"Analysis and Modelling of BPMN and DMN"

Major project report submitted in partial fulfilment of the requirement for the degree of Bachelor of Technology

in

Computer Science and Engineering

By

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UNDER THE SUPERVISION OF

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CERTIFICATE

This is to certify that the work which is being presented in the project report titled**"Modelling and Analysis of BPMN and DMN"** in partial fulfilment of the requirements for the award of the degree of Bachelor of Technology in Computer Science andEngineeringsubmitted to the Department of Computer Science & Engineering, Jaypee University of Information Technology, Waknaghat is an authentic record of work carried out by **Tanvi Tiwari (181468)** during the period from February 2022 to May 2022, under the supervision of **Dr. Ruchi Verma**, Assistant Professor (Grade - I), Department of Computer Science and Engineering, Jaypee University of Information Technology, Waknaghat.The matter embodied in the report has not been submitted for the award of any other degree or diploma.

Tanvi Tiwari

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The above statement made is correct to the best of my knowledge.

Dr. Ruchi Verma   **Monika Saxena**

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Candidate's Declaration

I hereby declare that the work presented in this project entitled **"Modelling and Analysis of BPMN and DMN"** has been done by me under the supervision of **Dr. Ruchi Verma** (Assistant Professor ,Grade-I), Department of Computer Science & Engineering), Jaypee University of Information Technology.

I also declare that the matter embodied in this project has not been submitted elsewhere for award of any degree or diploma.

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LIST OF ABBREVIATIONS

- **BPMN:**Business Process Modelling Notation
- **DMN:**Decision Modelling and Notation
- **CMMN:**Case Management Model and Notation
- **OMG:**Object Management Group
- **i.e:** that is
- **XML:**Extensible Markup Language
- **CSS:**Cascading Style Sheet
- **HTML:**HyperText Markup Language
- **JS:**JavaScript
- **RAM:** Random Access Memory
- **CPU:** Central Processing Unit
- **GPU:** Graphics Processing Unit

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ABSTRACT

The main and the most important foundation of an organization is the management of the business processes. The business processing models are built in order to explain in what way the corporation or institution must act or react to the circumstances and therefore synchronize their actions and work in order to meet its goals and aims.

Simultaneously the decisions regarding operations must be taken by them taking the internal and the external evaluative characteristics into account as well as the decision models that are primarily subjected to the declarative and rule-based requirements which explains the input arrangement be in tune with the output or the results produced.

As the importance of these tangled dimensions, or processes and decisions, increases exponentially, there has been a vast span of models and approaches like Business Processing Modelling Notation, abbreviated as BPMN, which is used in order to manage and make processes efficient, and Decision Modelling and Notation, abbreviated as DMN, for logical decision making and operational decision making.

Although it is essential to examine and research these two approaches individualistic to each other, it is also researched and mentioned by multiple researchers and professors that the two can be examined as a combination as well. The two standards are complementary.

Through this project, I aim to understand the DBPMN models which is again, an amalgamation of the BPMN and DMN model. The project helps in order to understand and analyse the model, how they work, their concepts as well as working on the models by creating its modeller and viewer using pre packages offered by bpmn-io in collaboration with Camunda. The project also helps understand the basics of NodeJs and Camunda.

Chapter 01: INTRODUCTION

1.1   Introduction

Every Company pursues to improve the work efficiency of their organization, everyone wants to improve the efficiency by minimizing the errors in their work. Efficiency can easily be increased with good analysis and understanding of the work one does, as well as an exponential improvement in the working methods.

If a situation is predictable, it requires a structured workflow and with these workflows, it requires good protocols that could respond to such dynamic scenarios where a fixed process could be difficult to create or prescribe.

After realizing these situations and requirements, an international, open membership, not-for-profit technology standards consortium, called Object Management Group came up with the very efficient and powerful standards that complement each other and named it "triple crown". These standards work with each other and can model a range of working methods used in multiple organizations.

The powerful standards, "triple crown" enhances the process and offers a helping hand for process specification – *Business Process Modelling Notation,* decision modelling – *Decision Modelling and Notation* as well as case management – *Case Management Model and Notation,* also abbreviated as BPMN, DMN and CMMN.
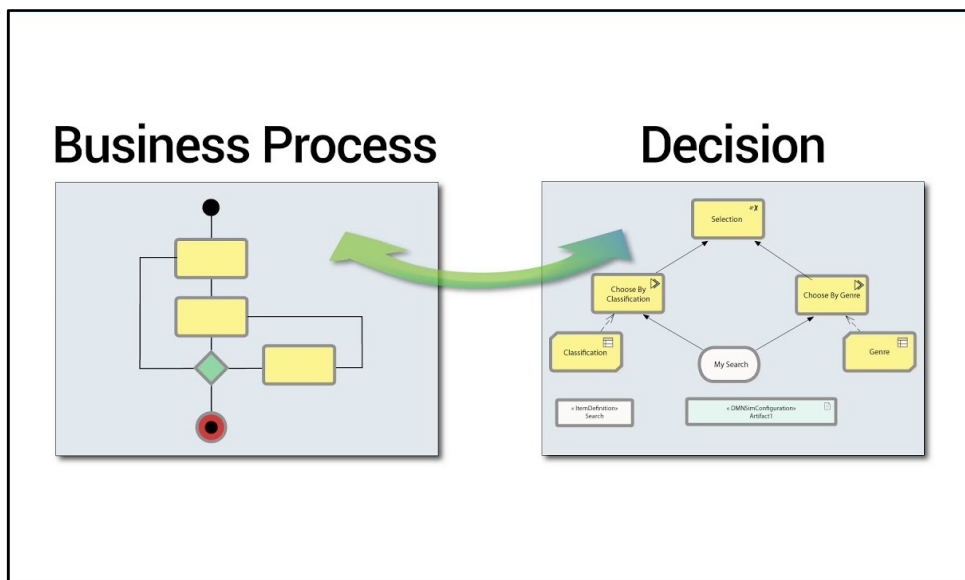
Figure 1.1 Business Process and Decision

Such   standards   like   the   Business   Process   Modelling   Notation   and   Decision

Modelling and Notation moreover provides us with a graphical flow with specific semantics that include specific type of symbol or shape for different function and model interchange from in languages like Extensible Markup Language that are universal. They are seen as standards since they have a standard semantics. The idea of BPMN and DMN came after researching and realizing the importance of efficient process by the organization known as OMG where the semantics for the same were created in accordance with UML model including the schema XML and for the DMN notations, the decision tables and the text required were defined in the specification document. All these measures adhered to making the BPMN and DMN as well as CMMN standards with standard semantics.

1.2   Project Objective

The aim of this project is to understand the concepts of process improvement standards namely, Business Process Modelling Notation, Case Management Model and Notation, and, Decision Modelling and Notation and then working on viewers, modelers of Business Process Modelling Notation and Decision Modelling and Notation as well as integrating the two models.

1.3   Project Motivation

The motivation behind this project was to understand the concepts of process improvement standards namely, Business Process Modelling Notation, Case Management Model and Notation, and, Decision Modelling and Notation. The objective is to understand how the BPMN diagrams are created in XML format and how they help manage processes and help improve organizations improve work efficiency, and in the similar way understand how DMN diagrams are created and work with logical decision making as well learn the benefits of integrating or combining the two complementary standards, therefore to understand how the business process modelling notation and decision modelling and notation work independently as well as combined.

Another reason to work on this project apart from learning about BPMN and DMN was to help understand the basics of NodeJs and Camunda.

1.4.1 Languages Learned during the Internship
(Apart from the ones used in the project)

Java

Java is a very well known object-oriented programming language which doesn't depend on any specific platform or operating system and has about 3+ billion applications and services working on it since it is used for multiple applications including gaming and scientific purposes. It was developed by The Sun Microsystems and is one of the mose reliable and fast language. Itsupports portability and is flexible and dynamic which makes it a general-purpose language. It is multithreaded and interpreted platform-independent language.

Figure 1.2 Java

Microservices

Before Microservices there used to be Monolithic Architecture.
Microservices is also known as microservice architecture. The services are small, independent and loosely coupled and can have different frameworks/technologies/databases and are deployed independently.
Large applications can be broken down into multiple services which together act as one large system, but behind the scenes, it's a microservice. Services communicate through API

Figure 1.3 Microservices

Databases – MySQL

To manage and organize the databases, an application or tool is used known as DBMN, database management system that modifies the data or work with data based on the input queries.MYSQL isa database management technique which is considered when working with relational data and systems. It is a structured query language that manages our data accordingly.

Figure 1.4 MySQL

1.4.2 Tools Used in the project

NodeJS

Node.js is a famous tool which provides a runtime environment for JavaScript. It works on the V8 engine which is also used in Chrome andis the fastest JavaScript engine out there and embeddedit inside a C++ program. It is one of the most efficient engines and that is why Node.js works greatin terms of quality and performance.

A Node.js consists of JS code that can be asynchronous or synchronous, blocking or non-blocking.Nodejs is a runtime environment for JavaScript code it contains a JavaScriptengine that can execute our JavaScript code but it also has certain objectsthat provide an environment to JSalthough the objects are not the same as the objects of environment.
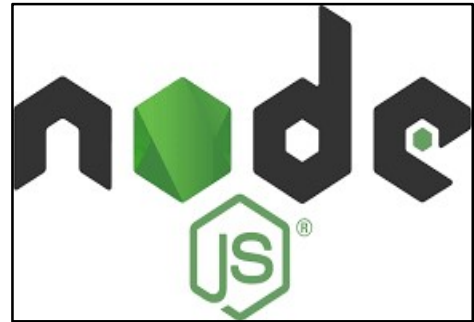
Figure 1.5 NodeJS

XML

XML stands forextensible markup language and hereit is called markup because we use marksor we usetags as we have seen in our example andthenthe tags are not restricted or already defined and can beextended, therefore making them extensible and thus, we call it asextensible markup language. The language is convenient to use to establish a communication between different applications. The language is makes it easy to use since it is platform independent. BPMN and DMN provides XLM file formats to create process diagrams and decision models.

Figure 1.6 XML

RedHat

Red Hat is a tool that helps to deliver the services with less cost and high efficiency. It is a fast tool and consists ofRed Hat Process Automation Manager which supply with mutilple tools for creating different models which can be businesss processes or business logical decision as otherwise known as the very powerful standards Business Process Model and Notation abbreviated as BPMN and Decision Model and Notation abbreviated as DMN. It has advanced technology which can even withstand complex models and therefore solve such tough problems to optimize the the result using these engines.

Figure 1.7 RedHat

BPMN

Business Process Modelling Notation, abbreviated as BPMN is one in three powerful standards developed by OMG that uses standardized graphical flowcharts in order to represent process elements and components and the flow between them and makes it easy for anyone to understand the process. It helps improve work quality and is therefore preferred by many organizations that aim to analyse their quality. The flowcharts are clear and detailed and doesn't require prior knowledge to be read by the users. BPMN can be used independently as well as with other models depending on the organization's requirements.

Figure 1.8 BPMN

DMN

Decision Modelling and Notation, abbreviated as DMN is a standard mainly for logical decisions and business-related rules. The best part about the notation is that it is easy-to-read. It doesn't require prior experience or knowledge of the notation to be read by the management of business people who set down the rules and direction and also look out for their implementation; business analysts that takes the input from the user and reshape them into informative and knowledgeable decision models; as well as software developers whose

Figure 1.9 DMN

responsibility is to work with these decision models in order to carry them out in the systems.

Camunda

Camunda is a Platform or a toolkit which is has many versions - enterprise and community and offers many functionalities to organize and visualize as well as operate the business models which can be business related process or logical decision models and allows working and maintaining the Business process modelling and Notation as well as Decision Modelling and Notation at a same place and lets the users deploy the work and diagram for visualization and understanding real time working to the work engine of Camunda. It is created in unison with the bpmn-io.

Figure 1.10 Camunda

1.5.1 Technical Requirements

❏ Linux Operating System/Windows

❏ Modern Web Browser

❏ Visual Studio Code

❏ RedHat Automation Manager

❏ Camunda

❏ Github

1.5.2 Methodology

The reason behind working on this project is to understand the ways in which the institutions can elevate the quality of their work. With appropriate amount of analysis and research, an organization named as OMG came up with some standards. The two main standards that were focused on this project where the Business Process Modelling Notation and Decision Modelling and Notation which describes information in a graphical flowchart that informs about the processes and logical decision in a simpler manner using visualization, respectively.

The first stage of the project begins with the research about the two standards, BPMN and DMN. Understand their behaviour and the why should we use these.

The second stage of the project is working on the BPMN model which would include the viewer and modeller and interactor of the created BPMN diagram.

The third stage of the project is working on the DMN model which again, like BPMN, will include the viewer for the diagram, as well as the modeller.

For the stages two and three, we work using node.js, which is a runtime environment for JavaScript programs for creating modeller and viewer. The diagrams for the DMN and BPMN models will be created in xml format using the .bpmn and .dmn extensions provided by the RedHat organisation. The diagrams will then be required to pushed to github, from where those will be loaded in the modeller and viewer of the models.

This same activity is then repeated in Camunda, in order to understand how it works in it. Camunda provides us with a cockpit where the diagrams can be deployed in order to visualize and organise.

The last stage of the project is understanding the interaction between the two models, could they be connected, why they should or should not be connect/linked with each other, the benefits of doing the same.

This helps understand the working of BPMN, DMN and node.js and JavaScript as well as Github.

1.7   Organization

The mentioned project is done at Paxcom – *by Paymentus*, working as an intern from February 2022.
Paxcom India (P) Ltd is a product-based company, a leading Digital Solution Provider that is a part of Paymentus now, a leading electronic bill payment provider.
The company is quickly gaining speed. Every day partnering with the world's largest brands to improve their digital presence and accelerate sales.

Figure 1.11Paxcom

As a Software Engineer Trainee, I was a part of the IVR team and am being given a training in Java and IVR Technology. The schedule for the training began with understanding the tools that would be required to work on the live project. The first month of training comprised of working on basics of Java and understanding the concepts as well as hands on Java. The next months were working on concepts of Databases, MySQL and basic knowledge of Docker and then NodeJs and about BPMN and DMN and so I was asked to work on BPMN and DMN application to understand them. Currently working on microservices and an application of microservices using Spring Boot.

Chapter 02: LITERATURE SURVEY/RESEARCH

BPMN, CMMN AND DMN SPECIFICATIONS AT OMG

The article regarding BPMN, CMMN and DMN provides information telling about the value proposition of the triple crown standards.

It tells how BPMN,CMMN and DMN:

- hold out quick accordance to the "as is" as well as to "to be" type of process with the help of obscure processes
- Motivate more organizations to use it because of its simpler graphical visualization
- Helps in smooth analysis as well as making work quality improve exponentially
- Develops a collection of the processes and rules and decisions in order to help in instructing the new members of the workforce

The article helps understand the concepts of Business Process Modelling Notation, Case Management Model and Notation as well as Decision Model and Notation and helped to learn the differences between the three in terms of what the concepts are, what they focus on as well as the semantics.

Apart from this, it also helped to learn about the Object Management Group, that came up with the Triple Crown of improving work efficiency by introducing these three very important standards that complement each other.

Understanding BPMN Diagrams and Symbols

The article helped understand the basics of the business process modelling and notation's diagram and what are the important components that are used in order to build a diagram.

It helps understand that the Business Process Model and Notation has a particular syntax that involves the usage of certain shapes and connections that provides us with the idea about how the project or process works and what steps it takes from the beginning till the very end. A BPMN model can be thought of as a route from the starting point to the destination that takes us through every stop of the workflow. It tells us about the path the process is taking to reach the end according to the provided conditions.

The symbols that form the workflow for the process are known as the flow objects. The most important flow objects that are used the most are:

- Events:
  The circular shaped components in a BPMN diagrams are known as Events that act as a trigger. They are used when we have to tell that a process is starting or contains an intermediate step or the process is ending.

- Activities:

  The rectangular shaped components of the BPMN diagrams are known as Activities that acts as particular tasks that can be carried out by a user or service or can be a decision task. There can be multiple activities in a process and can even consist of certain conditions that should be met in order to move forward.

- Gateways:

  The diamond shaped components of the BPMN diagrams are known as Gateways that illustrates the mapping between the decision points that decide the next turn for the process.They act as the forks that diverges or converges into different paths

  The Swimlaneshand out the tasks in different kind of ways. It circumscribes the task for a particular part, whereas, the pool represents the completesubsection like the whole online market or customer, etc

  The Data symbols specify a particular kind of information that is needed for an activity at present and they have no absolute repercussions or consequences in the movement of the process flow.

Understanding DMN Diagrams and Symbols

Decision Modelling and Notation is tool that provides the visualization in graphical terms to illustrate logical decisions. The main purpose of Decision Modelling and Notation is to differentiate the processes form the logical decisions that were making the business processes chaotic and unorganized as discusses in the prior section.

A decision modelling notation consists of elements and requirements

Elements:

- Decision

  A rectangular component in a DMN diagram is known as Decision. Its responsibility is to regulate the output based on the given input figures. It uses logic to conclude the result which can be referenced from another element called business knowledge models.

- Business Knowledge Model

  A rectangular component with a S curve at the bottom is known as business knowledge model. The responsibility of this component is to indicate functions enclosing the business knowledge which can be in form of decision tables or logical models or rules.

- Input Data

  A horizontal cylindrical component of the DMN diagram is known as the input data.

Its responsibility is to indicate the details that are being taken as an input by the decision components. It can be used by one or more decisions. When an input data is encapsulated inside a knowledge model, it acts as the model's arguments.

- Knowledge Source
  A rectangular component with slight cuts on upper left corner and lower right corner in a DMN diagram is known as a knowledge source. Its responsibility is toshowcase the command on the elements like decision or business knowledge model.

Requirements:

- Information Requirement
  An edge with solid arrow denotes information requirement. Its responsibility is to illustrate that the components such as ainput data or output from a decision is being taken as inputs for a making a decision.

- Knowledge Requirement
  An edge with dotted arrow denotes knowledge requirement. It illustrates the acknowledgement of a business knowledge model.

- Authority Requirement
  An edge with dotted line with a solid dot at the end denotes authority requirement. Its responsibility is to show the dependence of one component of the diagram on another component that showcases as a root of information or guidance.

Link DMN elements and diagrams

The article helped understand how to combine or integrate the BPMN diagram with the DMN diagram. It is better to embed decision diagrams to business process to make the maximum benefits like including main four key benefits like Streamlined business processes and Focused requirements process as well as Improved visibility and flexibility of business rules.

There are certain steps to integrate the dmn to bpmn and those are:

- In order to create a decision task in the BPMN diagram, we select the business rule task which can be linked to the dmn.
- Open the properties of that business rule task where we find some fields
- In the properties panel of that task, set the implementation as DMN format
- Another dialog box opens that asks for the decision id and name
- Fill the details of the decision model diagram that needs to be linked to the bpmn diagram
- If the user tasks require any implementation details or calculation, provide it to them which will receive the direction based on this business rule's decision
- Save the file

Chapter 03: SYSTEM DEVELOPMENT

3.1 Computational Model Development

For this project work we used the machine with the following specs at the time of training.

CPU: The computer we used had the following specs:

Parameter	Specifications
CPU Model name	Intel(R)Core(TM)
CPU frequency	2.3 Ghz
No of CPU cores	4
Available Ram	7.86 GB
Disk Space	400 GB

Table 3.1 CPU specifications

These are the CPU specs of the machine we used. The clock speed of the CPU mentioned 2.3 Ghz is the basic clock speed which if needed can go upto 5 Ghz. But no overclocking was needed as the system was able to do the work in its normal 4 cores.

Parameter	Specifications
GPU	NVIDIA GeForce GTX 1060
GPU Memory	10 GB
GPU Memory Clock	1.40 Ghz
GPU Release Year	2016

Cores	2
Available RAM	6 GB
Disk Space	400 GB

Table 3.2: GPU Specifications

Tools Used: We used the following tools in making our model.

- JavaScript
- NodeJS
- CSS
- XML
- BPMN
- DMN
- Camunda
- Github

These tools and frameworks mentioned above were used in their latest upto date editions. The code works properly and would not cause any issue until any further updates in them.

3.2 Design of Problem Statement

The problem statement for this project is to understand the analysis and modelling of the powerful work efficiency standards BPMN and DMN, i.e Business Process Modelling Notation and Decision Modelling and Notation. The idea behind selecting this project was to know how they work and to understand concepts of NodeJS as well as the Camunda platform and its tools like Cockpit and Toolkit for organization and visualization of the BPMN and DMN diagrams.

The Tasks to be performed in this project in a particular order were:

Task 1: Learn about BPMN and DMN
Task 2: Create BPMN diagram in xml format and using RedHat's .bpmn extension
Task 3: Create viewer, modeller and interactor for BPMN
Task 4: Create DMN diagram in xml format and using RedHat's .dmn extension
Task 5: Create viewer and modeller for DMN
Task 6: Create BPMN and DMN diagrams in Camunda
Task 7: Understand the integration of BPMN and DMN

3.3 Algorithm / Pseudo code of the Project Problem

3.3.1 Understanding the concepts

Although the Business Process Modelling Notation, Case Management Modelling and Notation and Decision Modelling and Notation can work independent to each other but researchers have mentioned and pointed out that they can actually be combined and complement each other in order to provide more benefits. And so, most of the companies and institutions prefer using the combination of these standards for when working with complex scenarios and for workflows and logical decisions for their work activities and business criteria. These institutions achieve better results by working these processes in amalgamation and selecting the one that works the best for their activity.

3.3.1.1 BPMN

Business Process Modelling Notation, abbreviated as BPMN is one in three powerful standards developed by OMG that uses standardized graphical flowcharts in order to represent process elements and components and the flow between them and makes it easy for anyone to understand the process. It helps improve work quality and is therefore preferred by many organizations that aim to analyse their quality. The flowcharts are clear and detailed and doesn't require prior knowledge to be read by the users. BPMN can be used independently as well as with other models depending on the organization's requirements.

Business Process Model and Notation, as the name suggests defines business process in a form of progression of one task to another or one activity to another. The tasks or activities are branched using Gateways to different paths. Before the development of BPMN standard, analysts used to include random decision logics in the process that would end up making the processes unorganized and chaotic.

The Business Process Model and Notation has a particular syntax that involves the usage of certain shapes and connections that provides us with the idea about how the project or process works and what steps it takes from the beginning till the very end. A BPMN model can be thought of as a route from the starting point to the destination that takes us through every stop of the workflow. It tells us about the path the process is taking to reach the end according to the provided conditions.
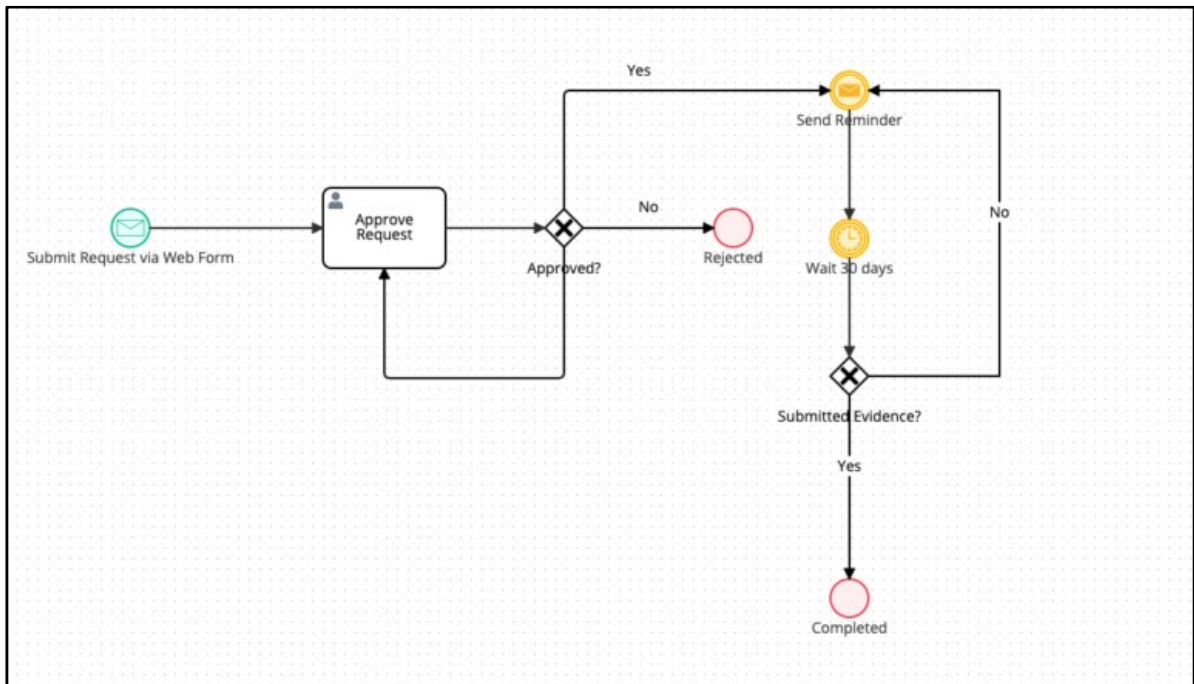
Figure 3.1 Example of Business Process Modelling Notation Diagram

3.3.1.1.1 BPMN Components

A BPMN diagram has some important symbols that helps us build the workflow for a process. These are:
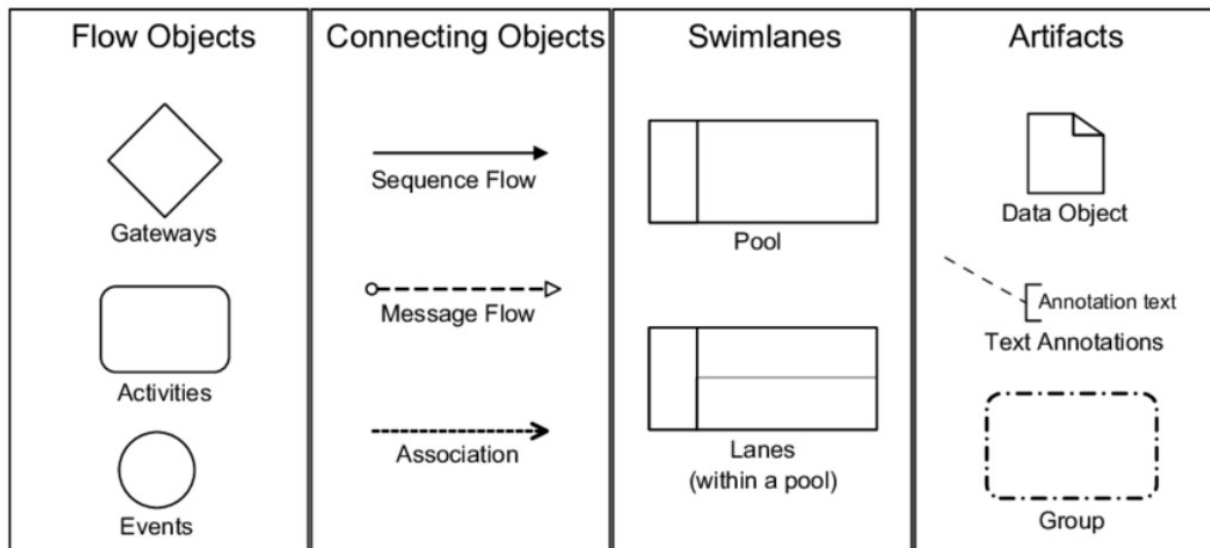

Figure 3.2 Important Components of BPMN Diagram

The symbols that form the workflow for the process are known as the flow objects. They act like pieces of puzzle where the process is the puzzle. The most important flow objects that are used the most are:

▪ Events:

The circular shaped components in a BPMN diagrams are known as Events that act as a trigger. They are used when we have to tell that a process is starting or contains an intermediate step or the process is ending.

- Activities:
  The rectangular shaped components of the BPMN diagrams are known as Activities that acts as particular tasks that can be carried out by a user or service or can be a decision task. There can be multiple activities in a process and can even consist of certain conditions that should be met in order to move forward.

- Gateways:
  The diamond shaped components of the BPMN diagrams are known as Gateways that illustrates the mapping between the decision points that decide the next turn for the process.They act as the forks that diverges or converges into different paths

The Swimlaneshand out the tasks in different kind of ways. It circumscribes the task for a particular part, whereas, the pool represents the completesubsection like the whole online market or customer, etc

The Data symbols specify a particular kind of information that is needed for an activity at present and they have no absolute repercussions or consequences in the movement of the process flow.

3.3.1.2 DMN

Decision Modelling and Notation, abbreviated as DMN is a standard mainly for logical decisions and business-related rules. The best part about the notation is that it is easy-to-read. It doesn't require prior experience or knowledge of the notation to be read by the management of business people who set down the rules and direction and also look out for their implementation; business analysts that takes the input from the user and reshape them into informative and knowledgeable decision models; as well as software developers whose responsibility is to work with these decision models in order to carry them out in the systems.

Decision Modelling and Notation can be complemented with the Business Process Modelling and Notation as well as Case Management Modelling and Notation. This gives and opportunity to model the logical decisions into both the case models and the processes.

Decision Modelling and Notation is a part of the OMG's derived three powerful standards that acts as some sort of a mediator. It transforms the complex codes that illustrates the logical decision making into laymen understandable graphical diagrams. The standard lets everyone in the business management to understand the decisions and visualize the workflow.

It is tool that provides the visualization in graphical terms to illustrate logical decisions. The main purpose of Decision Modelling and Notation is to differentiate the processes form the logical decisions that were making the business processes chaotic and unorganized as discusses in the prior section. This not only makes BPMN less complex, but also makes both the processes and decisions easy to read and understandable by everyone without prior knowledge of them.
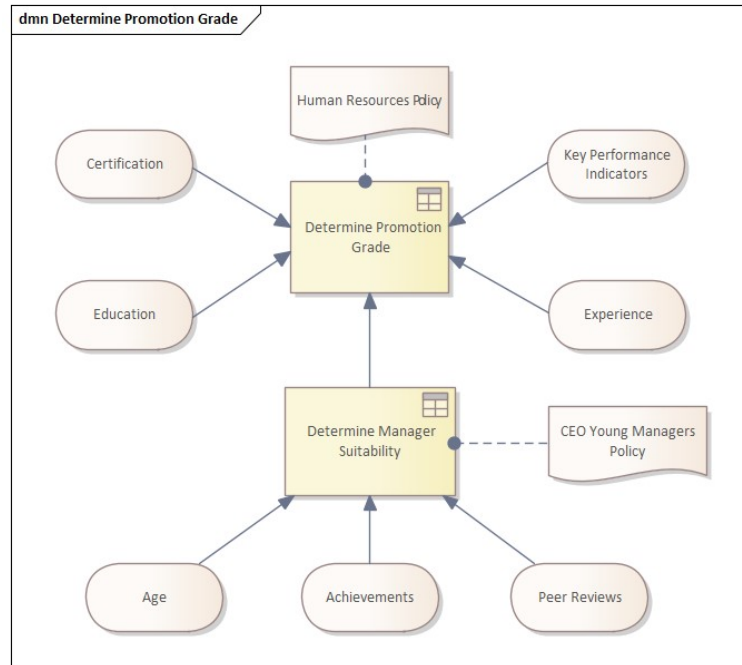

Figure 3.3 Example of Decision Modelling Notation Diagram

A decision modelling notation consists of elements and requirements

Elements:

- **Decision**
  A rectangular component in a DMN diagram is known as Decision. Its responsibility is to regulate the output based on the given input figures. It uses logic to conclude the result which can be referenced from another element called business knowledge models.

- **Business Knowledge Model**
  A rectangular component with a S curve at the bottom is known as business knowledge model. The responsibility of this component is to indicate functions enclosing the business knowledge which can be in form of decision tables or logical models or rules.

- **Input Data**
  A horizontal cylindrical component of the DMN diagram is known as the input data. Its responsibility is to indicate the details that are being taken as an input by the

decision components. It can be used by one or more decisions. When an input data is encapsulated inside a knowledge model, it acts as the model's arguments.

- **Knowledge Source**
  A rectangular component with slight cuts on upper left corner and lower right corner in a DMN diagram is known as a knowledge source. Its responsibility is toshowcase the command on the elements like decision or business knowledge model.

Requirements:

- **Information Requirement**
  An edge with solid arrow denotes information requirement. Its responsibility is to illustrate that the components such as ainput data or output from a decision is being taken as inputs for a making a decision.

- **Knowledge Requirement**
  An edge with dotted arrow denotes knowledge requirement. It illustrates the acknowledgement of a business knowledge model.

- **Authority Requirement**
  An edge with dotted line with a solid dot at the end denotes authority requirement. Its responsibility is to show the dependence of onecomponent of the diagram on another component that showcases as a root of information or guidance.
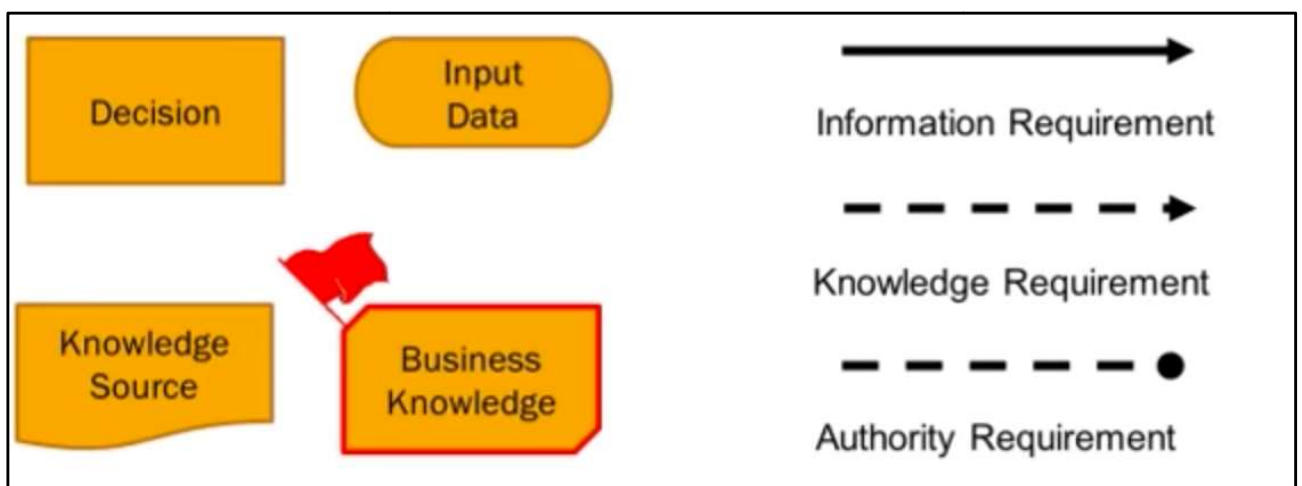

Figure 3.4 Important Components of DMN Diagram

3.3.1.3 CMMN

Case Management Modelling and Notation is again one of the standards for improving work efficiency. As the name suggests, the responsibility of CMMN is to illustrate a visualization in a graphical format to handle the cases that may be in need for different activities that can be performed in random order that cannot be predicted. CMMN uses a

technique in order to expand itself on what could be modelled with the other standard, namely, Business Process Modelling and Notation, that would involve less predictable and structured work efforts. Users are able to expand much vast possibilities of work techniques using the Business Process Modelling Notation with the Case Management Modelling and notation together.
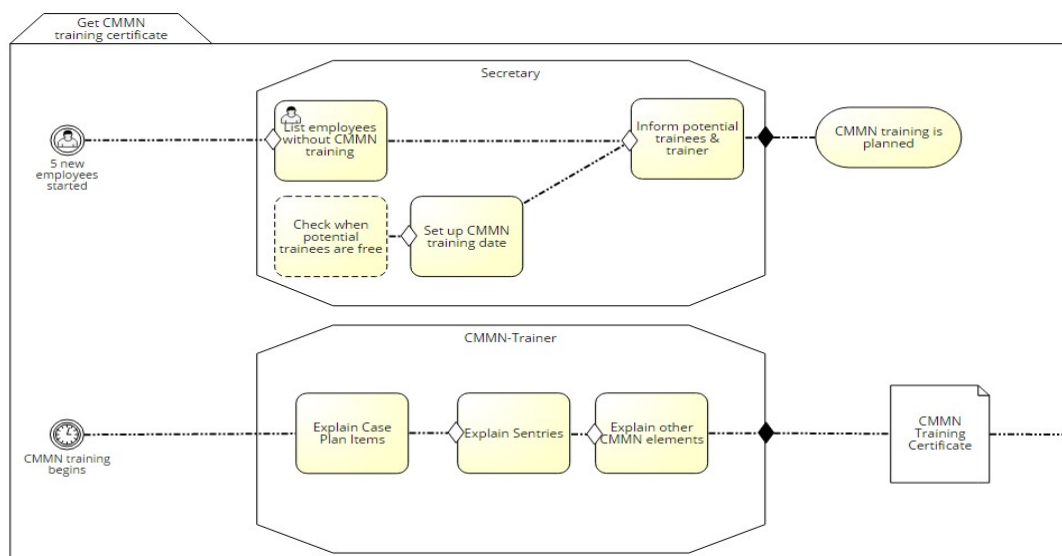

Figure 3.5 Example of Case Management Model and Notation Diagram

3.3.1.3.1 CMMN Components

- **Task**

One of the main components of CMMN as well as BPMN is Tasks. It denotes a single task that needs to be carried out. There are different varieties of tasks in CMMN – Blocking human, Non blocking human, decision, case and process tasks.

- **Stage**

One of the elements of CMMN is Stage that has a responsibility of dividing the cases of the ongoing activity into subdivisions or vice-versa, i.e stages can be formed by combining or grouping the sequence flows, substages or tasks together.

- **Milestones**

One of the elements of CMMN is Milestones that acts as sub-goals inside the model. They show that we have reached aparticular area or a stage inside a case and therefore tells about its completion.

- **Sentries**

The diamond shaped entryexit criterion shapesare one of the elements of CMMN known as Sentries that can be attached to any other element of CMMN where the direction of the sequence flow or the dependencies of the same can be illustrated by this element.They don't have to be connected to some element necessarily but can also exist independently.

- **Event listeners**

One of the elements of CMMN is a listener that holds on for some event to occur in order to trigger a latest sequence flow.

- **Case file item**

One of the elements of CMMN are case file items that denotes information that tells us about the ongoing activity or case in a document or file format.The case file items are connected to other CMMN components by a connector to depict the relevant data being used from the connected element for working of this case file. Not just this, but a case file item can stand the workflow by sometimes working as a trigger.

- **Connectors**

One of the elements of CMMN are connectors that has a responsibility to create and explain the relationship between the CMMN components. It is known that a sequence flow can be defined but an entry or exit criteria.

- **Plan fragment**

One of the elements that are displayed by the dotted lines in a CMMN is a plan fragment that includes a batch of elements that are not occurringinside this cases' runtime. The elements that are encapsulated inside this element may be involved with sequence flows or have sentries connected to it. It includes everything that should be present in the case but does not have a proper place to be fixed at.

- **Planning table**

One of the elements of CMMN is a planning table that informs us that there are some discretionary tasks that are ongoing. Another term seen in this is a collapsed planning table, which illustrates that these ongoing discretionary tasks are not shown, whereas the expanded planning table tells us that they are being displayed.

- **Text Annotation**

One of the elements of CMMN is a text annotation that includes some additional data or knowledge about the activity, or the diagram, or some elements.
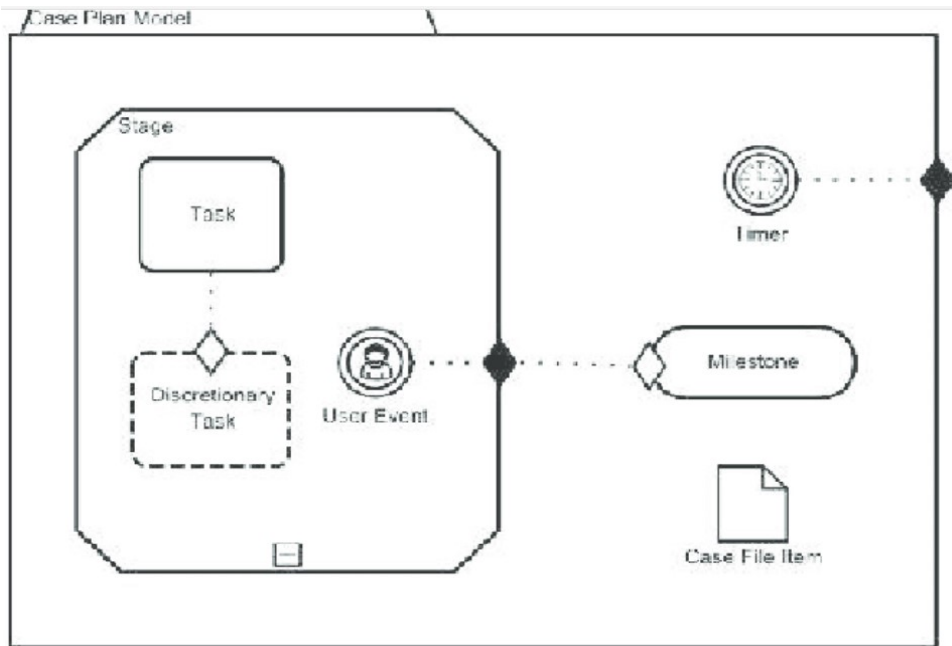
Figure 3.6 Important Components of CMMN Diagram

Differences between BPMN, CMMN and DMN

Table 3.3 Differences between BPMN, CMMN and DMN

It is clear from the above table that the Business Process Modelling Notation, also sometimes called, Business processing Model and Notation work on processes and activities and gives a procedural format for understanding the transitional workflow of the business processes using tokens, while the Case Management Model and Notation as the name suggests, work on activities involving cases and events and gives us a graphical visualization to understand the contextual information flow of the ongoing case scenarios using event condition actions. On the other hand, the Decision Model and Notation works on logical decisions that consists of some rules on the basis of which the output result is determined. It uses the Applied methods and provides us with the functional knowledge

about the decisions that are being made in a business process or in case activities using the first order logic method. The three standards can exist independent of each other but can also be used together in accordance with the requirements of the organization for their business model activities and cases and decision making.

3.3.2 Working with BPMN

bpmn-io:

The bpmn.io is an important and fundamental part of and isexamined by Camunda. The tools provided by the project helps us in order to look up or make changes to our Business Process Modelling Notation as well as Case Management Model and Notation and Decision Modelling and Notation and apart from these standards, it also allows working and editing or viewing the Forms within the browsers we use.

Bpmn-io has great extensible libraries that are present for community on Github for users to use freely.

As of today, bpmn toolkit has been developed and released for community to use and work upon. It is a JS library which lets us use bpmn 2.0 diagrams in our applications. Bpmn-io lets user run a demo version to understand how it works.

This application enables us to work and modify the diagrams bpmn has to offer and not only this, it also allows to export the diagrams as a SVG image format.

bpmn-js:

bpmn-js is a toolkit written in JS, of Business Process Modelling and Notation that renders and work as a web modeler. It implants the bpmn diagrams to the browser without any extended requirements of backend which makes it simple to work with applications. Bpmn-js is a library that could work as a viewer, to just look at the diagrams as well as a modeler if one would like to make edits in the bpmn diagram.

The bpmn-js lets the users work with bpmn diagrams as long as they keep the bpmn logo in their projects as it is licenced under the MIT license and published on github.

3.3.2.1 BPMN Diagram

Business Process Model and Notation, as the name suggests defines business process in a form of progression of one task to another or one activity to another. The tasks or activities are branched using Gateways to different paths. Before the development of BPMN standard, analysts used to include random decision logics in the process that would end up making the processes unorganized and chaotic.

The Business Process Model and Notation has a particular syntax that involves the usage of certain shapes and connections that provides us with the idea about how the project or process works and what steps it takes from the beginning till the very end. A BPMN model can be thought of as a route from the starting point to the destination that takes us through every stop of the workflow. It tells us about the path the process is taking to reach the end according to the provided conditions.

The BPMN diagram diagrams basically consists of components or symbols that connect to each other in order to create a process workflow and the process can be a public or a private process. It helps to improve the lack of communication between the different departments in the institution or company.

A BPMN diagram is used to make complex scenarios easy to understand using easy visualization graphical workflows. The diagram can easily be understood by technicians and developers in order to transform them to a working system for further use.

The Business Process Modelling and Notation, which was researched and released by the OMG organization which provides the definitions in an XML format. The BPMN diagrams represent the business process in an easy-to-understand way with its great visualization.

RedHat's .bpmn2 extension:

Every process model has its own working flow and has its own BPMN diagram and notation. In order to run the diagram, we require some extension. One such way is Red Hat Process Automation Manager which consists of latest designed processes for developing business process model and notation diagrams and let the user create new and old BPMN diagrams using .bpmn2 extension. The new diagrams are created in the latest designer and it also has better layout and features which make the diagrams better.

Types of BPMN diagrams

BPMN diagrams are of certain types based on the depiction which can be for internal process as well as external process, simple process or a complex process. They are:

- **Collaboration diagrams**that depict the communication between multiple processes by using two or more pools. There main attention is on the performance of every pool that passes messages and information among one another.

- **Choreography diagrams** that depict the communicationbetween more than one participant in a diagram. Such diagrams can be encapsulated inside a collaboration, including other elements and connectors to create better interaction between participants.

- **Conversation diagrams**depicts a batch of related information exchange in the business processes and act like an easier version of a collaboration diagram.

Bpmn-js three variants:

BPMN when viewed from the libraries that it offers is seen as the following three fundamental features:

- **BPMN Viewer:**in order to view the diagram
- **BPMN NavigatedViewer:**helps to navigate the diagram as well as display it
- **BPMN Modeler:**in order to edit the diagram

Approaches to use bpmn-js in our application

Bpmn-js can be used in applications in two ways:

One of the ways is to use the pre-packaged version that consists of the libraries that are required to add BPMN to the applications and sites. Including those libraries in script automatically brings in all the requirements of BPMN.

Another way to work with BPMN is to use thenpm version. This is a slightly complex way although it provides access to each component of the library and also easily extended.

3.3.2.2BPMN Viewer

The BPMN viewer, offered by bpmn-js is a tool that helps to display and view the BPMN diagrams that are embedded in the applications. The bpmn-io has embedded all the libraries in Github with MIT licence but is open source so that it can be used by the users.

The BPMN viewer enriches the data and showcases the diagram.

Embed the Pre-Packaged Viewer

One of the ways to work with the BPMN viewer is to embed the pre-packaged version to the diagram that includes all the required libraries to our model.

An addition script of adding an element known as container is to be written in order to render the bpmn diagram to the application as well to let the page understand which library is to be used.

The viewer is them available for use and can be invoked using a JavaScript code and

runtime environment, Node.js.

```html
<!-- BPMN diagram container -->
<div id="canvas"></div>

<!-- replace CDN url with local bpmn-js path -->
<script src="https://unpkg.com/bpmn-js/dist/bpmn-viewer.development.js"></script>
```

Figure 3.7 (a) Pre-packaged viewer

```html
<script>
  // the diagram you are going to display
  const bpmnXML;

  // BpmnJS is the BPMN viewer instance
  const viewer = new BpmnJS({ container: '#canvas' });

  // import a BPMN 2.0 diagram
  try {
    // we did well!
    await viewer.importXML(bpmnXML);
    viewer.get('canvas').zoom('fit-viewport');

  } catch (err) {
    // import failed :-(
  }
</script>
```

Figure 3.7 (b) Pre-packaged viewer

Although this is one of the ways, we can also load the diagram using AJAX. This is a part of JQuery and requires additional scripts to embed these libraries as well. The diagrams are loaded dynamically and again JQuery and JavaScript together work to provide an API to render diagram.

3.3.2.3 BPMN Modeler

As we use a viewer to display the diagrams, but it does not offer us to edit the diagram if we want to. If we want to do so, we use BPMN modeler which provides us additional factors of creating the diagram from scratch or modifying the existing diagram as well as viewing.

As we saw earlier, we can embed the libraries using the pre-packages version, but the other way to build a diagram is to use npm for installing the libraries. This way has some better advantages including accessing some specific and particular components of the library. Not only this, but through installation via npm, we gain more control over the model.

```
import Modeler from 'bpmn-js/lib/Modeler';

// create a modeler
const modeler = new Modeler({ container: '#canvas' });

// import diagram
try {
  await modeler.importXML(bpmnXML);
  // ...
} catch (err) {
  // err...
}
```

Figure 3.8 BPMN modeller

Now, once we embed the modeller, we need to attach the scripts and stylesheets as well in order to render the diagrams to the webpage. The stylesheets include the frontend view of the diagram as well as the mandatory BPMN logo.

This not only allows us to work on our diagram but also ensures that the format and style of our diagram is appropriate and clear to understand as well as visually better. It looks into the formatting and styling od the components and symbols.

```
<link rel="stylesheet" href="bpmn-js/dist/assets/diagram-js.css" />
<link rel="stylesheet" href="bpmn-js/dist/assets/bpmn-font/css/bpmn.css" />
```

Figure 3.9 BPMN stylesheets

3.3.2.4 BPMN Interaction

As of now, we can tell that bpmn-io gives us great libraries for viewing and modelling the BPMN diagram. There is another functionality of BPMN Interaction that tells us about the ways in which a user can interact with the diagram, using bpmn-js. It provides us with a console which logs the information about user interaction with BPMN diagram.

In order to understand the functionality well, we need to link some event listeners that could trigger the interaction and log the information. They can be used in BPMN viewer a well as BPMN modeler once the diagram is opened in the webpage:

```
var viewer = new BpmnJS({ container: SOME_CONTAINER });

try {
        await viewer.importXML(diagramXM);

        // diagram is loaded, add interaction to it now
        // see below for options
        // ...
} catch (err) {
        console.error('Error happened: ', err);
}
```

Figure 3.10 BPMN interaction

The diagram-user interaction can work in the following ways:

- **diagram events**

We can use the service known aseventBuswhich has certain events related to the elements, for eg: hover, out, mouseup, mousedown, etc and accordingly logs the user interaction with the diagram. It is made in such a way that even if the user is working via a touchpad, it would still log correct information.

```
var eventBus = viewer.get('eventBus');

// you may hook into any of the following events
var events = [
  'element.hover',
  'element.out',
  'element.click',
  'element.dblclick',
  'element.mousedown',
  'element.mouseup'
];

events.forEach(function(event) {

  eventBus.on(event, function(e) {
    // e.element = the model element
    // e.gfx = the graphical element

    log(event, 'on', e.element.id);
  });
});
```

Figure 3.11 BPMN Interaction hook into diagram events

- **listener attached to DOM**

Another way can be to attach the listener directly to HTML or SVG nodes known as DOM nodes which gives us better access and power on the required elements.

This is done by using querySelector with [data-element-id=ID_OF_ELEMENT] and
search for them:

```
// each model element a data-element-id attribute attached to
// it in HTML

// select the end event
var endEventNode = document.querySelector('[data-element-id=END_EVENT]');
endEventNode.addEventListener('click', function(e) {
  alert('clicked the end event!');
});
```

Figure 3.12 BPMN interaction directly attach listener to DOM

Both the ways are convenient and works efficiently and can be used for interaction between
user and the bpmn diagram.

3.3.3 Working with DMN

Dmn-js:

Similar to bpmn-js, dmn-js works with the decision models, Decision Modelling and
Notation, DMN and gives us functionalities like viewing, modifying and building the
diagram and decision tables and DRDs. It lets embeds these into applications.

3.3.3.1 DMN Diagram and Decision Table

A DMN model is represented by decision requirements diagram, abbreviated as DRD. This
in turn can contain many decision requirements graphs, abbreviated as DRG which depicts
a specific part of the DRD. The decision requirement graphs can trace the whole decision
track and all nodes involving decision making models and tables, as well as other elements
and components included in the diagram.

A tabular representation is given by a decision table in the decision modelling and notation
which is a visual outlook of what the decision of business process are. They define the
rules that are applied in order to give the result based on given input in a decision model.
The decision tables include multiple columns that are inputs and every rule includes a row
and the rule is applicable on that row's input columns to give the result.The input and
output can be of any type which are defined in the code.

The decision tables are easily modified and edited based on the user's requirement and can
be given a hit policy as to in what way it searches for the result.

Table 3.4Decision Table for DMN diagram

3.3.3.2DMN Viewer

Figure 3.13 DMN viewer

3.3.3.3 DMN Modeler

As we use a viewer to display the diagrams, but it does not offer us to edit the diagram if we want to. If we want to do so, we use DMN modeler which provides us additional factors of creating the diagram from scratch or modifying the existing diagram as well as viewing.

Modelling is initiated at the viewer of Decision Requirements Diagram. Then the modeler is started and can be used to work around the canvas in order to build or edit diagram or decision table.

The diagram or components or decision tables can be modified by using the canvas drag and drop option or by working on the xml format script in dmn extension and embedding the required scripts to the code by giving a name to the DMN model as well as an id.

The modeler consists of the components that are used to create or modify the diagram and table, namely, Decisions, input data, as well as knowledge source and business knowledge model as well as requirements that connect them.

```
Modeler

<link rel="stylesheet" href="https://unpkg.com/dmn-js@12.1.1/dist/assets/diagram-js.css">
<link rel="stylesheet" href="https://unpkg.com/dmn-js@12.1.1/dist/assets/dmn-js-shared.css">
<link rel="stylesheet" href="https://unpkg.com/dmn-js@12.1.1/dist/assets/dmn-js-drd.css">
<link rel="stylesheet" href="https://unpkg.com/dmn-js@12.1.1/dist/assets/dmn-js-decision-table.css">
<link rel="stylesheet" href="https://unpkg.com/dmn-js@12.1.1/dist/assets/dmn-js-decision-table-controls.css">
<link rel="stylesheet" href="https://unpkg.com/dmn-js@12.1.1/dist/assets/dmn-js-literal-expression.css">
<link rel="stylesheet" href="https://unpkg.com/dmn-js@12.1.1/dist/assets/dmn-font/css/dmn.css">

<script src="https://unpkg.com/dmn-js@12.1.1/dist/dmn-modeler.development.js"></script>
```

Figure 3.14 DMN modeler

3.3.4 Working with BPMN and DMN in Camunda

3.3.4.1 Camunda

Camunda is a Platform or a toolkit which is has many versions - enterprise and community and offers many functionalities to organize and visualize as well as operate the business models which can be business related process or logical decision models and allows working and maintaining the Business process modelling and Notation as well as Decision Modelling and Notation at a same place and lets the users deploy the work and diagram for visualization and understanding real time working to the work engine of Camunda. It is created in unison with the bpmn-io.

In Camunda, we can create the process flow diagrams easily using the standard symbols and understand the actual flow of the process. Camunda allows user to build a diagram from scratch as well as work on any existing diagram while providing additional properties panel to add or link other standards. Once completed, it allows user to deploy the work to its interactive webapps in the work engine which can then be started and can show the user the path from the starting point till the destination pointing out every stop of the flow.

Camunda BPM Engine can be used to work on the Business Processing Model notation, Decision Modelling and Notation as well as Case Management Modelling and Notation.

The main advantageof working on this tool is that it is more flexible as well as easy to understand and the webapps and technologies can be used with any prior experience, doesn't produce much additional costs of license as well as improves the process quality.
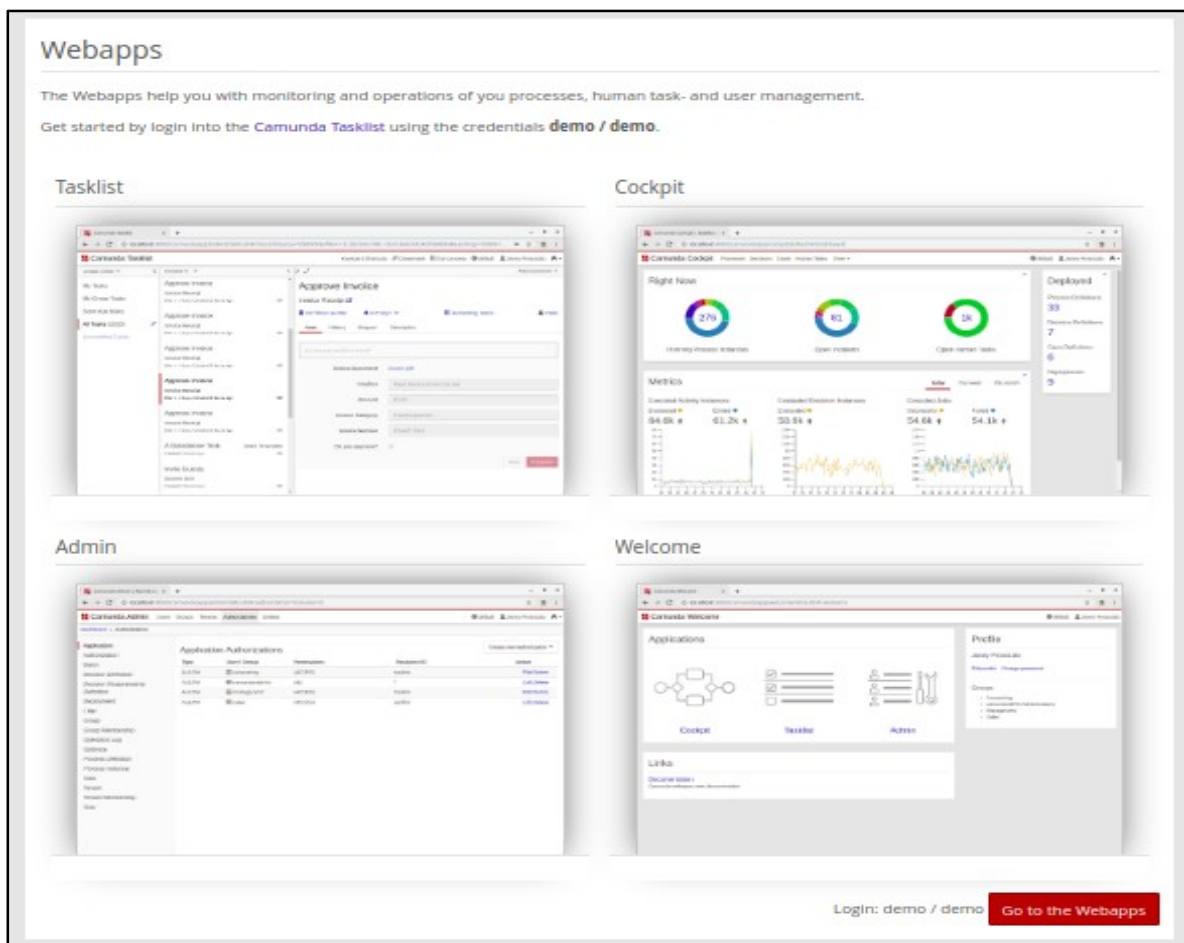
Figure 3.15 Camunda Tools

Figure 3.16 Camunda Webapps

3.3.4.2 Camunda Modeler

Camunda Modeller is based on bpmn-io and provides a solution to combine the business process modelling and Notation, Decision Modelling and Notation as well as Forms. The Camunda Modeler desktop application lets user work with the diagrams, lets them view it and edit it if they want to. The applications let the developers work with them to

create processes and decision tables and models.

It depicts the diagram in a graphical format for easy visualization such that anyone can use it without requiring additional knowledge and experience. It also consists of XML format code and allows us to deploy the diagrams, processes and decision tables to the workflow engine.

3.3.4.3 Camunda Cockpit

Camunda offers an application that is known as the Cockpit, it is the part of the Camunda application that's gives us live view of how the processes and decisions are taking place at the moment through the BPMN and DMN notations while they are running. This helps in monitoring the diagrams and understand how they work and if their needs to be any changes done technically or visually in order to make them more fast and efficient.
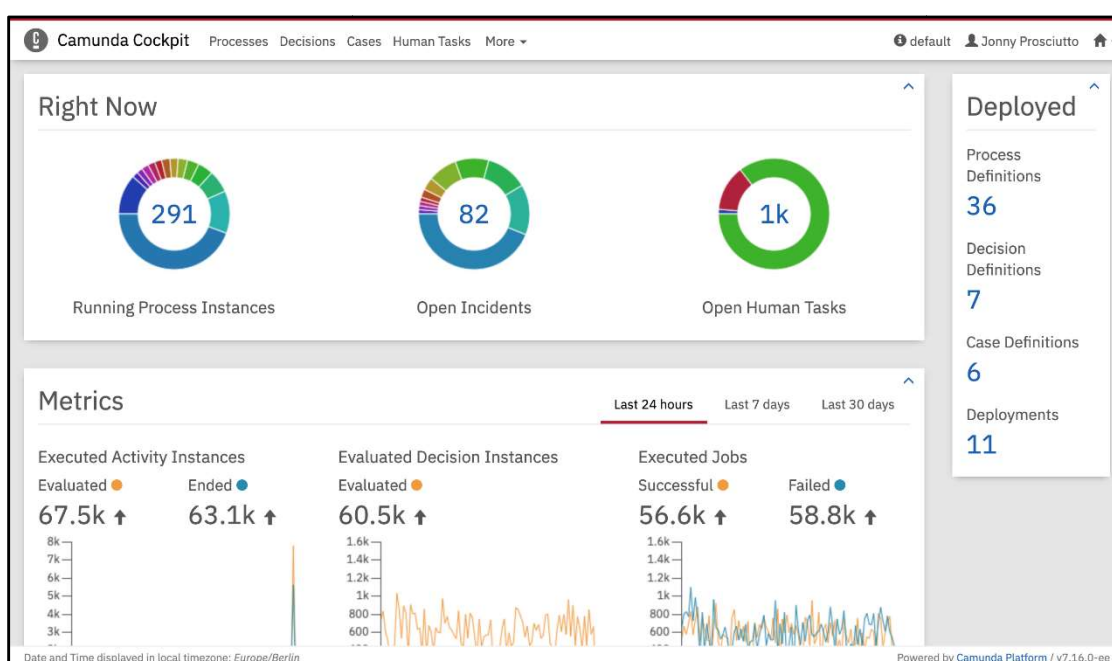
Figure 3.17 Camunda Cockpit

3.3.4.4 Camunda Tasklist

Camunda offers an application that is known as the Tasklist, it is the part of the Camunda application that's connected to the balanced process capabilities Camunda has to offer. When a user has to work on a task, the process is listed in the Tasklist to start it and work on it. The model is deployed from the Camunda Modeler to the Workflow engine. It works with the BPMN process to get results but putting requested input in the form if provided.
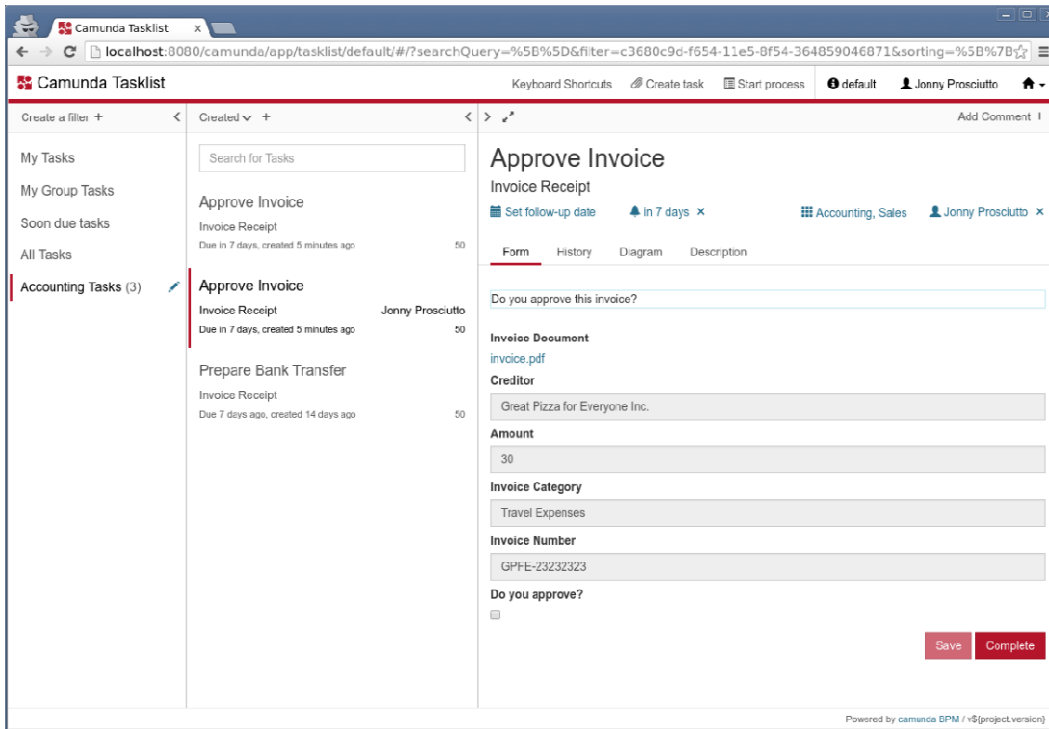
Figure 3.18 Camunda Tasklist

3.3.5 Integrating BPMN and DMN

Although we have seen enough times that the BPMN and DMN models can work independent to each other but according to many analysts, it has been seen that the two standards can actually be combined together in order to give better results. It is observed that the amalgamation of BPMN and DMN gives a full tool for analysis and modelling of business process that requires logical decision making. It depends on organization to organization whether or not they want to use them together or not on the basis of their process work requirements.

The release of Decision Model and Notation added a new outlook to the pre-existing Business Process Modelling Notation which used to dominate earlier. This was because the DMN allowed decision to be taken into consideration while creating the process workflow without creating a chaos in a vendor-neutral way.

Before the development of BPMN standard, analysts used to include random decision logics in the process that would end up making the processes unorganized and chaotic. The BPMN diagram would end up scattered. This resulted in a weak process model. DMN helps take major decisions in a business process based on logical thinking and based on the calculation from the given inputs to provide a correct decision result for the process to move forward.
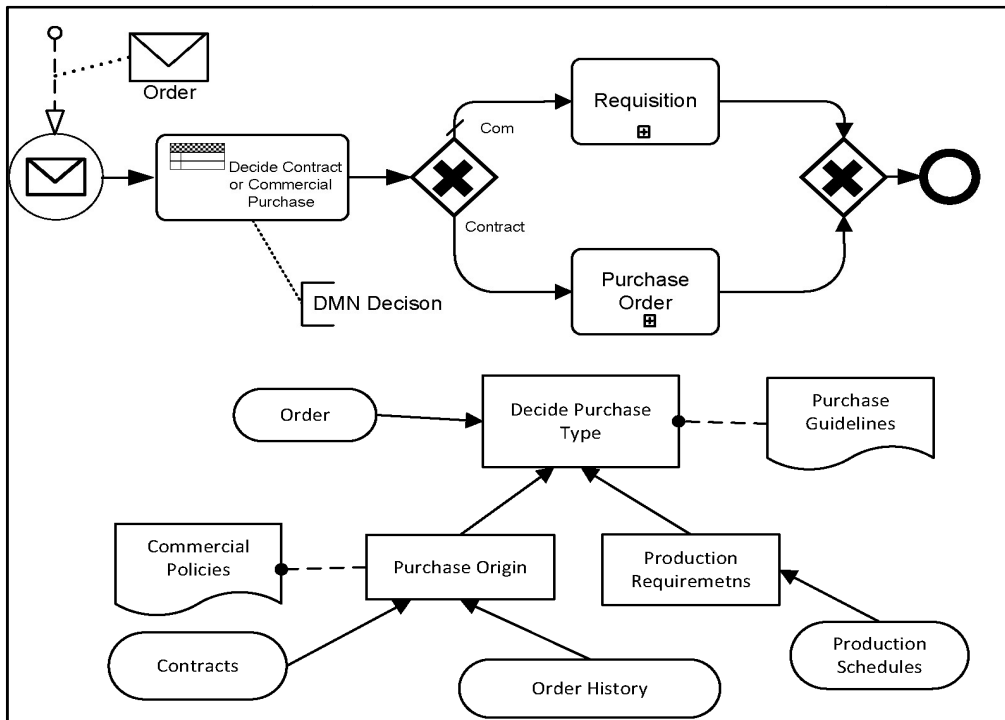
Figure 3.19 Example of BPMN and DMN integrated

Combining the two standards BPMN and DMN lay out an even more great and super as well as capable toolkit for the analysts, including main four key benefits like Streamlined business processes and Focused requirements process as well as Improved visibility and flexibility of business rules.

The two key advantages in adding a decision layer to a Business Process Model are: changing a process routing without re-deploying it and testing the system behaviour without side effects.

Streamlined processes

An integrated model of BPMN and DMN makes it easier to change the decision layer without disrupting the whole model since the two models are linked to one another, i.e work independently but complete each other.

Focused requirements

The integration helps to focus on the process and decision independently which increases the efficiency and make work better and since the models are independently create, it is easy to mange them individually and then link them

Improved visibility and flexibility

Earlier, BPMN used to become chaotic since the analysts used to add decisions into the process and it would make it complex and visually complicated. Addition of DMN has improved the visibility as well as improved the credibility and efficiency of the process as well as making them more flexible.

Framework for analytics

DMN lets advanced analytics be combined to a process and yields a model with decision making which impacts the analytic models to be expressed rather clearly.

A BPMN Process is integrated to a DMN using a component known as the business rule task in BPMN which can be implement as DRL or as DMN file and on the basis of the output produced by it, it gets assigned to a user task.

3.4   Flow Graph of the Project
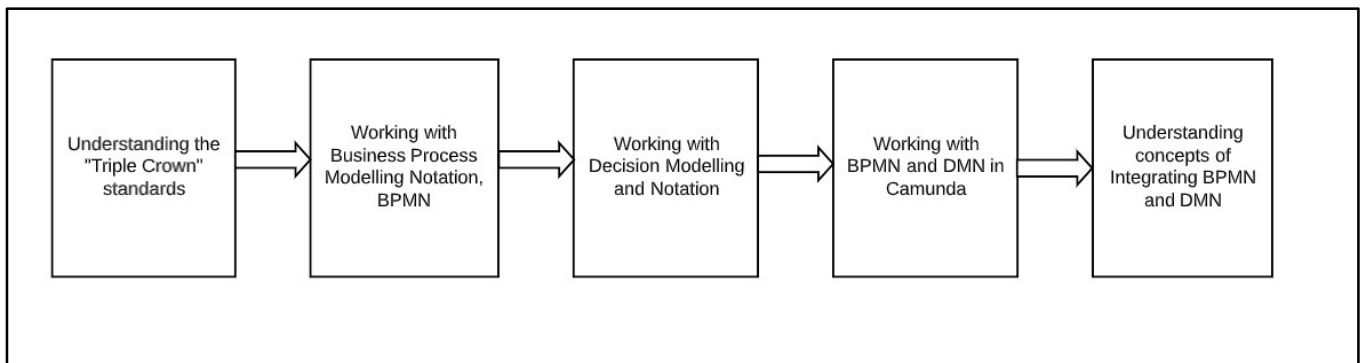
Fig 3.20Project flow chart

The reason behind working on this project is to understand the ways in which the institutions can elevate the quality of their work. With appropriate amount of analysis and research, an organization named as OMG came up with some standards. The two main standards that were focused on this project where the Business Process Modelling Notation and Decision Modelling and Notation which describes information in a graphical flowchart that informs about the processes and logical decision in a simpler manner using visualization, respectively.

The first stage of the project begins with the research about the two standards, BPMN and DMN. Understand their behaviour and the why should we use these.

The second stage of the project is working on the BPMN model which would include the viewer and modeller and interactor of the created BPMN diagram.

The third stage of the project is working on the DMN model which again, like BPMN, will include the viewer for the diagram, as well as the modeller.

For the stages two and three, we work using node.js, which is a runtime environment for JavaScript programs for creating modeller and viewer. The diagrams for the DMN and BPMN models will be created in xml format using the .bpmn and .dmn extensions provided by the RedHat organisation. The diagrams will then be required to pushed to github, from

where those will be loaded in the modeller and viewer of the models.

This same activity is then repeated in Camunda, in order to understand how it works in it. Camunda provides us with a cockpit where the diagrams can be deployed in order to visualize and organise.

The last stage of the project is understanding the interaction between the two models, could they be connected, why they should or should not be connect/linked with each other, the benefits of doing the same.

This helps understand the working of BPMN, DMN and node.js and JavaScript as well as Github.

Chapter 04: PERFORMANCE ANALYSIS

4.1 Screenshots of the Performance Analysis
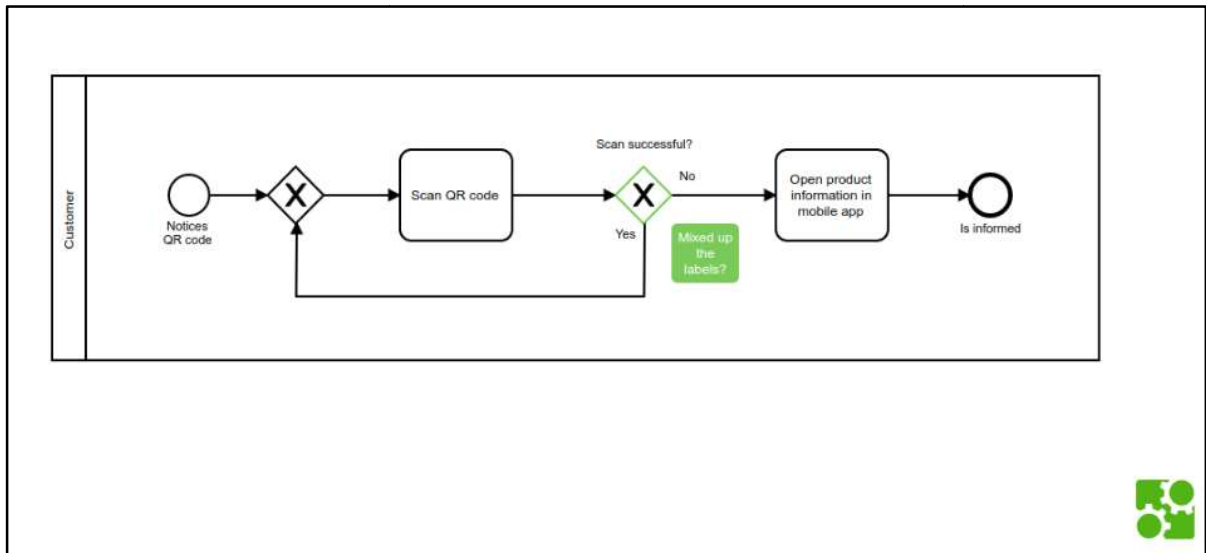
Figure 4.1 BPMN Diagram-1 viewer
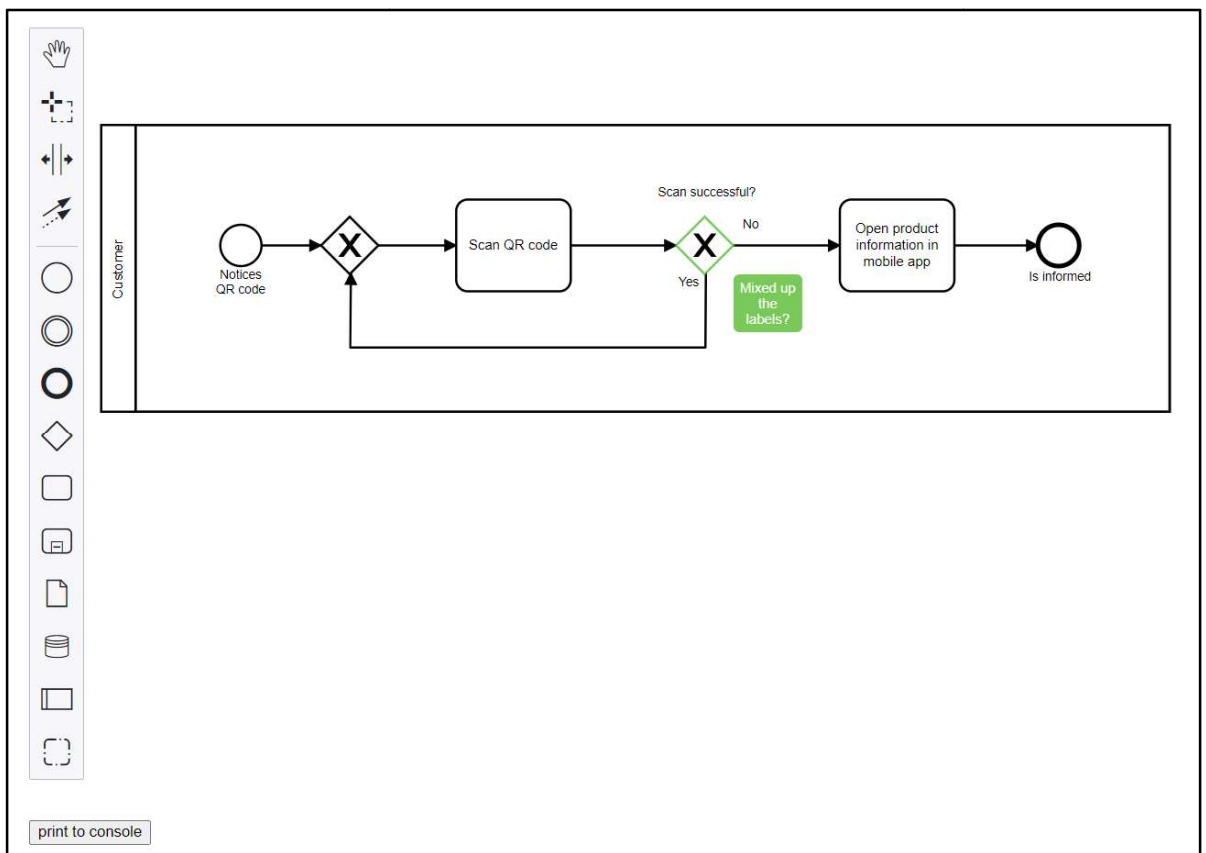
Figure 4.2 BPMN Diagram-1 modeler

Figure 4.3 BPMN Diagram-1 interaction
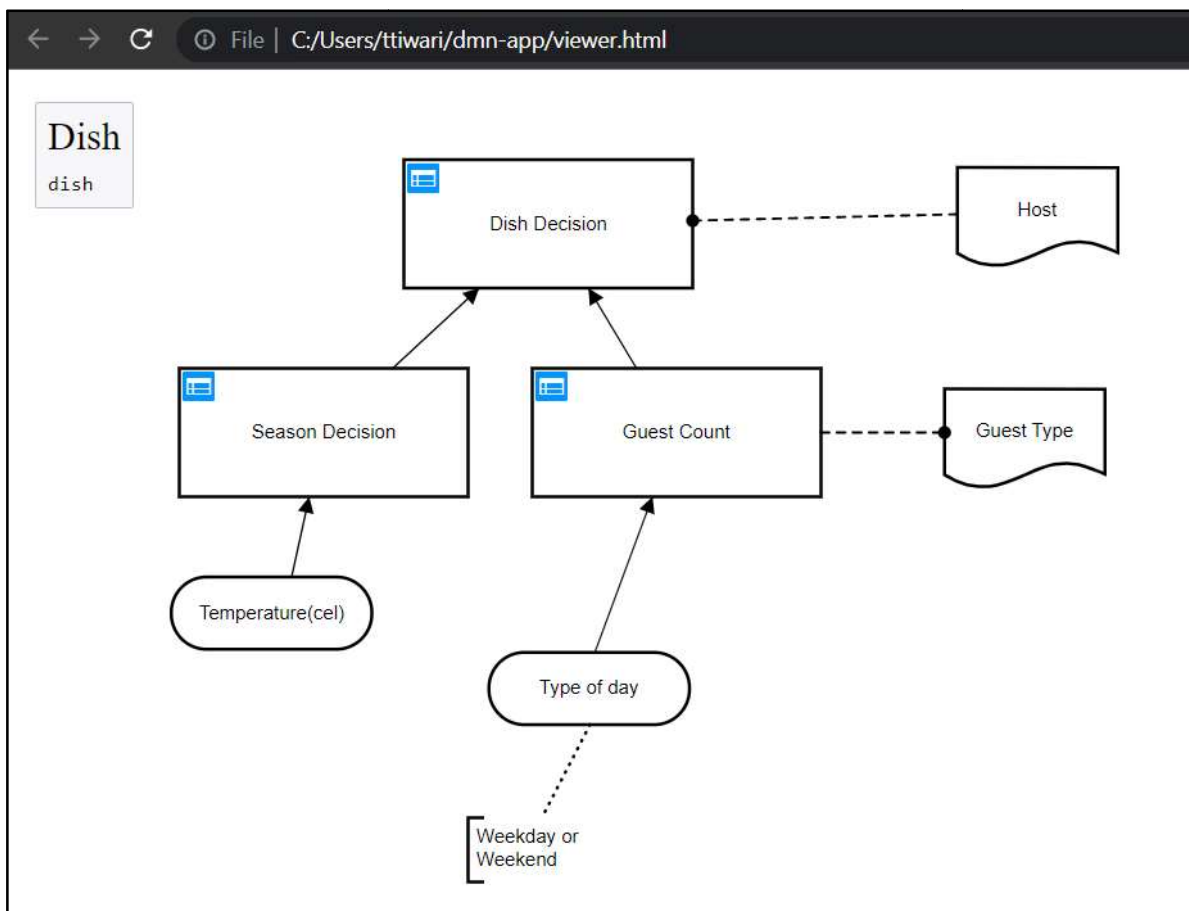
Figure 4.4 DMN Diagram-1 viewer

Dish Decision | Hit Policy: Unique

|	When Season *string*	And How many guests *integer*	Then Dish *string*	Annotations
1	"Winter"	<=8	"SpareRibs"	-
2	"Winter"	>8	"Pasta"	-
3	"Summer"	<10	"Light Salad"	-
4	"Winter"	<=10	"Beans Salad"	-
5	"Spring"	<10	"Stew"	-
6	"Spring"	>=10	"Stake"	-

Table 4.1 DMN Decision Table - Dish Decision

Season Decision | Hit Policy: Unique

	When Weather in Celsius *integer*	Then season *string*	Annotations
1	>30	"Summer"	-
2	<10	"Winter"	-
3	[10..30]	"Sprint"	-

Table 4.2 DMN Decision Table - Season Decision

Guest Count | Hit Policy: Unique

	When Type of day *string*	Then Guest Count *integer*	Annotations
1	"Weekday"	4	-
2	"Holiday"	10	-
3	"Weekend"	15	-

Table 4.3 DMN Decision Table – Guest Count
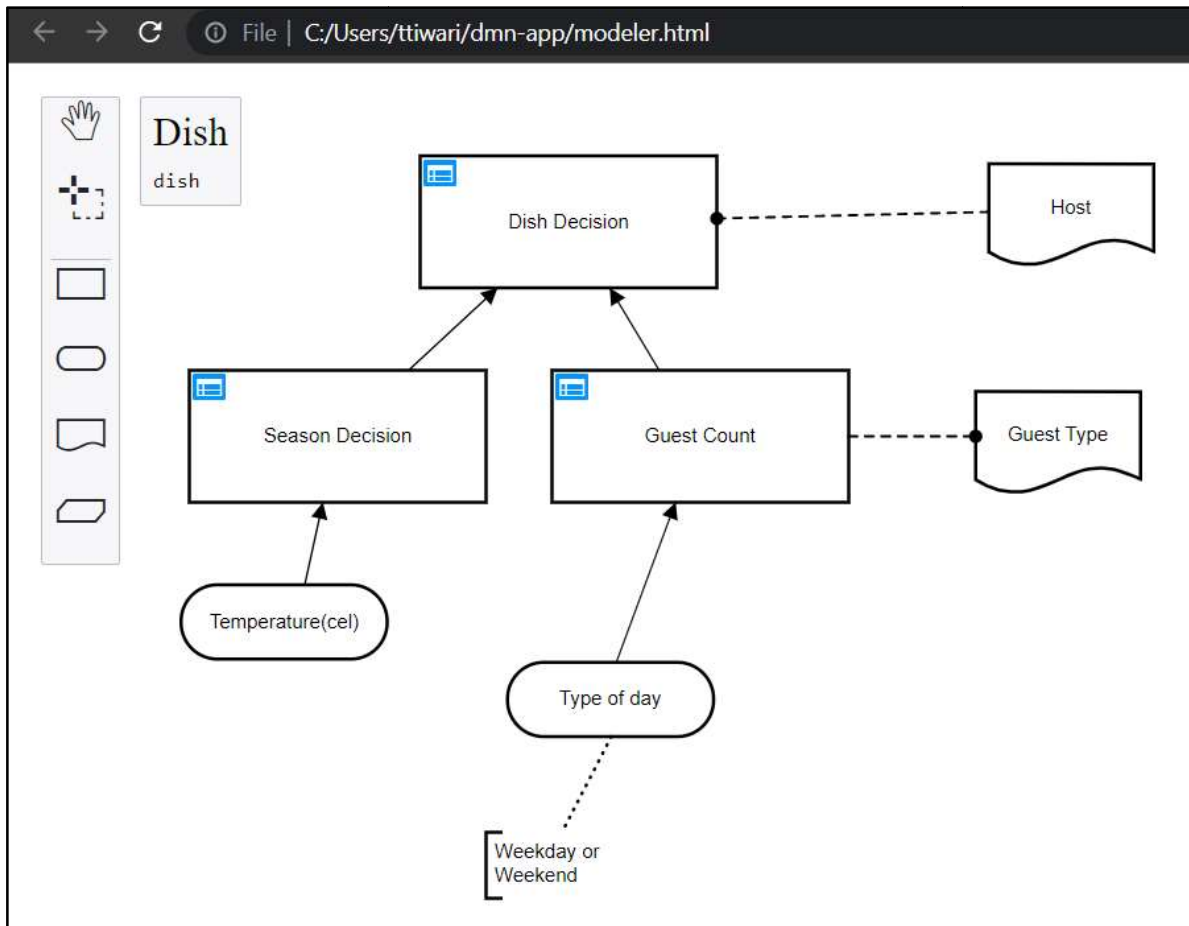
Figure 4.5 DMN Diagram-1 modeler

Table 4.4 DMN Decision Table - Dish Decision modeler
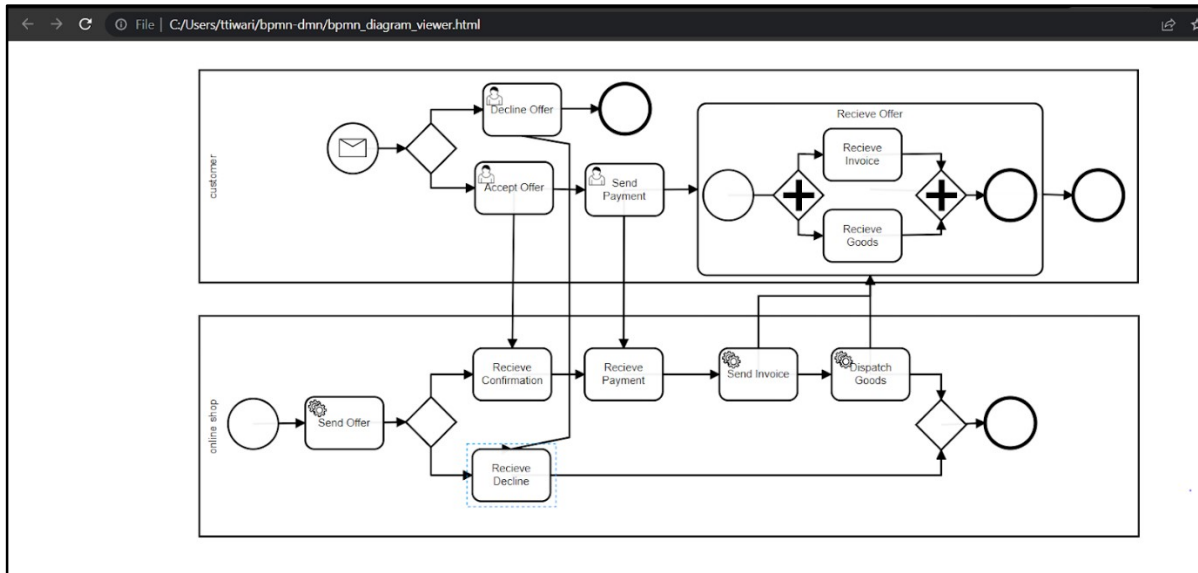
Figure 4.6 BPMN Diagram-2 viewer
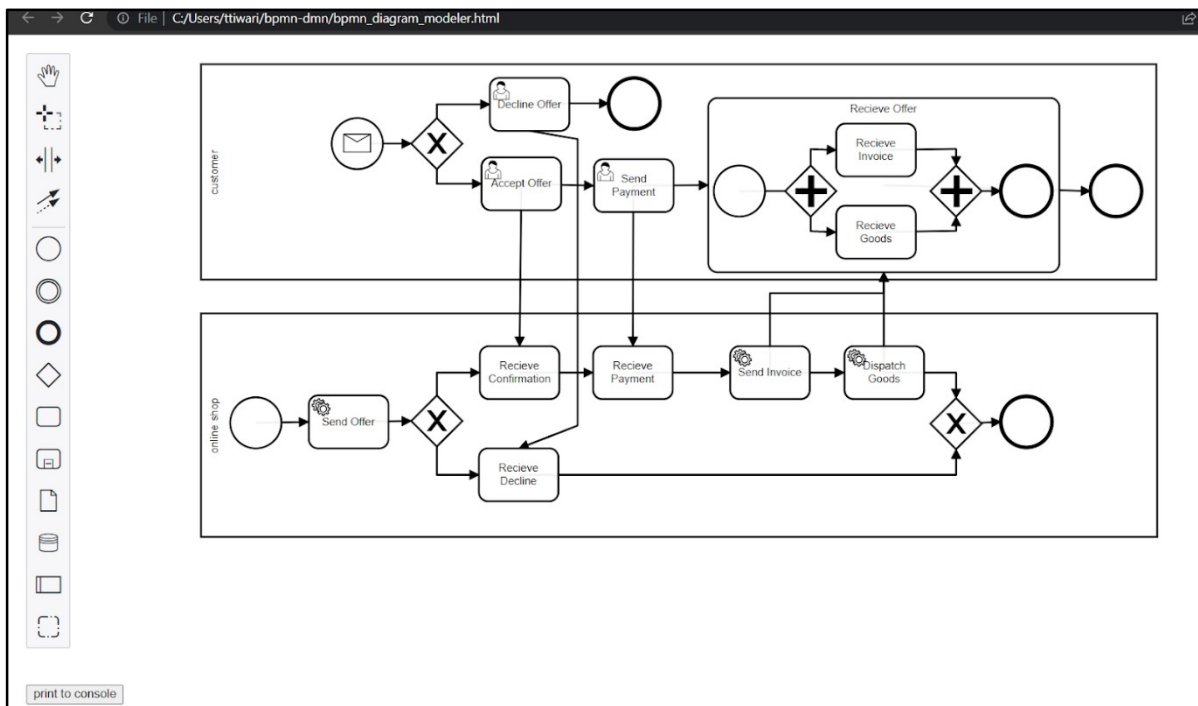
Figure 4.7 BPMN Diagram-2 modeler

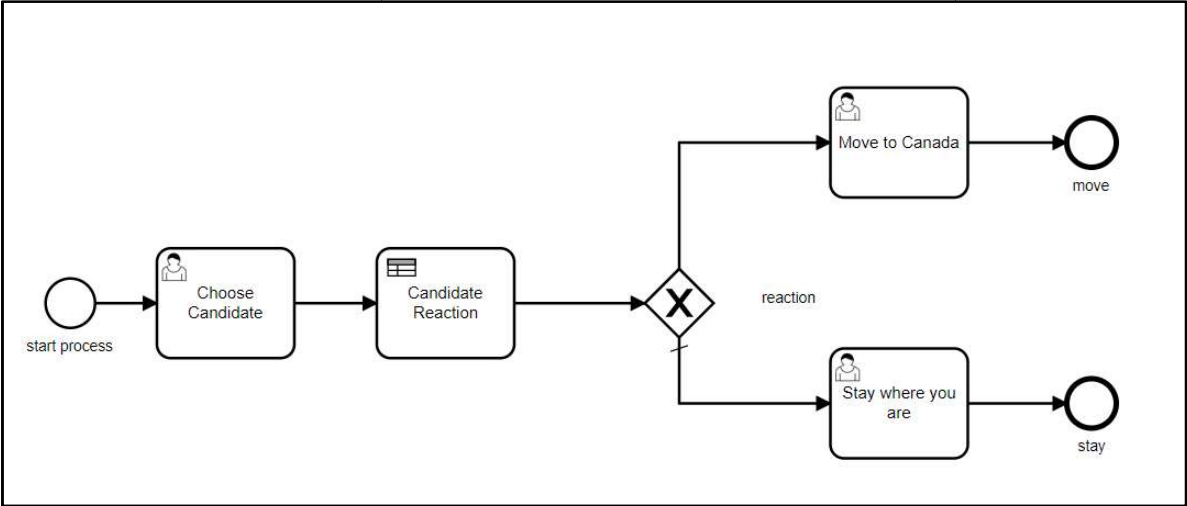Figure 4.8 BPMN-DMN Integration (BPMN Diagram) in Camunda

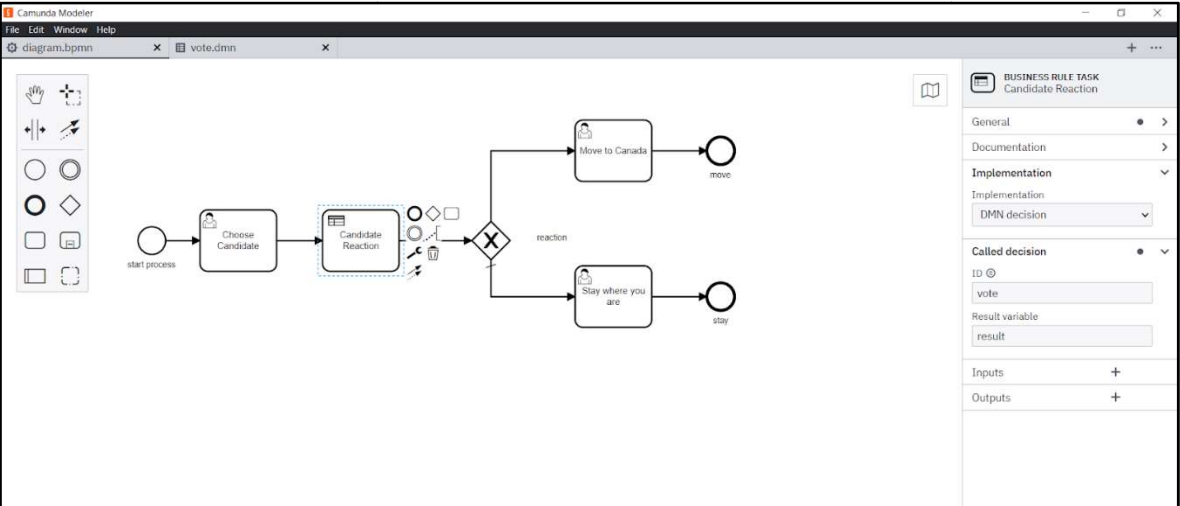Table 4.5 BPMN-DMN Integration (DMN Decision Table) in Camunda
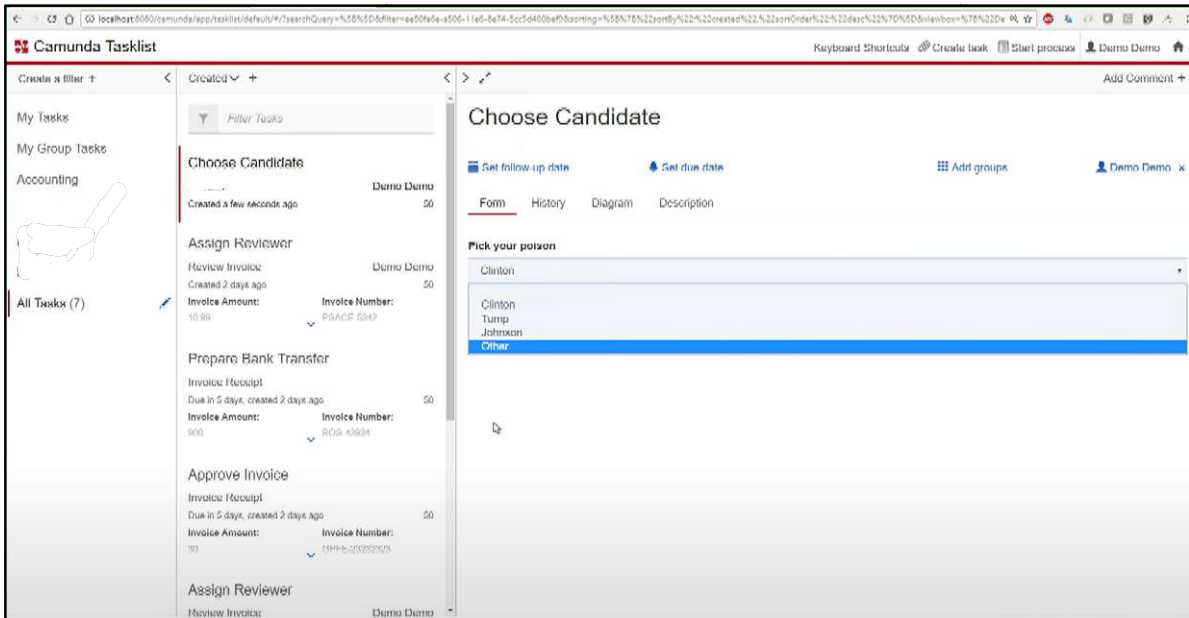

Figure 4.9 BPMN-DMN Integration in Camunda

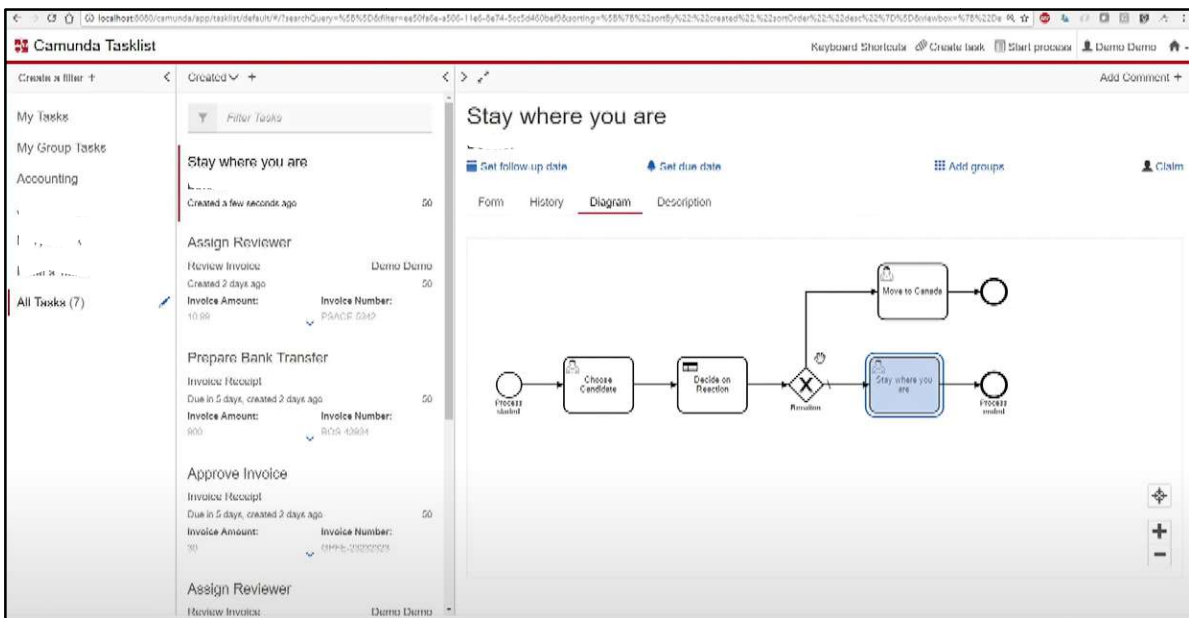Figure 4.10 BPMN-DMN Deployment in Camunda (Tasklist)

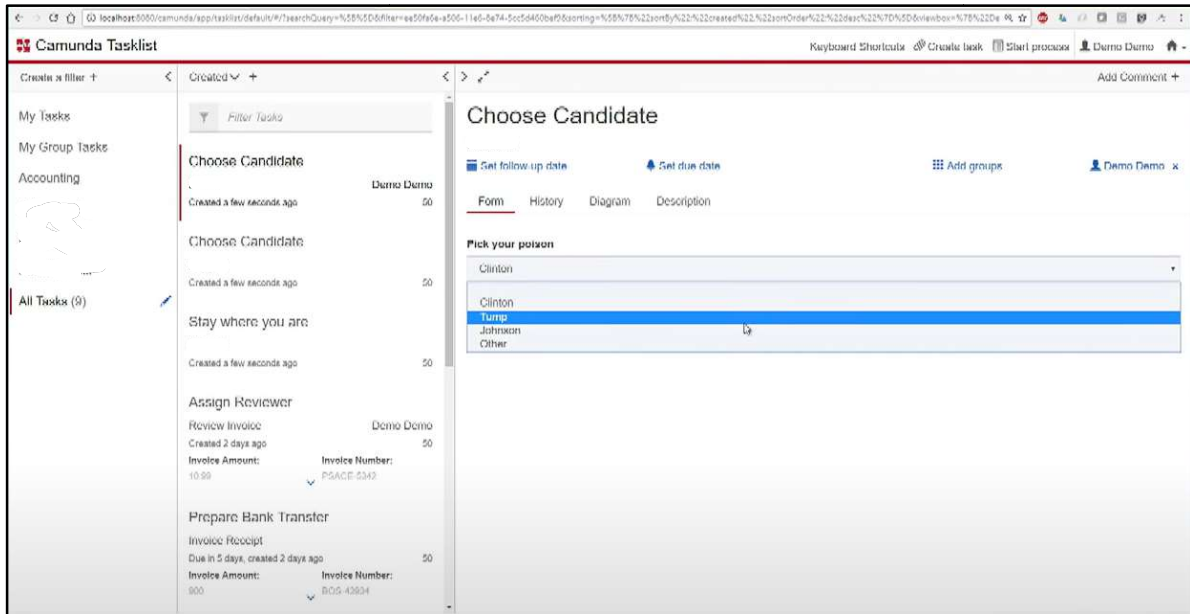Figure 4.11 BPMN-DMN Deployment in Camunda (Result)

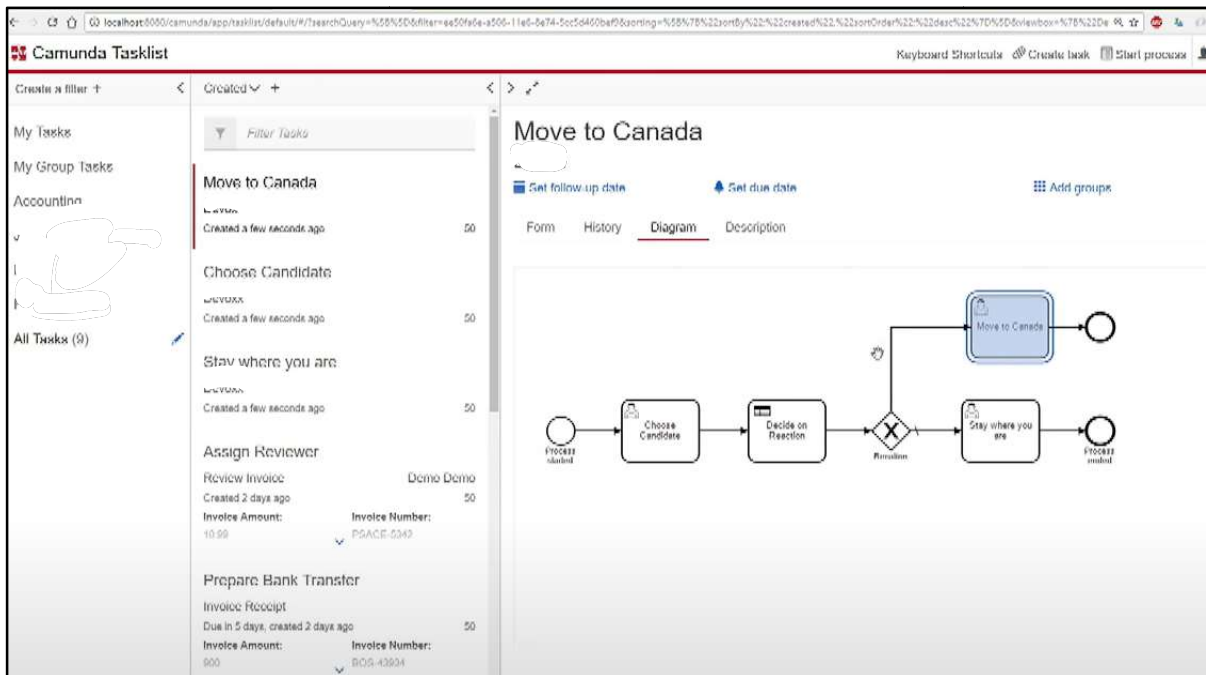Figure 4.12 BPMN-DMN Deployment in Camunda (Tasklist)

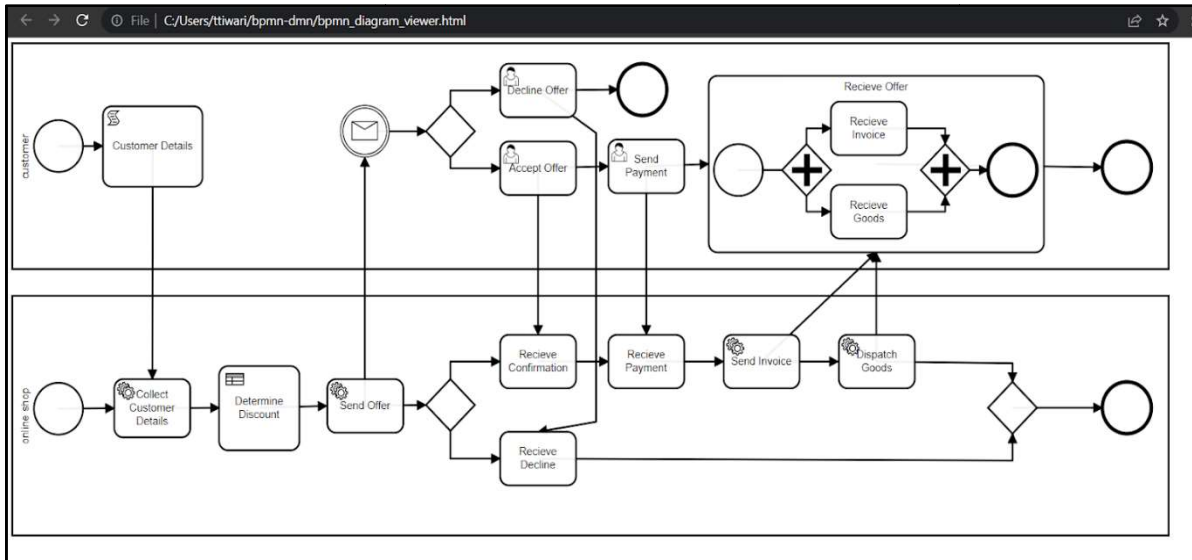Figure 4.13 BPMN-DMN Deployment in Camunda (Result)

Figure 4.14 BPMN-DMN Integration (BPMN Diagram-2)

View DRD

Determine Discount | **Hit Policy:** First

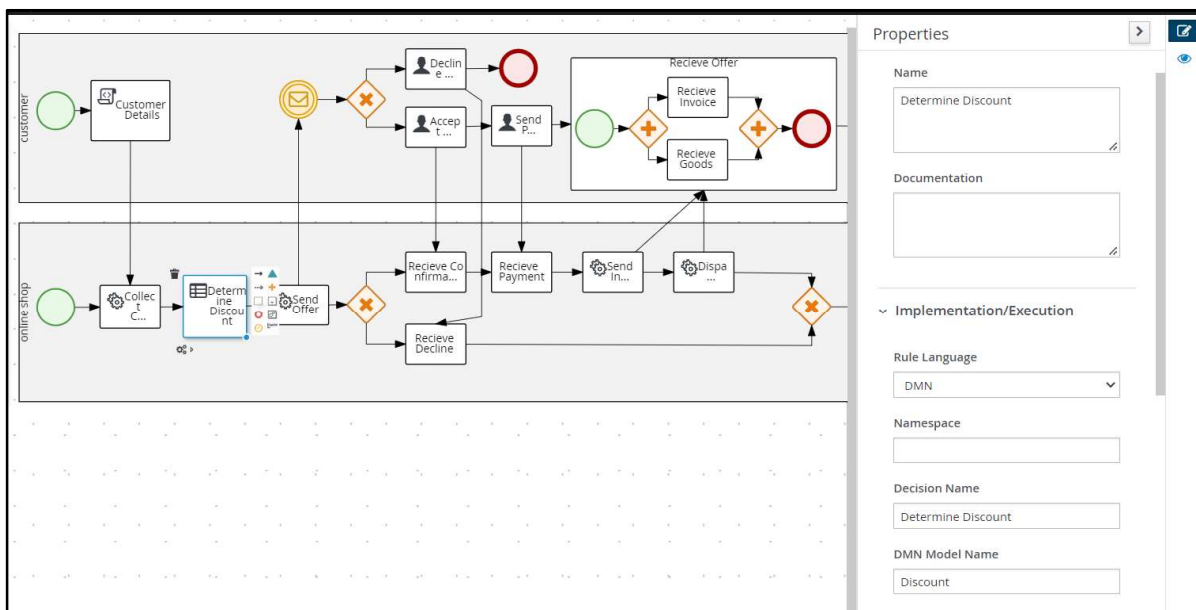|	When	And	Then	
	VIP status	Age	Discount	Annotations
	string	Integer	string	
1	"yes"		"25%"	-
2	"no"	>=40	"20%"	-
3	"no"	[18..39]	"15%"	-
4	"no"	<18	"10%"	-

Table 4.6 BPMN-DMN Integration (DMN Decision Table) 2

Figure 4.15 BPMN-DMN Integration in RedHat VSCode

Chapter 05: RESULTS AND CONCLUSION

5.1 Discussion on the Results Achieved

The screenshots of the project in the earlier section gives us the whole report about how the diagrams turned out to be and how the bpmn diagram process workflow takes place and different kinds of elements and components like service task and user task has been used according to the requirement in the BPMN diagram and similarly in the Decision Model and Notation we can see how multiple knowledge sources are evaluating the decision and how the decision tables are created and the hit policy of the table. Not only this, but the integration of the two standards can also be seen and how camunda helps us in order to deploy and work upon the organizing and viewing our diagram in the Camunda Tasklist and Cockpit. Total 2 bpmn diagrams and 2 dmn diagrams and 2 integrated models can be seen to understand the standards completely and also have worked on the modeler and viewer of the BPMN and DMN models using redhat's extension and NodeJs, HTML and CSS.

5.2 Applications of the Project

Business Process Modelling Notation can be seen in many fields and applications from Information Systems Development, to Business Process Management and so on and so forth.
BPMN is known for creating an easy and correct way to contrast between the different models and also helps in communicating between different departments in an institution or company.
BPMN helps organizations and business to break down complex problems by understanding their problems and creating an easy-to-understand graphical workflow.
Since BPMN is considered a standard, it is obvious that it consists of standard semantics that helps everyone to understand the graph easily.

As discussed before, Decision Modelling Notation helps in building logical decisions for the business process and makes the process more readable and efficient by and helps the company to make better decisions.
Similar to BPMN models, the DMN diagram is also easy to understand by everyone in the business management.
It lays out a basis for having an argument and agreement on the nature of decision making.

Although BPMN and DMN can work independently, but it has been observed that integrating the two standards actually provide a whole tool and has benefits like Streamlined business processes and Focused requirements process as well as Improved visibility and flexibility of business rules.

5.3 Limitation of the Project

In conclusion, there are some limitations of the project. The Camunda Community version doesn't provide much area of deployment to the users and therefore, we can not see the working and organizing as well as the real-time visualization of our project. Apart from this, the red hat automation manager on one hand provides us with the bpmn and dmn extensions but provides no place for deployment due to which we had to shift to Camunda.

5.4 Future Work

The future work for this project can be to work with Case Management Model and Notation independently as well as in combination with Business Process Modelling Notation and Decision Modelling and Notation and understand how they work.

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➢ *K. Kluza, P. Wiśniewski, K. Jobczyk, A. Ligęza and A. S. Mroczek, "Comparison of selected modeling notations for process, decision and system modeling," 2017 Federated Conference on Computer Science and Information Systems (FedCSIS), 2017, pp. 1095-1098, doi: 10.15439/2017F454.*

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