicit or inappropriate content in user-uploaded images to ensure a safe and compliant platform environment.	High		NFR-05, NFR-03
Image Upload	FR-10	The system shall allow users to upload images in a single supported format.	Medium		NFR-06
Product Catalog Search	FR-11	The system shall be able to search products using the catalog, and the most reviewed and highest-rated products will sort the results.	Medium		NFR-01, NFR-04
User Interface	FR-12	The system shall offer an interface for presenting search results in a simple and navigational form to allow users to see images, prices, and product ratings.	Low		NFR-05
Privacy	FR-13	The system shall include a data minimization feature that ensures only necessary user-uploaded images and related metadata are collected by PIPEDA's data collection principles.	High		NFR-01, NFR-03

Privacy	FR-14	The system shall allow users to request the removal of their submitted photos whenever they choose, ensuring compliance with PIPEDA's data preservation and disposal guidelines.	High 	NFR-03, NFR-04
Search Filter	FR-15	The system shall enable users to filter search results by categories, price range, and customer ratings, enabling a more specialized and compelling shopping experience.	Low 	NFR-05

Non- Functional Requirements

Section	Requirement Identifying Number	Requirement Description	Requirement prioritization (H, M, L)	Traceability
Performance	NFR-01	The system shall deliver search results within 2 seconds to maintain an optimal user experience.	High 	FR-02
Scalability	NFR-02	The system shall be scalable to accommodate increased user traffic without any degradation in performance.	High 	FR-02
Security	NFR-03	The system shall ensure that all uploaded images are processed securely, complying with relevant data protection regulations.	High 	FR-09, FR-03
Availability	NFR-04	The system shall maintain a minimum uptime of 99.9% to provide consistent and reliable service to users.	High 	FR-06, FR-11
Usability	NFR-05	The system shall be designed to include a user-friendly graphical user interface acceptable to users of all levels of computer literacy.	Medium 	FR-04, FR-08, FR-09, FR-12, FR13
Compatibility	NFR-06	The system shall be compatible with various devices, including desktops,	Medium 	FR-01, FR-10

		tablets, and mobile phones, and support all major browsers.		
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To-be process

As Canadian Tire continues to expand its e-commerce offerings, the company faces increasing pressure to adopt advanced technologies to improve customer experience and stay competitive. One such technology is AI-powered image search, which allows customers to upload images of products they are interested in and receive matching or similar items from Canadian Tire's catalogue. This feature can be integrated into the Gift Registry, Mobile App, and online platforms, streamlining product discovery and enhancing user engagement.

Solution Option

Option A: Partnership with Technology Providers

Description:

Form a strategic partnership with technology providers specializing in AI and image recognition solutions. This approach allows Canadian Tire to leverage existing technology without fully outsourcing development or management.

Pros:

- Access to advanced technology and expertise while maintaining a level of control over implementation.
- Collaborative development can lead to tailored solutions that meet specific business needs.
- Potential for shared costs and risks, as well as ongoing innovation through collaboration.

Cons:

- May require additional management resources to coordinate and oversee the partnership.
- Shared decision-making can slow down implementation processes and limit flexibility.
- Potential for misalignment of goals between partners, impacting project success.

Potential Partners:

- Smaller specialized AI firms, tech incubators, or universities with strong AI programs that can provide cutting-edge solutions.

High-Level Design

Overview:

- The AI-powered image search solution will be co-developed with a technology partner, ensuring that Canadian Tire benefits from both industry expertise and customization.

Components:

- **User Interface (UI):** Co-developed app interface where customers can upload images and view search results.

- **Collaborative AI Processing:** The technology partner's AI infrastructure processes images, matches them with the product catalog, and returns results while ensuring alignment with Canadian Tire's systems.
- **Data Management:** Both partners will collaboratively manage secure data storage and processing, ensuring compliance with privacy regulations.
- **Integration with Canadian Tire Systems:** The solution will integrate seamlessly with Canadian Tire's existing e-commerce platform and databases, allowing real-time product availability, pricing, and inventory syncing.

Low-Level Design

Application Programming Interface (API):

- A jointly developed API will connect Canadian Tire's front-end systems to the partner's AI-powered backend, facilitating data requests, image uploads, and search results retrieval.

Data Flow:

- **Image Input:** Customers upload an image to the website or app.
- **API Request:** The image is sent to the partner's AI model via the API for processing.
- **Image Recognition:** The partner's AI model analyzes the image, matches it with catalog data, and returns relevant products.
- **Product Recommendation:** The search results are sent back through the API and displayed in the Canadian Tire interface with pricing and availability.

Security Protocols:

- Image data will be anonymized and encrypted during processing to ensure compliance with privacy regulations.

Impact Analysis (Djock, 2024)

- **On Operations:** Encourages collaboration and knowledge sharing between Canadian Tire and technology partners, leading to enhanced operational capabilities.
- **On Customer Experience:** Improved user experience with tailored image search capabilities that meet customer needs, promoting engagement and loyalty.
- **On Costs:** Shared costs may reduce the financial burden on Canadian Tire, although initial investment may still be necessary.

On Competitiveness: Enhances Canadian Tire's position in the market by adopting innovative technology and improving the overall shopping experience. (Djock, 2024)

Out-of-Scope

- **Full Control Over Development:** Canadian Tire will not have complete control over the development process as it will involve joint decision-making with the partner.
- **Integration with Legacy Systems:** The project will not address potential integration issues with older legacy systems; the focus will be on new technology.
- **In-Store Implementation:** The image search feature will be limited to digital platforms and will not extend to physical stores or point-of-sale systems.

Risk Analysis and Mitigation

Risk: Misalignment of Goals

- **Description:** Differences in priorities or goals between Canadian Tire and its technology partner could impact project success.
- **Mitigation:** Establish a clear partnership agreement outlining roles, responsibilities, and shared objectives. Regular check-ins and progress assessments will help align both parties throughout the project.

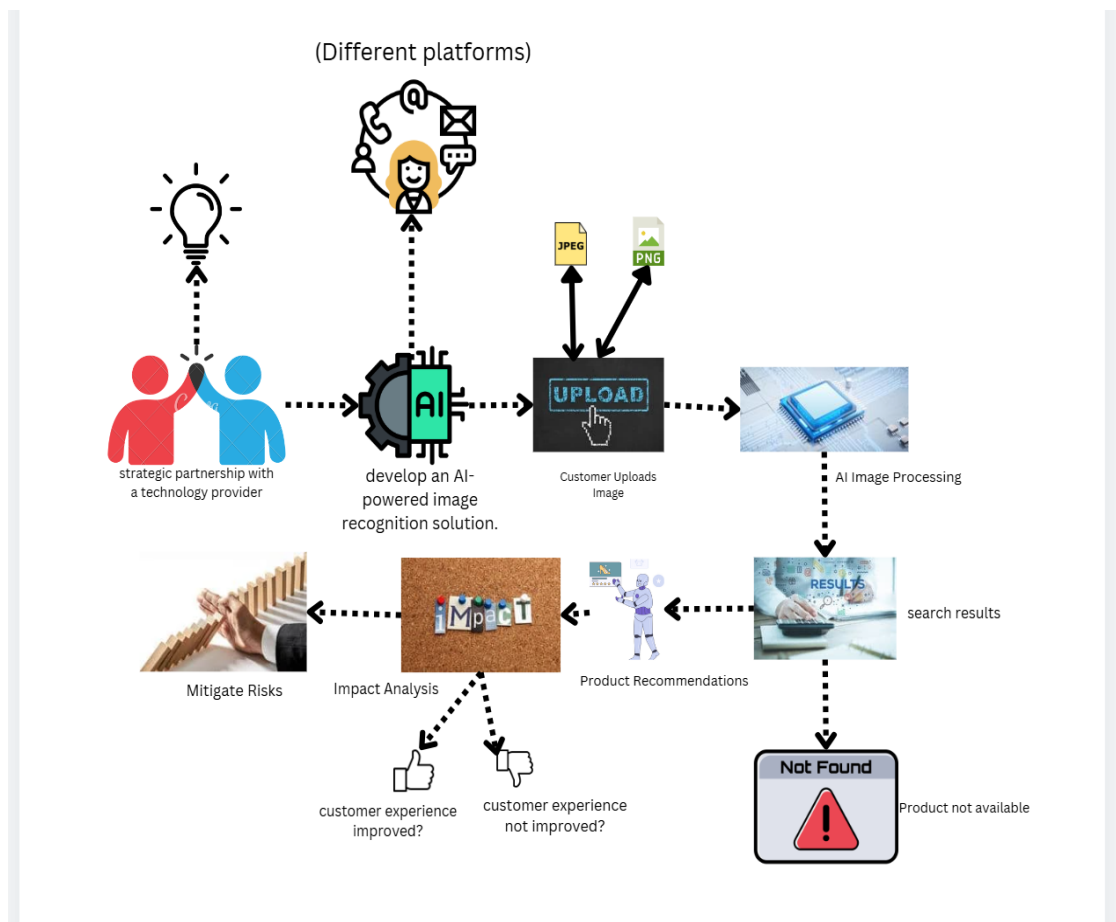


Fig1.1

Option B: Outsourcing

Description

Outsource the development and management of the AI-powered image search functionality to an experienced vendor. This can include the full solution, hardware, software, and data management, or select components.

Pros:

- Access to cutting-edge technology and expertise without the need for in-house resources. (Accenture, 2023)
- Reduced internal workload, allowing Canadian Tire to focus on core business activities.

- Flexible cost structure, potentially scaling up or down as needed.

Cons:

- Dependency on the vendor for ongoing support and updates.
- Limited control over customization and security measures.
- Risk of increased costs over time due to vendor reliance.

Potential Vendors: Accenture, Cognizant, Deloitte AI, and cloud providers like AWS, Google Cloud, or Azure for managed AI services. (Gartner, 2023)

High-Level Design

Overview: The AI-powered image search solution will be managed externally, with a vendor handling end-to-end development, deployment, and maintenance.

Components:

- **User Interface (UI):** User-facing app interface where customers can upload images and receive search results.
- **AI Processing:** The Vendor's catalog and AI infrastructure processes the image, matches it with the product catalog, and returns results.
- **Data Management:** Vendor manages secure storage of the product catalog and handles data processing according to privacy regulations.
- **Integration with Canadian Tire Systems:** The vendor's solution integrates with Canadian Tire's existing e-commerce platform and databases, syncing real-time product availability, pricing, and inventory data.

Low-Level Design

Application Programming Interface (API): Vendor's API will connect Canadian Tire's front-end systems to the AI-powered backend, handling data requests, image uploads, and returning search results.

Data Flow:

- **Image Input:** Customer js upload an image to the app or website.
 1. **API Request:** The image is sent to the vendor's AI model via API for processing.
 2. **Image Recognition:** The vendor's AI model analyzes the image, matches it with catalog data, and returns relevant products.
 3. **Product Recommendation:** Search results are sent back through the API, displayed in Canadian Tire's UI with pricing and availability.
- **Security Protocols:** Image data is anonymized, encrypted, and stored temporarily on vendor servers for processing, ensuring PIPEDA compliance.

Impact Analysis

- **On Operations:** Reduced burden on Canadian Tire's IT team, as the vendor will handle system maintenance, upgrades, and troubleshooting.
- **On Customer Experience:** Significant user experience enhancement, providing a seamless and intuitive product search feature that encourages engagement and repeat visits.

- **On Costs:** Reduced need for internal infrastructure investment, but ongoing vendor costs will vary depending on usage and pricing structure.
- **On Competitiveness:** Increases Canadian Tire's competitiveness by offering advanced search capabilities comparable to larger e-commerce players. (Deloitte, 2023)

Out-of-Scope

- **In-Store Integration:** The image search feature is limited to digital platforms and will not be integrated into in-store systems or point-of-sale devices.
- **Physical Infrastructure:** No physical servers or on-premises hardware will be included in this solution, as it relies on the vendor's cloud infrastructure.
- **Product Catalog Management:** The responsibility for maintaining an updated product catalog (e.g., product images and details) remains with Canadian Tire and is not managed by the vendor.

Risk Analysis and Mitigation

Risk: Vendor Dependency

- **Description:** Canadian Tire may become overly reliant on the vendor for updates, support, and customizations.
- **Mitigation:** Negotiate a Service Level Agreement (SLA) with defined support and maintenance terms. Include provisions for knowledge transfer and termination clauses if switching vendors becomes necessary.

Risk: Data Security Concerns

- **Description:** Handling customer-uploaded images and associated data increases the risk of data breaches or non-compliance.
- **Mitigation:** Ensure the vendor adheres to strict security protocols and data encryption standards. Conduct regular audits for PIPEDA compliance and data protection.

Risk: Cost Escalation Over Time

- **Description:** Ongoing vendor costs may increase as the solution scales.
- **Mitigation:** Choose a vendor with a predictable pricing model. Regularly review the contract and assess for cost-effectiveness. Plan for periodic cost-benefit evaluations.

Risk: Limited Customization and Control

- **Description:** Outsourcing may restrict Canadian Tire's ability to tailor the AI solution as market needs evolve.
- **Mitigation:** Work closely with the vendor to define initial requirements. Include customization capabilities in the vendor agreement to allow flexibility for updates.

Approach to Implementation

Cost:

- **Upfront Costs:** Expected initial setup fees in the range of \$50,000 - \$100,000, depending on vendor and required customizations.

- **Ongoing Costs:** Monthly costs estimated at \$10,000 - \$20,000 for data processing, storage, and maintenance. This figure will scale with user growth and data volume.

Quantity and Scalability:

- **User Traffic:** The vendor's cloud infrastructure will scale to accommodate fluctuating user demand, minimizing downtime.
- **Data Processing:** The expected capacity to handle thousands of image searches per day, scaling as needed without additional infrastructure investment from Canadian Tire.

Models and Features:

- **AI Models:** Custom image recognition models tailored for Canadian Tire's product categories, trained to recognize common products.
- **Additional Features:** API integration with Canadian Tire's e-commerce platform for real-time inventory updates and personalized product recommendations.



Fig 1.2

Option C: The Do-Nothing Method

Description

We considered this solution the 'do nothing' solution, which entails the organization doing nothing without engaging in any changes, inventing new technologies, or running any new processes. In this case, it would mean that Canadian Tire would continue with the current operational style and structure without incorporating the new image search using AI features into the mix or improving the Gift Registry process.

High-Level Design

- This solution keeps the current system unchanged without using any AI image search feature. They also



still use simple text-based box searches and can still scan barcodes.

Low-Level Design

- There are no adjustments in established machinery or systems in the business world.
- Keep on using the present search options.

Impact Analysis

Positive:

- No initial costs incurred.
- No risks associated with technology implementation or change management.
- The current infrastructure and operational processes remain stable and predictable

Negative:

- Missed opportunities to enhance customer engagement and increase sales through innovation.
- The organization risks falling behind competitors who are adopting similar AI-driven technologies.
- The customer experience may stagnate, leading to decreased satisfaction and loyalty in the long term.
- Future technology upgrades may become more complex as competitors and the industry advance.
- Lack of exposure to enhance client satisfaction, losing out in competition, client dissatisfaction, and low retention rates.

Out of Scope

- The use of any artificial intelligence or other advanced data processing system.
- Further improvements to the functions will help people to find what they are interested in.

Risk and Mitigation

Risk: Losing in competition against competitors who embraced the e-commerce initiative lowers the percentage of market share.

Mitigation: Continually consider market conditions and customer data to find moments when it will be appropriate to use AI.

Database Design

This intelligent search option is based on the application of AI, which is aimed at comparing the images and making recommendations according to the results. The service's database organization connects central data such as Products, Images, Users, Searches, and Feedback so that the necessary data is periodically transferred, and the specificity of the search is enhanced. It helps the clients organize the engagements and promotes the ease of purchase from one stage to another in a visually appealing structure.

Key Data elements and purpose.

Product Table

Purpose: Stores product-related information to support searches, filtering, and categorization.

- Product ID: Unique ID for each product (Primary key)
- Product Name: Product name in the catalog
- Category: Product classification (e.g., electronics, home decor)
- Brand: Manufacturer's name
- Description: Product features and applications
- Attributes: Product details like color, size, etc.
- Tags/Keywords: Search phrases to improve relevance

Image Table

Purpose: Manages product images and provides data for AI-based image search.

Fields:

- Image ID: Unique ID for each image (Primary key)
- Product ID: Links the image to a product (Foreign key)
- Image URL/Path: Location of the image file
- Metadata: File format, colour profile, resolution

Feature Embeddings: AI-generated vector for image similarity

User Table

Purpose: Stores user profiles and preferences for personalized searches and recommendations.

- User ID: Unique ID for each user (Primary key)
- User Profile Data: Demographics, interests, preferences
- Search History: Record of user searches

Search Query Table

Purpose: Logs user searches for analytics, trends, and recommendations.

- Query ID: Unique ID for each search query (Primary key)
- User ID: Links the query to a user (Foreign key)
- Query Text/Uploaded Image Reference: Text or image details for the search
- Timestamp: Date and time of the search

Feedback Table

Purpose: Collects user feedback on search results to improve relevance and accuracy.

- Feedback ID: Unique ID for each feedback entry (Primary key)
- User ID: Links feedback to a user (Foreign key)
- Product ID: Links feedback to a product (Foreign key)
- Relevance Score: Rating of search result relevance
- Comments: User-provided feedback

Recommendation Table (Optional)

Purpose: Stores personalized product recommendations for users.

- Recommendation ID: Unique ID for each recommendation (Primary key)
- User ID: Links recommendation to a user (Foreign key)



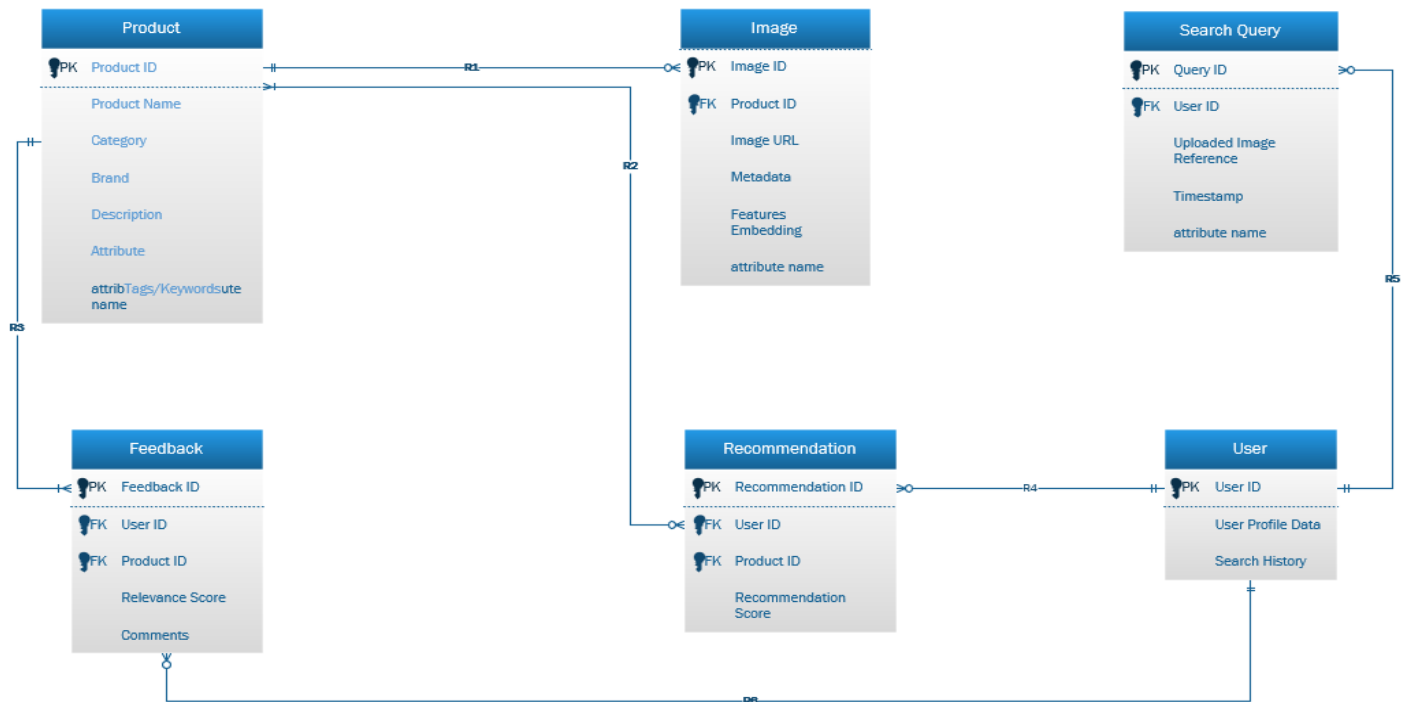
- Product ID: Links recommendation to a product (Foreign key)
- Recommendation Score: Algorithm-generated relevance score

Range of Value

Product Table	Image Table	User Table
Product ID: Alphanumeric Product Name: Text Category: Automotive, Hardware, Sports, Leisure, and Housewares Brand: Text Description: Text Attributes: Depending on the product type Tags/Keywords: Text	Image ID: Alphanumeric Product ID: Same as Product ID Image URL or Path: Text Metadata: JPEG, PNG, GIF, TIFF, WebP Features Embeddings: Array of 128 or 256 float values	User ID: Number User Profile Data: Same as Product ID Search History: Search ID's
Recommendation Table	Feedback Table	Search Query Table
Recommendation ID: Alphanumeric User ID: Same as User ID Product ID: Same as Product ID Recommendation: Float (0.0 to 1.0)	Feedback ID: Alphanumeric User ID: Same as User ID Product ID: Same as Product ID Relevance: Integer Comments: Text	Query ID: Number User ID: Same as User ID Query Text or Uploaded Image Reference: Text query Timestamp: Date and Time

ERD Visio Diagram

This is an Entity-Relationship Diagram (ERD) description that shows the database tables and their relationships. With relationships showing how fields in one table relate to another, this ERD emphasizes each table as an entity.



Relationship table

Relationship	Description	Cardinality
R1- Product: Image	Has Image	1: N
R2- Product: Recommendation	Is Recommended	M: N
R3- Product: Feedback	Receives Feedback	1: N
R4- User: Recommendation	Gets Recommendations	1: N
R5- User: Search Query	Makes Queries	1: N
R6- User: Feedback	Gives Feedback	1: N

Normalization Table

Product Table



Product Table X							
ID	ProductID	ProductName	Category	Brand	SKU	Description	Attributes/Tags/Keywords
1	P25345	Camping Tent	OutDoor Gear	Macbeltco	SKU7500	4-person tent with waterproof coating	Tent, 4-person, Waterproof, Outdoor
2	P25885	Hiking Backpack	Outdoor Gear	Billymaster	SKU7501	40L hiking backpack with hydration pack	Backpack, 40L, Hiking, Outdoor
3	K83844	Electric Drill	Power Tools	PMax	SKU7608	20V cordless electric drill	Drill, Cordless, 20V, Power Tools
*	(New)						

User Table

Product Table X		User Table X	
User_Profile_Data		Search_History	
Name: Jacob, Location: NY		Query_ID: 1001, Timestamp: 2024-01-01, Query_ID: 1002, Timestamp: 2024-01-02	
Name: Joseph, Location: CA		Query_ID: 1003, Timestamp: 2024-02-01, Query_ID: 1004, Timestamp: 2024-02-02	
Name: Abisola, Location: TX		Query_ID: 1005, Timestamp: 2024-03-01, Query_ID: 1006, Timestamp: 2024-03-02	
*			

Search Query Table

Search Query Table X				
ID	QueryID	UserID	Uploaded_Image_Reference	
1	1001	107	/images/search/camping_tent.jpg	
2	1002	108	/images/search/drill.jpg	
3	1003	109	/images/search/backpack.jpg	
*	(New)	0	0	

ROI

5-Year ROI

Option A (Partnership)

- **Costs:** \$80,000 setup + \$15,000/month = \$980,000 total over 5 years.
- **Returns:** Starts at \$150,000/year with 15% annual growth = \$1,011,357.
- **ROI:** 3.2%.

Option B (Outsourcing)

- **Costs:** \$50,000 setup + \$12,000/month = \$770,000 total over 5 years.



- **Returns:** Starts at \$120,000/year with 15% annual growth = \$809,085.
- **ROI:** 5.08%.

Conclusion: Option B offers a higher 5-year ROI (5.08% vs. 3.2%) and lower costs, making it the better investment.

Evaluation Criteria

Evaluation Criteria Matrix for solution option (Scale 1 to 5)

1= Poor and 5= Excellent. This will help us to evaluate a clearer comparison to identify the most suitable option.

Category	Evaluation Criteria	Option A (Partnership)	Option B (Outsourcing)	Option C (Do Nothing)
Process	Performance	4	4	2
	Scalability	4	5	2
	Reliability	4	3	3
	Portability	3	3	4
	Usability	4	4	2
	Time to Implement	3	4	5
	Resource Requirements	3	4	5
People	Maintainability	4	3	3
	Accessibility	4	4	3
	Supportability	4	5	2
	Business ROI	4	4	1
	Contract Terms	3	3	5
	Licensing or Sub-licensing	4	5	5
Technology	Durability	5	4	2
	Availability	4	4	3
	Features	4	5	2
	Portability	3	3	4
	Integration with Existing Tech	4	4	3



	Support Infrastructure	4	4	3
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Category	Evaluation Criteria	Option A(Partnership)	Option B (Outsourcing)	Option C (Do Nothing)
Image Processing	Image Upload Capability	4	4	2
	Image Preprocessing	4	5	1
	Content Filtering	4	5	1
Search Accuracy	Image Recognition Precision	4	5	1
	Relevancy of Results	4	5	1
	Product Recommendations	4	5	1
	Upselling Suggestions	3	4	1
Performance	Response Time	4	5	2
	Scalability	4	5	2
	Efficiency in Resource Use	4	4	2
User Experience	Ease of Use	4	5	3
	Interface Design	4	5	3
Filtering and Sorting	Budget Filtering Options	4	5	1
	Category and Price Range Filtering	4	5	1
Security	Data Encryption	4	5	3
	Authentication	4	5	3
	Privacy Controls	4	5	3
Compliance	Regulatory Compliance (PIPEDA, etc.)	5	5	3
Error Handling	Handling Unsupported File Formats	4	5	2
	Error Messaging and Feedback	4	5	2
Business Alignment	Alignment with Business Goals	5	4	2

	Value of Suggested Results	4	4	1
Total		140	151	83

Recommendation

We recommend **Option B(outsourcing)** for its numerous advantages:

- Higher **5-year ROI** and better cost-efficiency.
- **Lower upfront costs** make budgeting easier.
- Vendor scalability ensures quick resource expansion during peak demand.
- Access to the **latest AI technologies** without managing updates.
- Reduced workload allows Canadian Tire employees to focus on other tasks.
- Faster solution deployment with dedicated support for issue resolution.

Test Strategy

Test Strategy for AI-Powered Image Search Implementation

This test strategy outlines a comprehensive plan to ensure the AI-powered image search system's quality, functionality, and readiness through structured stages, defined criteria, and diverse testing approaches.

Key Components

Testing Stages and Objectives

- **Unit Testing:** Validate individual components for accuracy.
- **Integration Testing:** Ensure seamless integration of system parts.
- **System Testing:** Test end-to-end functionality.
- **UAT:** Validate usability and alignment with business needs
- **Performance Testing:** Assess scalability and responsiveness.
- **Security Testing:** Identify and mitigate vulnerabilities.
- **Regression Testing:** Ensure updates do not affect existing features.
- **Final Testing & Sign-off:** Confirm readiness for deployment.

Entry and Exit Criteria:

- **Entry:** Completing preparatory tasks (e.g., test case development, prior stage stability).
- **Exit:** Meeting test success thresholds and resolving critical issues.

Testing Approach

- A phased methodology from unit testing to full system validation.



- Focus on defect management, environment setup, and continuous monitoring.

Testing Types

- **Functional Testing:** Check core functionalities like search accuracy and navigation.
- **Load & Performance Testing:** Simulate various user loads.
- **Security Testing:** Ensure secure data handling and regulatory compliance.
- **Usability Testing:** Evaluate user experience.
- **Regression Testing:** Verify no disruption from updates.

Defect Management:

- Defects will be logged, prioritized, assigned, resolved, and re-tested using tools like JIRA for efficient tracking.

Test Environment:

- Configurations to mirror production settings.
- Dedicated environments for development, UAT, and performance testing with anonymized data.

Tools and Support:

- Tools like Selenium, JIRA, JMeter, and TestRail will automate and enhance testing processes, reporting, and defect management.

Risk Management:

- Proactive identification and mitigation of risks, including integration issues and performance bottlenecks.

Implementation/Deployment Strategy

Everything Go Live

- **Approach:** Full deployment at once.
- **Cost:** High upfront; lower operational costs.
- **Risk:** High; issues affect all users simultaneously.
- **Stability:** Uncertain; all components launched together.
- **Scalability:** Must handle full user volume immediately.
- **Location:** Uniform deployment without regional customization.

Pilot and Roll Out All

- **Approach:** Start with a small-scale pilot, then expand to all users.
- **Cost:** Moderate upfront, higher operational costs due to pilot setup.
- **Risk:** Lower; issues resolved during the pilot.
- **Stability:** Improved through pilot testing.
- **Scalability:** Gradual scaling reduces overload risks.

- **Location:** Selective rollout allows for adjustments.

Go Live in Multiple Phases

- **Approach:** Deploy in phases across regions or units.
- **Cost:** Spread over time; total costs may be higher.
- **Risk:** Lower; issues resolved incrementally.
- **Stability:** Improved through phased adjustments.
- **Scalability:** Gradual transition smooths user adoption.
- **Location:** Flexible, addressing regional differences.

Pilot with Go Live in Multiple Phases

- **Approach:** Start with a pilot, followed by a phased rollout.
- **Cost:** Higher upfront; controlled operational spending.
- **Risk:** Lowest; combines pilot and phased deployment for issue mitigation.
- **Stability:** High; iterative improvements enhance stability.
- **Scalability:** Gradual and feedback-driven scaling.
- **Location:** Highly flexible, adapting to regional needs.

Risk Log

Risk log for Outsourcing AI image search

Risk ID	Description	Severity	Probability	Impact	Mitigation Strategy
O-01	Vendor Capacity Constraints – The vendor may have limited resources or infrastructure to handle surges in demand during peak times.	High	Medium	High	Choose a vendor with scalable infrastructure; set up regular performance reviews to assess their capacity to handle increased loads.
O-02	Compliance with PIPEDA and Privacy Laws – Vendors may fail to adhere strictly to Canadian privacy regulations (PIPEDA).	High	Medium	High	Include regular data audits and compliance checks in the contract and require the vendor to provide certification of adherence to PIPEDA.
O-03	Downtime Risk Due to Vendor Dependency – The Vendor may	High	Medium	High	A robust SLA is required that guarantees uptime and provides compensation for

	experience unplanned outages affecting Canadian Tire's ability to offer services.				outages. Implement contingency protocols for critical services.
O-04	Limited Control Over AI Model Customization – Vendor's AI models may lack flexibility, limiting custom search features for Canadian Tire.	Medium	Medium	High	Negotiate for customization clauses in the contract, allowing adjustments or dedicated resources to meet Canadian Tire's specific needs.
O-05	Data Transfer Latency – Processing image searches through an external vendor may introduce delays, impacting user experience.	High	Medium	High	Optimize data flow by selecting a vendor with low-latency solutions; test latency benchmarks before full deployment to minimize delays.
O-06	Intellectual Property (IP) Limitations – The vendor may retain IP rights over customizations, restricting Canadian Tire's ownership and use.	Medium	High	High	Ensure clear IP terms in the contract, granting Canadian Tire full access and rights to any co-developed or customized solutions.

Transition Requirements

The purpose of this transition from the requirement of Canadian Tire Text Search to AI image Search Implementation is to smoothly migrate from the existing text-based search engine to the better-optimized AI-based image search for the buying and gift registry section of the Canadian Tire site. (Anderson, 2024), (Wright, 2021) These requirements are:

Data Integration Requirements

Data Mapping:

- Convert current text-based product search data into the format needed for training and retrieval by the AI model.

- To improve accuracy, match AI search capabilities with product metadata (such as tags and categories).

Data Cleansing and Enrichment:

- To support AI search capabilities, ensure the current product photos are of a good calibre and labelled adequately with metadata.
- Update the database with missing product details and images.

System Requirements

Platform Compatibility:

- Integrate the gift registration system and the current e-commerce backend with the AI-powered image search module.
- Verify compatibility with mobile and online platforms.

API Development:

- Develop APIs to enable smooth communication between the current Canadian Tire platform and the AI search engine.
- Verify and test API calls for features, including processing, uploading images, and displaying results.

User Experience (UX) Requirements

UI Enhancements:

- Update the search interface to include an option for uploading or capturing images for search.
- Provide clear instructions and feedback mechanisms during image search interactions (e.g., image quality alerts).

Hybrid Search Support:

- Ensure the platform supports text- and image-based searches during and after the transition.
- Enable users to toggle between search modes for flexibility.

Training and Testing Requirements

Model Training:

- Train the AI model using Canadian Tire's proprietary product catalogue and imagery.
- Incorporate user-generated data (e.g., popular searches and feedback) into training datasets.

Quality Assurance:

- To confirm accuracy, relevancy, and performance, thoroughly test the image search feature in controlled settings.
- Implement A/B testing to assess user satisfaction and engagement between image and text searches.

Change Management Requirements

User Education:

- Provide FAQs, demo videos, and tutorials to introduce customers to the AI-powered image search feature.
- During the initial launch phase, include instructions and prompts in the user interface.

Support Systems:

- Provide troubleshooting instructions and an update to support workers regarding the new search functionality.
- After launch, set up monitoring tools to monitor and resolve user complaints.

Operational Requirements

Performance Monitoring:

- After installation, track key performance indicators (KPIs) such as user satisfaction, accuracy, and search speed.
- Update the AI model frequently in response to user comments and search engine trends.

Rollout Plan:

- Before launching on a large scale, start with a trial group and gradually roll out the AI-powered image search.
- Maintain the existing text search as a fallback option until the AI search reaches optimal performance.

Outcome

A seamless transition from text-based search to AI-powered image search, enhancing user experience and improving search relevance for Canadian Tire's online shopping platform and gift registry.

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