University of Kerbala
College of Computer Science &
Information Technology
Computer Science Department

Data analysis of the annual statistical collection using KNIME platform

Authors

Haider Adel Jaafar

Abdullah Falih shaheed

Ameer Ibrahim Sahib

Supervised by

Dr. Dhamyaa A. Nasrawi

A partial requirement for the Bachelor of Science (B.Sc.) in Computer Science

University of Kerbala / College of Computer Science & Information Technology /
Computer Science Department

2024

Supervisor Certification

I certify that the project entitled

" Data Analysis of the Annual Statistical Collection Using KNIME Platform"

was prepared under my supervision at the departtment of Computer Science / College of Computer Science & Information Technology / University of Kerbala as a partial requirement for the Bachelor of Science (B.Sc.) in Computer Science

Signature:

Name: Assist Prof. Dr. Dhamyaa A. Nasrawi

Date: / /2024

Abstract

Sustainable development is development that takes into account the social and environmental dimensions in addition to the economic dimensions to make good use of available resources to meet the needs of individuals while preserving the rights of future generations.

The Sustainable Development Goals (SDGs), officially known as Transforming Our World (2030 Agenda for Sustainable Development) are a set of 17 goals set by the United Nations. On 1 January 2016, the 17 SDGs were included in the development agenda. Sustainable by 2030.

The aim of this project is to collect and analysis data of the 3rd goal (Good Health and Wellbeing) and tries to assess and analyze the progress made toward it.

The dataset was collected from the official Iraqi agencies sourced by the UN.

The dataset was analyzed assessed and displayed in clear meaningful charts using the KNIME Analytics Platform (open-source software that allows users to access, blend, analyze, and visualize data, without any coding).

The analysis shows that the Iraq has achieved or is on track to achieve some of the goals, stagnant or no available data on some, and achieved negative progress in some, mainly traffic accidents, and suicide rates.

This project can help the authorities to focus their effort on the most challenging areas and paint a clear picture that highlights where we are now and what should we do next.

Iraq's score is not completely bleak or shiny, It shows that some promising progress has been made in some areas and it's possible, with the right efforts, to achieve the same in the remaining challenges.

Table of Contents

Chapter One

Sustainable Development Goals

On September 2015, The UN Proposed 17 Sustainable Development Goals (SDGs) of the 2030 Agenda for Sustainable Development [1]. provides a shared blueprint for peace and prosperity for people and the planet, now and into the future. Here is a list of the 17 SDGs with a brief explanation:

1.1 End poverty in all its forms everywhere

This goal aims to eliminate extreme poverty (living on less than $1.25 a day) and reduce overall poverty by half. It also includes providing social protection systems for everyone and ensuring equal rights to economic resources and basic services.

1.2 End hunger, achieve food security, and promote sustainable agriculture

It’s about making sure everyone has access to enough safe and nutritious food all year round. It also involves doubling the productivity and incomes of small-scale food producers and ensuring sustainable food production practices.

1.3 Ensure healthy lives and promote well-being for all at all ages

This aim at reducing maternal and child mortality, ending epidemics like AIDS, tuberculosis, and malaria, and promoting mental health. It also aims to ensure universal access to healthcare services and reduce deaths and illnesses from pollution.

1.4 Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

We have to ensure that everyone, regardless of gender or background, has access to quality education from early childhood to adulthood. It includes eliminating disparities, promoting literacy and numeracy, and building inclusive learning environments.

1.5 Achieve gender equality and empower all women and girls

It's hope is end discrimination and violence against women and girls, eliminate harmful practices like child marriage and female genital mutilation, and ensure equal opportunities in leadership and decision-making.

1.6 Ensure availability and sustainable management of water and sanitation for all

Providing universal access to safe drinking water and adequate sanitation, with a focus on ending open defecation and improving water quality is the goal. It also involves protecting water-related ecosystems and enhancing international cooperation in water management.

1.7 Ensure access to affordable, reliable, sustainable, and modern energy for all

This urges governments to provide universal access to affordable and clean energy, increase the share of renewable energy sources, and improve energy efficiency. It also involves expanding infrastructure and promoting international cooperation in clean energy technologies.

1.8 Promote sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all

Governments should achieve economic growth that benefits everyone not a certain class of society and especially for the poorest, by promoting job creation, entrepreneurship, and innovation. It also involves protecting labour rights, eliminating forced labour, and supporting sustainable tourism and financial inclusion.

1.9 Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation

This goal focuses on developing quality infrastructure, especially in developing countries, to support economic growth and well-being. It includes promoting sustainable industrialization, upgrading industries to be environmentally friendly, and increasing access to technology and innovation.

1.10 Reduce inequality within and among countries

This seeks to ensure that the income of the poorest 40% of the population grows at a rate higher than the national average, promoting inclusive growth. Additionally, the goal emphasizes the need to empower marginalized groups and promote their social, economic,

and political inclusion. This includes efforts to eliminate discriminatory laws and policies and promote greater equality through measures such as fiscal policies and social protection. By tackling inequality, Goal 10 strives to create more equitable societies where everyone has a fair chance to thrive.

1.11 Make cities and human settlements inclusive, safe, resilient, and sustainable

When building cities and settlements they should be inclusive, safe, resilient, and sustainable. It aims to ensure access to adequate, safe, and affordable housing and basic services for all, with particular attention to upgrading slums. The goal also emphasizes the importance of sustainable transport systems, urbanization, and integrated human settlement planning to promote inclusive and sustainable development. Efforts to protect cultural and natural heritage, reduce disaster risks, and improve environmental sustainability are central to achieving this goal. By making cities and human settlements more livable and resilient, Goal 11 aims to enhance the quality of life for all residents and contribute to sustainable urban development.

1.12 Ensure sustainable consumption and production patterns

Goal 12 seeks to promote responsible consumption and production patterns to ensure environmental sustainability. It calls for the efficient use of natural resources, reduction of waste generation, and adoption of sustainable practices by individuals, businesses, and governments. Efforts to manage chemicals and waste safely, promote sustainable tourism, and integrate sustainability into corporate practices are key components of this goal. By encouraging more sustainable consumption and production patterns, Goal 12 aims to

minimize environmental degradation, reduce resource depletion, and promote economic growth that benefits both present and future generations.

1.13 Take urgent action to combat climate change and its impacts

This highlights the urgent need to address climate change and its adverse effects. It emphasizes the importance of strengthening resilience to climate-related hazards, integrating climate change measures into policies and planning, and enhancing education and awareness on climate action. Additionally, Goal 13 calls for increased financial and technological support to help developing countries mitigate and adapt to climate change. By taking decisive action to combat climate change, Goal 13 aims to protect ecosystems, safeguard livelihoods, and secure a sustainable future for all.

1.14 Conserve and sustainably use the oceans, seas, and marine resources

The goal focuses on the conservation and sustainable use of marine resources to ensure the health and productivity of oceans and seas. It aims to prevent marine pollution, protect marine and coastal ecosystems, and promote sustainable fisheries management. Efforts to address ocean acidification, protect marine biodiversity, and support small-scale artisanal fishers are integral to achieving this goal. By conserving and sustainably using marine resources, Goal 14 seeks to preserve the marine environment, support livelihoods dependent on oceans, and promote sustainable development.

1.15 Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

This centers on the protection, restoration, and sustainable use of terrestrial ecosystems, including forests, wetlands, and mountains. It calls for action to combat land degradation, deforestation, and biodiversity loss, as well as efforts to promote sustainable land management practices. The goal also highlights the need to conserve and restore habitats, protect endangered species, and integrate biodiversity values into national planning and development processes. By safeguarding terrestrial ecosystems, Goal 15 aims to preserve biodiversity, mitigate climate change, and ensure the sustainable use of natural resources for future generations.

1.16 Promote peaceful and inclusive societies for sustainable development, provide access to justice for all, and build effective, accountable, and inclusive institutions at all levels

Promoting peaceful, inclusive societies and strengthening institutions to achieve sustainable development is the goal. It emphasizes the importance of reducing violence, promoting the rule of law, and ensuring access to justice for all. Efforts to combat corruption, promote accountability, and build transparent and inclusive institutions are central to this goal. Additionally, Goal 16 calls for the protection of fundamental freedoms, the promotion of inclusive decision-making processes, and the provision of legal identity

for all individuals. By fostering peaceful, just, and inclusive societies, Goal 16 aims to create an enabling environment for sustainable development and ensure that no one is left behind.

1.17 Strengthen the means of implementation and revitalize the global partnership for sustainable development

Strengthening the means of implementation and revitalizing global partnerships to achieve sustainable development is the goal. It calls for increased financial resources, technology transfer, and capacity-building support for developing countries. Efforts to enhance international cooperation, promote trade, and mobilize domestic resources are central to this goal. Additionally, Goal 17 emphasizes the importance of building partnerships between governments, civil society, and the private sector to mobilize resources and share knowledge. By strengthening the means of implementation and promoting global partnerships, Goal 17 aims to accelerate progress towards achieving all the Sustainable Development Goals by 2030.

Chapter Two

Using Artificial Intelligence to achieve sustainable development goals

2.1 What is AI?

Artificial intelligence is any software that possesses at least one of the following: perception, decision-making, prediction, automatic knowledge extraction and pattern recognition from data, interactive communication, logical reasoning, or machine learning. These include more niche sub-fields like natural language processing, which is used to understand and create realistic text [2].

Artificial intelligence is becoming increasingly accessible with no-code tools such as Akkio to handle tasks that would otherwise require a highly-specialized AI engineering professional. With tools like these, AI has become prevalent in almost every industry, from manufacturing to healthcare.

AI can help meet the SDGs because it augments, rather than replaces, our own intelligence and capabilities. Any actions humans take to achieve the SDGs can be augmented with artificial intelligence.

Artificial Intelligence (AI) has emerged as a transformative tool with the potential to significantly influence the trajectory of global sustainable development efforts. This brief embarks on an exploration of how AI, when wielded by various stakeholders, can propel progress towards the Sustainable Development Goals (SDGs) and, ultimately, foster sustainable development. Our hypothesis posits that key actors such as businesses, non-governmental organizations (NGOs), the scientific and technological community, and governmental bodies possess the requisite resources and influence to not only impact the advancement of the SDGs but also serve as conduits through which AI can optimally contribute to sustainable development objectives [3].

2.2 using (AI) to achieve sustainable development goals

1-Societal outcomes

A recent publication in Nature [4]. Indicates that approximately 82% of the metrics pertaining to societal outcomes outlined in the Sustainable Development Goals (SDGs) could potentially benefit from the application of AI-based technologies. These include SDG 1 addressing poverty, SDG 4 focusing on quality education, SDG 6 concerning clean water and sanitation, SDG 7 targeting affordable and clean energy, and SDG 11 addressing sustainable cities.

2-Decreasing carbon

For instance, the utilization of interconnected technologies such as electric autonomous vehicles and smart appliances equipped with demand-response AI has the potential to mitigate gas emissions in urban areas and decrease reliance on fossil fuels.

AI is being used in a host of other areas [5]. as well, such as smart traffic management systems that minimize traffic congestion and idle time, smart cooling solutions that reduce energy consumption in data centers, and AI-optimized aircraft components that decrease carbon emissions by up to 40%. Consequently, AI holds the promise of facilitating the transition towards a zero-carbon economy, particularly within the context of smart cities.

Moreover, AI stands to enhance agricultural efficiency significantly [6]. Through the utilization of predictive analytics, farmers can optimize the usage of fertilizers and water resources to maximize yields, while also mitigating risks by analyzing weather patterns, pest infestations, and extreme weather events. Given that agriculture is traditionally a major contributor to carbon emissions, the integration of AI represents a potent tool in combating carbon pollution.

3-Fighting poverty

Furthermore, by employing pattern recognition algorithms on satellite imagery, various international organizations have enhanced their ability to swiftly identify regions with high levels of poverty within expanding urban areas and rural landscapes alike,

thereby aiding in the monitoring of progress towards the UN's "no poverty" goal

For instance, Stanford's sustainability and AI lab [7]. harnesses high-resolution satellite imagery in conjunction with sophisticated machine learning algorithms to discern the socioeconomic status of specific locations. By analyzing both daytime and nighttime imagery, AI algorithms automatically identify features such as roads, agricultural lands, urban settlements, and water bodies.

4-Economic outcomes

The same study published in Nature[4] indicates that AI technologies harbor the potential to positively influence 70% of economic outcomes concerning the SDGs.

5-Improving economic efficiencies

AI finds extensive utility across various industries, either in automating tasks or providing insights into future trends.

Recently, the food industry has turned to AI to optimize efficiency in meeting food demand. According to Microsoft [8] , AI can enhance agricultural land productivity by up to 70%.

Moreover, these algorithms can enable real-time forecasting of commodity prices and market trends, allowing businesses ranging from agriculture to manufacturing to proactively plan and meet demand more efficiently.

6-Job creation

Furthermore, research conducted by the World Economic Forum [9]. suggests that robots empowered by artificial intelligence could alleviate labor shortages in intensive sectors such as construction, mining, or agriculture, thereby enabling humans to engage in more fulfilling, intricate, or creative endeavors.

7-Environmental outcomes

AI emerges as a potent tool for governments, businesses, and NGOs to pursue their respective environmental objectives more effectively and affordably. In fact, AI could contribute to achieving 93% of the environmental SDG targets [10].

8-Environmental preservation

An article from the Stanford Social Innovation Review [11]. highlights the application of AI, termed "mission-driven artificial intelligence," to address social and ecological challenges. For instance, AI could analyze the proliferation of invasive species and collaborate with governments to enact regulatory measures. This approach would alleviate the financial burden on countries such as New Zealand, which expends millions annually on eradicating invasive species.

AI's potential extends to aiding in the monitoring of natural disasters like earthquakes and tsunamis, as highlighted in a research paper published in Springer [12]. Moreover, AI technology, when coupled with data from sources like GPS and weather data, can enhance landslide prediction capabilities.

9-Understanding climate change

In the realm of climate change, artificial intelligence (AI) can be employed to monitor alterations in atmospheric conditions over time and construct models depicting various climate scenarios.

Utilizing AI tools will empower individuals to grasp the ramifications of climate change more comprehensively than ever before. For example, at Yale University [13], researchers

are harnessing AI to develop climate models that offer unprecedented foresight, such as precise forecasts of phenomena like intense rainfall.

10-Supporting low-carbon systems

Addressing climate change necessitates achieving objectives such as integrating renewable energy, establishing low-carbon energy systems, and enhancing energy efficiency.

AI is already deployed in these domains, with IBM [14]. utilizing AI to optimize renewable energy generation by predicting optimal times to activate solar power plants or wind turbines.

2.3 KNIME Platform

Knime which stands for Konstanz Information Miner : is an open-source data analytics, reporting, and integration platform. It allows users to visually design data workflows, enabling them to manipulate, analyze, and visualize data without the need for extensive programming knowledge. KNIME provides a graphical user interface (GUI) that allows users to drag and drop nodes representing data processing steps and connect them to create complex data pipelines [15].

2.3.1 Key features of KNIME

1-Visual Workflow Designer: KNIME offers a user-friendly interface for designing data workflows using a drag-and-drop approach. Users can easily create, modify, and execute workflows without writing code.

2-Data Integration: KNIME supports data integration from various sources, including databases, files, web services, and APIs. Users can import, preprocess, and clean data to prepare it for analysis.

3-Data Analysis and Modeling: KNIME provides a wide range of data analysis and modeling tools, including statistical analysis, machine learning algorithms, text mining, and image processing. Users can perform exploratory data analysis, build predictive models, and evaluate model performance.

4-Visualization: KNIME offers visualization tools for exploring and presenting data insights. Users can create interactive charts, graphs, and dashboards to communicate their findings effectively.

5-Extensions and Integrations: KNIME supports a vast ecosystem of extensions and integrations, allowing users to extend its functionality with additional nodes, plugins, and integrations with other tools and platforms.

6-Scalability and Deployment: KNIME is scalable and can be deployed in various environments, including desktop, server, and cloud. It supports parallel processing and distributed computing for handling large datasets and complex analyses.

7-Community and Support: KNIME has a vibrant community of users, developers, and contributors who actively share knowledge, resources, and best practices. It also offers documentation, tutorials, and forums for support and assistance.

Chapter Three

Design and Implementation

3.1 Introduction

Data analysis plays a crucial role in understanding challenges and identifying opportunities for sustainable development globally. This project focuses on analyzing Iraq's progress towards the third Sustainable Development Goal (SDG) using the KNIME platform. KNIME offers powerful tools for comprehensive data analysis.

Through this project, we aim to collect and analyze relevant data regarding health and well-being in Iraq, using KNIME to extract insights and address challenges hindering SDG attainment. The results will guide strategic decision-making, enhancing Iraq's efforts toward sustainability in various domains.

3.2 Collecting data

We faced many challenges in finding data related to Iraq for analysis, as we initially searched for industrial data and Iraqi annual data to analyze, to no avail. Finally, we succeeded in finding data on sustainable development for Iraq in Sustainable Development Goal indicators [16].

After reviewing and analyzing all available data, we found that data related to SDG 3 was the most comprehensive and best available. Although not all available data were comprehensive, they were better than data on other objectives.

Import and read data

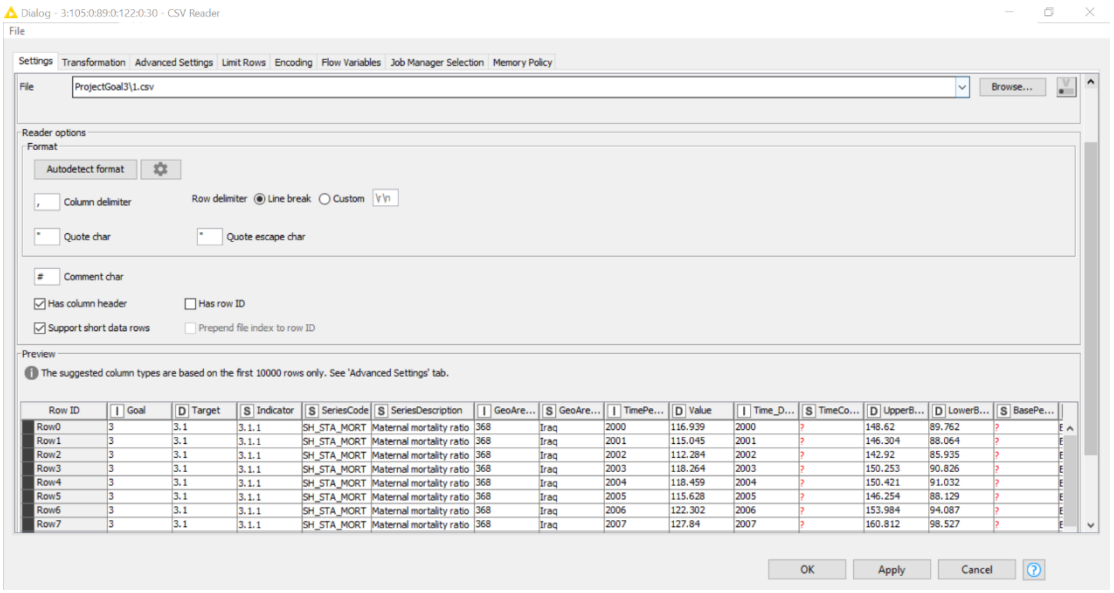


Figure 3.1 Reading Data

CSV Reader

CSV Reader : is a tool used for reading comma-separated values (CSV) data files. It allows users to import data from various sources, such as the hard disk or databases, and convert it into internal data tables within KNIME.

Explore and clean data

In this stage, the dataset was explored and cleaned to maintain the quality of the data. Missing values were identified and removed, and columns were visually enhanced through color coding to improve readability and highlight important information. These actions were conducted using specialized nodes within the KNIME workflow, ensuring a systematic and effective approach to preparing the data for further analysis.

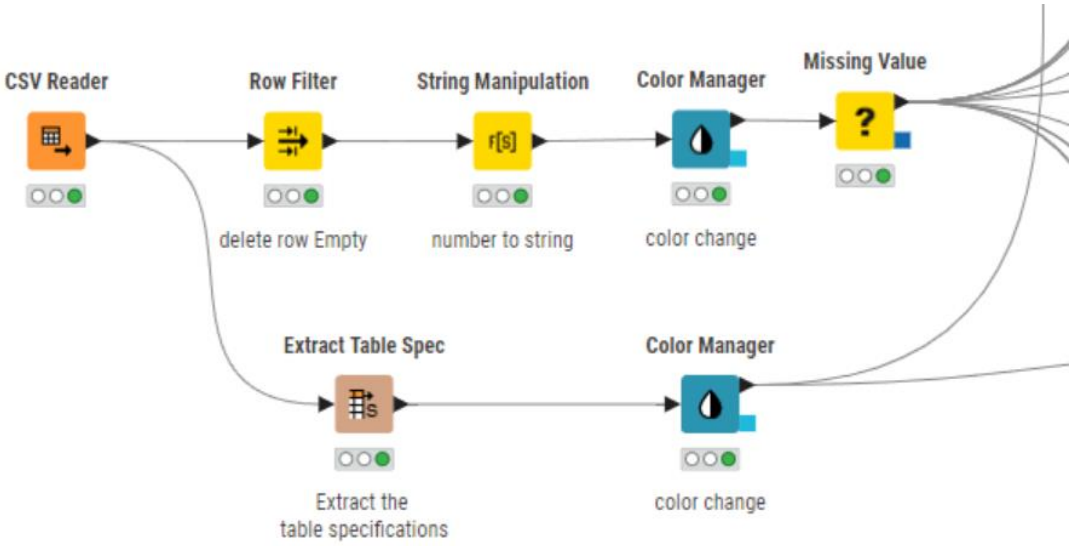
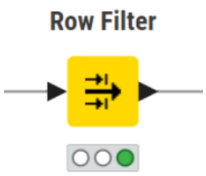
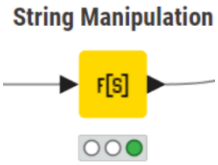


Figure 3.2 Data Cleaning and Enhancement



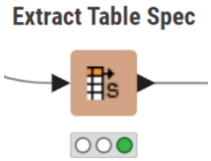
Row Filter : is used to filter rows of data based on specified conditions or criteria. It allows users to selectively retain or remove rows from a dataset, depending on whether they meet certain criteria or conditions defined by the user.



String Manipulation : is a tool used for manipulating and transforming string data within a dataset. It enables users to perform various operations on string columns, such as extracting substrings, replacing characters or patterns, converting case, concatenating strings, and much more.

Color Manager : is like a toolbox for managing colors in your data visualizations. It helps you choose and control the colors you use in your charts and graphs.

Missing Value: is a tool used to handle missing or null values within a dataset. It allows users to specify how missing values should be treated, such as by imputing them with a specific value, removing rows or columns containing missing values.



Extract Table Spec: is used to extract the structure, or specifications, of a table without the actual data. It helps users understand the layout of a table, including the names and types of columns, without needing to examine the entire dataset.

1: Output table | 2: PMML Transformations | Flow Variables

Rows: 21 | Columns: 25 — Table | Statistics

Row...	Goal	Target	Indicator	SeriesCo...	SeriesDe...	GeoArea...	GeoArea...	TimePeri...	Value	Time_De...	TimeCov...	UpperBo...
	Number (inte...	Number (dou...	String	String	String	Number (inte...	String	Number (inte...	Number (dou...	Number (inte...	String	Number (dou...
Row0	3	3.1	3.1.1	SH_STA_MORT	Maternal mor...	368	Iraq	2000	116.939	2000	none	148.62
Row1	3	3.1	3.1.1	SH_STA_MORT	Maternal mor...	368	Iraq	2001	115.045	2001	none	146.304
Row2	3	3.1	3.1.1	SH_STA_MORT	Maternal mor...	368	Iraq	2002	112.284	2002	none	142.92
Row3	3	3.1	3.1.1	SH_STA_MORT	Maternal mor...	368	Iraq	2003	118.264	2003	none	150.253
Row4	3	3.1	3.1.1	SH_STA_MORT	Maternal mor...	368	Iraq	2004	118.459	2004	none	150.421
Row5	3	3.1	3.1.1	SH_STA_MORT	Maternal mor...	368	Iraq	2005	115.628	2005	none	146.254
Row6	3	3.1	3.1.1	SH_STA_MORT	Maternal mor...	368	Iraq	2006	122.302	2006	none	153.984
Row7	3	3.1	3.1.1	SH_STA_MORT	Maternal mor...	368	Iraq	2007	127.84	2007	none	160.812
Row8	3	3.1	3.1.1	SH_STA_MORT	Maternal mor...	368	Iraq	2008	130.548	2008	none	164.484
Row9	3	3.1	3.1.1	SH_STA_MORT	Maternal mor...	368	Iraq	2009	125.899	2009	none	158.187
Row10	3	3.1	3.1.1	SH_STA_MORT	Maternal mor...	368	Iraq	2010	114.876	2010	none	143.168

Figure 3.3 Data after improvements

3.3 Data Analysis Dashboards

This section encapsulates a series of purpose-built dashboards meticulously designed to dissect various analytical aspects of the dataset related to the third goal.

1-Bar Chart

The Bar Chart node is utilized to create the chart. This node specifies the data to be plotted in the chart, where the column containing the years and values is selected.

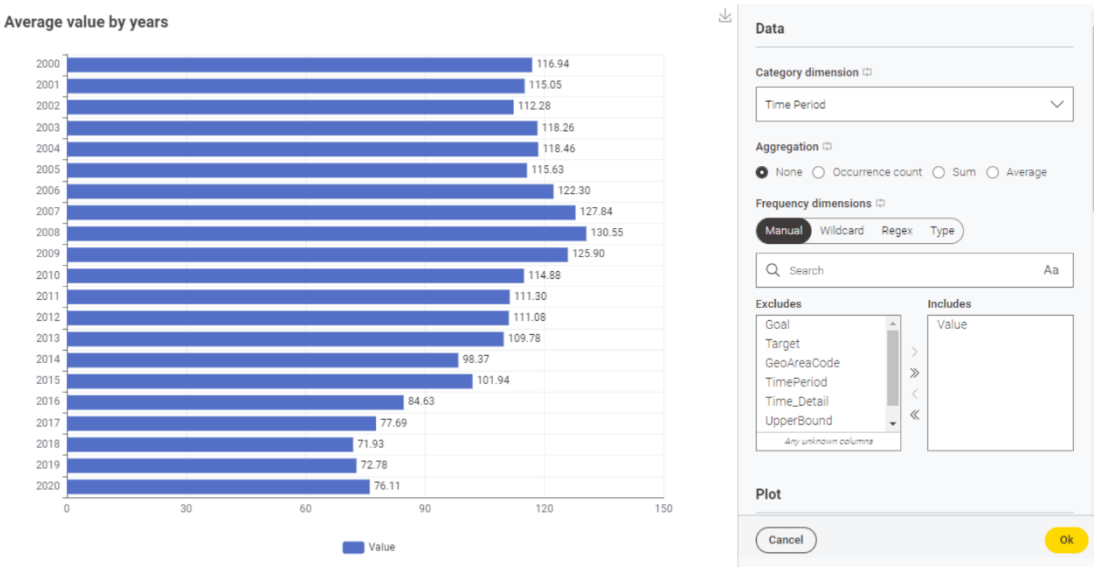


Figure 3.4 Bar Chart

Figure 3.4 displays a bar chart illustrating the distribution of values across years. The values are depicted on the horizontal axis (X-axis), while the time periods are shown on the vertical axis (Y-axis). Each year is represented by a bar indicating its corresponding value. This type of chart effectively communicates changes in values over time in a visual and clear manner.

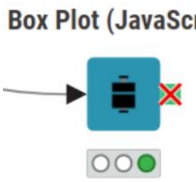
2-Scatter Plot

The Scatter Plot node is utilized to generate the scatter plot. This node specifies the data points to be plotted, where the columns containing the two variables of interest are chosen.

Figure 3.5 Scatter Plot

Figure 3.5 depicts a scatter plot illustrating the relationship between two variables. Each data point is represented by a marker on the plot, with one Time Period plotted on the horizontal axis (X-axis) and the other variable plotted on the vertical axis (Y-axis). The scatter plot facilitates the visualization of patterns, trends, or correlations between the two variables.

3-Box Plot



The Box Plot node is utilized to generate the box plot. This node enables users to specify the column containing the values to be plotted. Additionally, users can customize various aspects of the box plot, including color, style, and orientation, through the settings of this node.

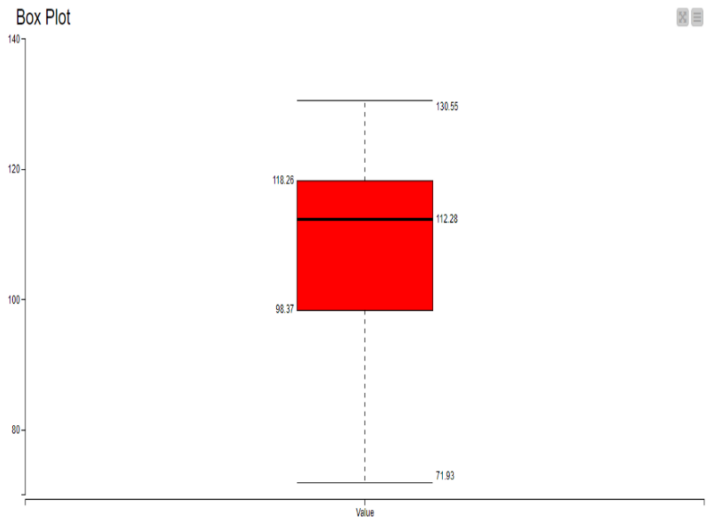


Figure 3.6 Box Plot

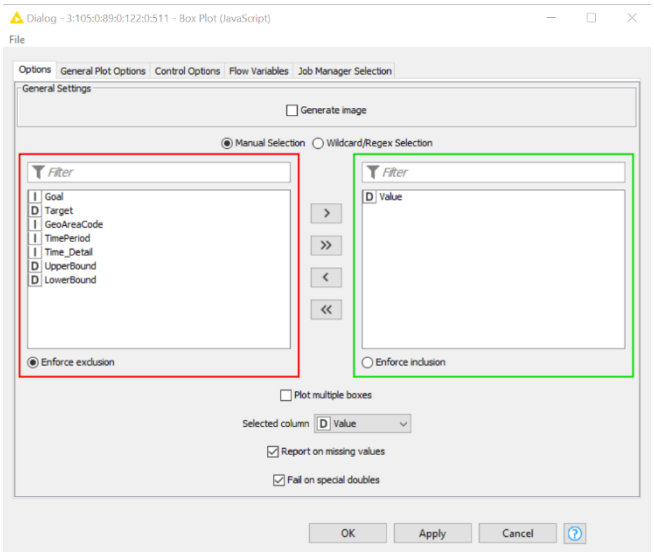
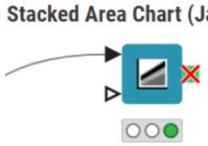


Figure 3.7 Box Plot Configure

Figure 3.6 illustrates a box plot depicting the distribution of a single variable. This visualization displays the median, quartiles, and potential outliers of the data. The box represents the interquartile range (IQR), with the median marked by a line inside the box.

4-Stacked Area Chart



The Stacked Area Chart node is utilized to generate the visualization. This node incorporates variables such as value, timeperiod, UpperBound, and LowerBound. The value variable dictates the height of each area on the chart, while the timeperiod variable specifies the position along the horizontal axis. Optionally, the UpperBound and LowerBound variables can be employed to denote confidence intervals or uncertainty ranges around the values, thereby enhancing the context of the chart.

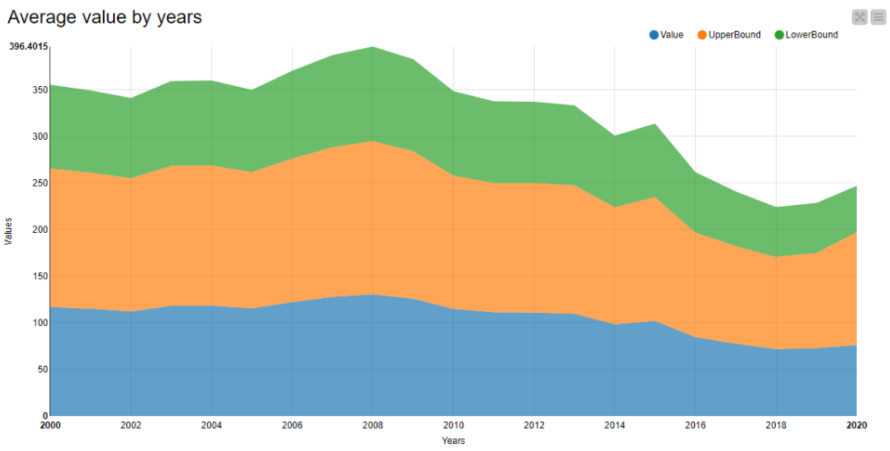


Figure 3.8 Stacked Area Chart

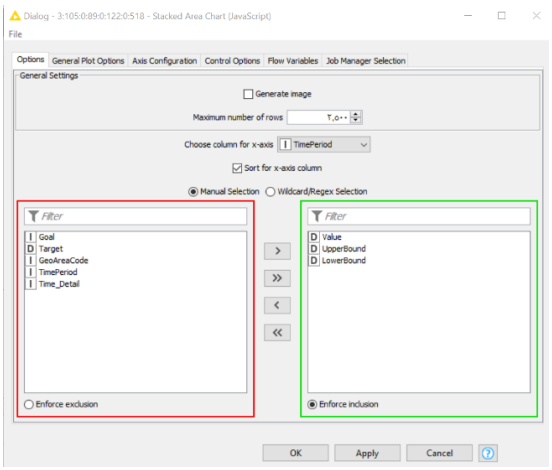
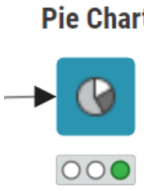


Figure 3.9 Stacked Area Chart Configure

Figure 3.8 illustrates a stacked area chart displaying variations in values over time. The chart comprises multiple-colored areas stacked atop one another, each representing a distinct category or subgroup of data. The vertical axis (Y-axis) denotes the values, while the horizontal axis (X-axis) signifies the time periods. As time advances, the areas expand or contract in accordance with the values attributed to each category.

5-Pie Chart



The Pie Chart node is utilized to produce the visualization. This node incorporates variables such as values and time period. The values variable dictates the size of each slice within the pie chart, while the time period variable can categorize the values or represent distinct time periods. Users have the ability to customize several aspects of the pie chart, including colors, labels, and tooltips, through this node.

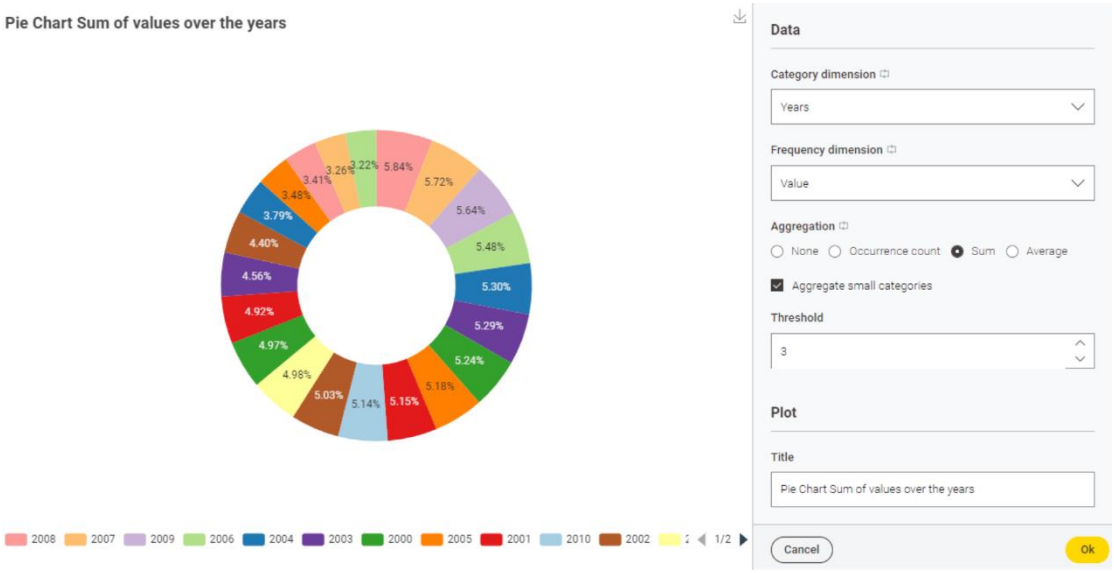
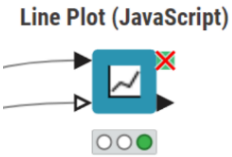


Figure 3.10 Pie Chart

Figure 3.10 depicts a pie chart illustrating the distribution of values across categories or time periods. Each category or time period is represented by a slice of the pie, with the size of each slice proportional to the value associated with it. The chart provides a visual representation of how the values are distributed among the different categories or time periods.

6-Line Plot



The Line Plot node is utilized to generate the visualization. It incorporates variables such as values and timeperiod. The values variable dictates the position of each data point on the Y-axis, while the timeperiod variable defines the position along the X-axis. Users have the ability to customize various aspects of the line plot, including line style, color, markers, and axis labels, through this node.

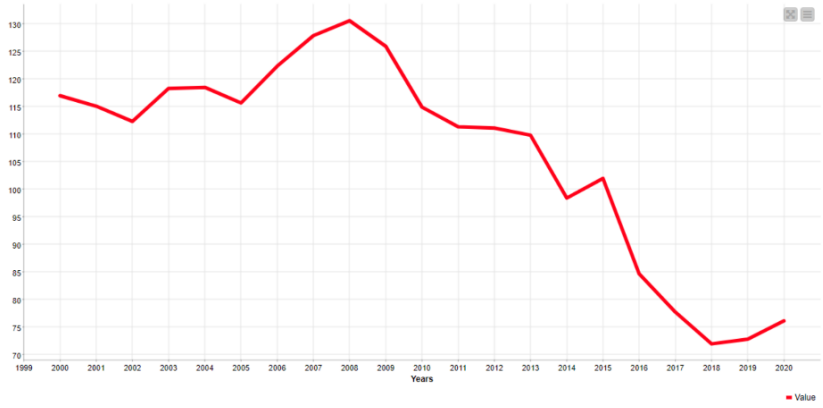


Figure 3.11 Line Plot

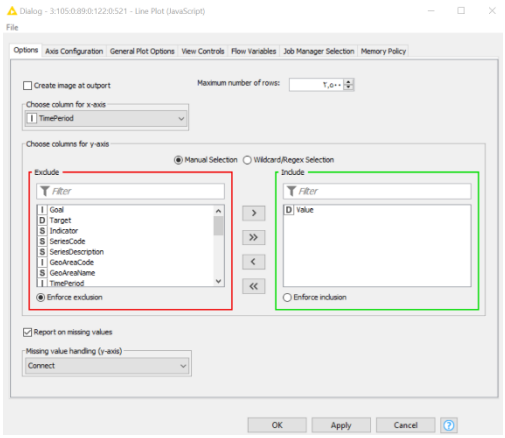
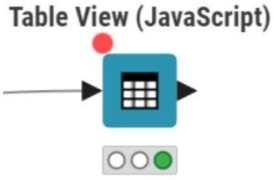


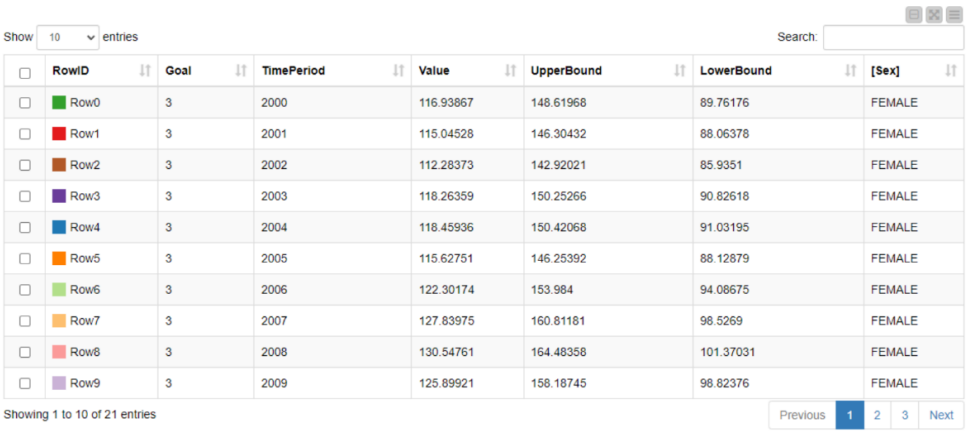
Figure 3.12 Line Plot Configure

Figure 3.11 shows a line plot illustrating the trend of values over time. Each data point is represented by a marker on the plot, connected by lines to show the progression of values over different time periods. The vertical axis (Y-axis) represents the values, while the horizontal axis (X-axis) represents the time periods. The line plot helps visualize trends, patterns, or relationships between values and time.

7-Table View



The Line Plot node is used to create the visualization. It incorporates variables such as values and time period. The values variable dictates the position of each data point on the Y-axis, while the time period variable defines the position along the X-axis. Users have the ability to customize various aspects of the line plot, including line style, color, markers, and axis labels, through this node.



Show 10 entries Search:

	RowID	Goal	TimePeriod	Value	UpperBound	LowerBound	[Sex]
	Row0	3	2000	116.93867	148.61968	89.76176	FEMALE
	Row1	3	2001	115.04528	146.30432	88.06378	FEMALE
	Row2	3	2002	112.28373	142.92021	85.9351	FEMALE
	Row3	3	2003	118.26359	150.25266	90.82618	FEMALE
	Row4	3	2004	118.45936	150.42068	91.03195	FEMALE
	Row5	3	2005	115.62751	146.25392	88.12879	FEMALE
	Row6	3	2006	122.30174	153.984	94.08675	FEMALE
	Row7	3	2007	127.83975	160.81181	98.5269	FEMALE
	Row8	3	2008	130.54761	164.48358	101.37031	FEMALE
	Row9	3	2009	125.89921	158.18745	98.82376	FEMALE

Showing 1 to 10 of 21 entries Previous 1 2 3 Next

Figure 3.13 Table View

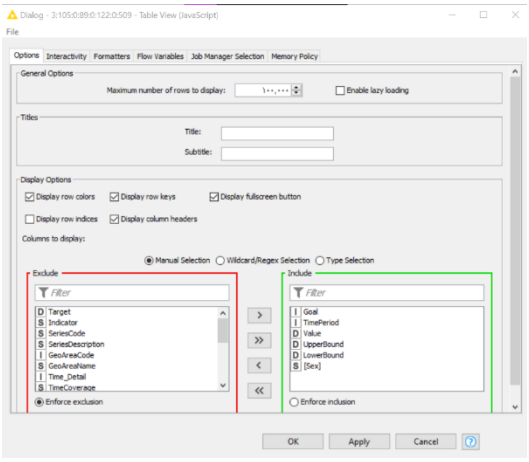
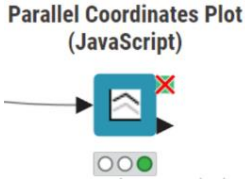


Figure 3.14 Table View Configure

Figure 3.13 presents a table view displaying a comprehensive dataset with multiple variables. Each row represents a data entry, while each column represents a different variable or attribute. The table provides a structured and tabular representation of the data, allowing users to easily view and analyze multiple variables simultaneously. Users can scroll through the table to explore all the data entries and can apply filters or sorting functions to customize their view.

8-Parallel Coordinates Plot



The Parallel Coordinates Plot node is used to create the visualization. It incorporates variables such as value, timeperiod, UpperBound, and LowerBound. Each variable is mapped to a separate vertical axis, and the lines connecting the points represent the relationships between the variables.

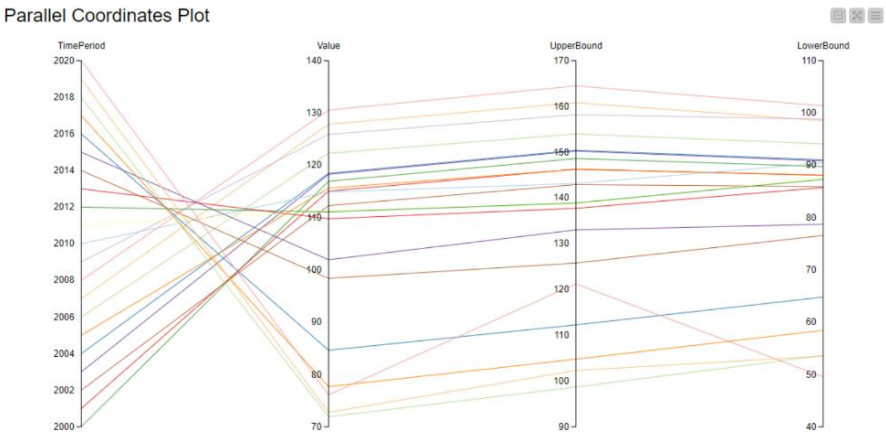


Figure 3.15 Parallel Coordinates Plot

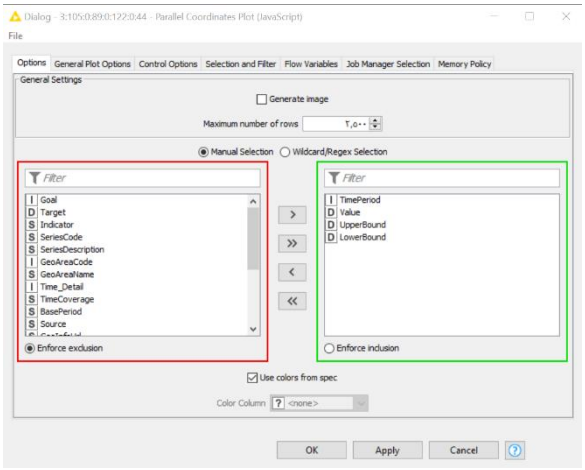
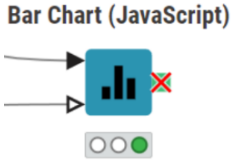


Figure 3.16 Parallel Coordinates Plot Configure

Figure 3.15 illustrates a parallel coordinates plot, a visualization technique used to explore multivariate data. Each variable is represented by a vertical axis, and each data point is represented by a line intersecting all the axes at the corresponding values. These lines are connected to form a polyline, enabling users to analyze relationships and patterns between variables. The plot provides insights into overall trends and correlations within the dataset.

9-Bar Chart (JavaScript)



The Bar Chart (JavaScript) node is utilized to generate the visualization. This node allows users to employ custom JavaScript code to create a bar chart tailored to their specific requirements. It offers flexibility and customization in designing the chart's appearance and functionality, including aspects such as colors, tooltips, axis labels, and interactivity.

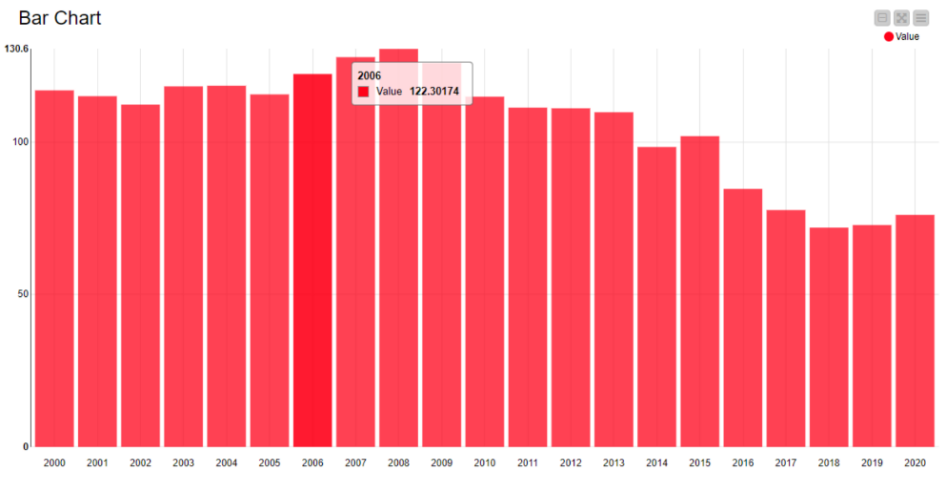


Figure 3.16 Bar Chart (JavaScript)

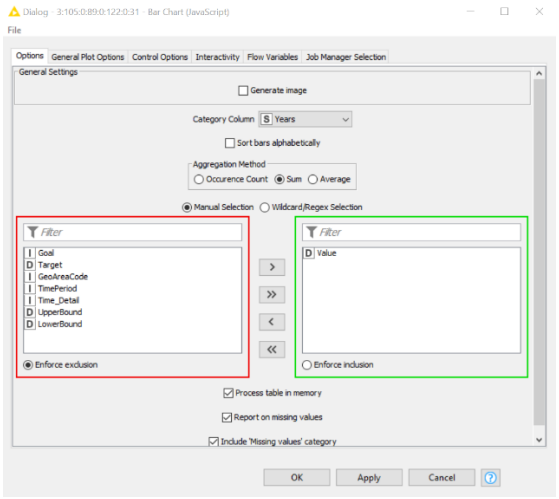


Figure 3.17 Bar Chart (JavaScript) Configure

The image illustrates a bar chart representing the sum of values for each time period. Each bar corresponds to a specific time period, with its height indicating the total sum of values associated with that period. The horizontal axis (X-axis) displays the time periods, while the vertical axis (Y-axis) represents the sum of values. This visualization offers a clear overview of the total values across different time periods.

10-Total males and females

Figure 3.18 Pie chart for Gender

Figure 3.19 Bar chart for Gender

Figure 3.18 and Figure 3.19 depict pie and bar charts representing the total sum of values for both genders, male and female. The pie chart illustrates the proportion of the total sum attributed to each gender category, with each slice representing either males or females. Meanwhile, the bar chart provides a visual comparison of the total sums for both genders, where each bar represents the combined sum of values for males and females. These visualizations offer insights into the overall distribution of values across gender categories, enabling easy comparison and understanding of the contribution of each gender to the total sum.

3.4 Achieving the goal

Figure 3.18 and Figure 3.19 depict pie and bar charts representing the total sum of values for both genders, male and female. The pie chart illustrates the proportion of the total sum attributed to each gender category, with each slice representing either males or females. Meanwhile, the bar chart provides a visual comparison of the total sums for both genders, where each bar represents the combined sum of values for males and females. These visualizations offer insights into the overall distribution of values across gender categories,

enabling easy comparison and understanding of the contribution of each gender to the total sum.

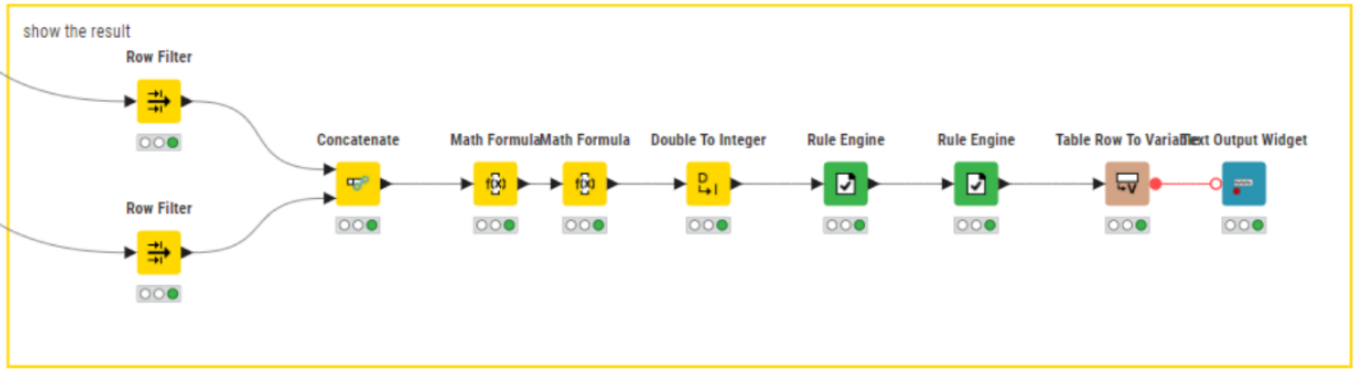
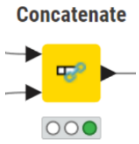
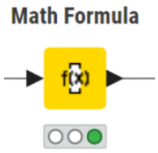


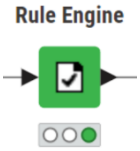
Figure 3.20 illustrates the workflow used to calculate the results



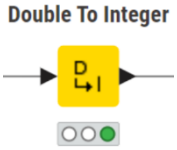
Concatenate : node is used to combine multiple datasets or columns into a single dataset or column. It allows you to merge data vertically (stacking rows) or horizontally (joining columns) based on specified criteria.



Math Formula: node enables you to perform mathematical calculations on your data. You can create custom mathematical expressions using variables, mathematical operators, functions, and constants.



Rule Engine : node is a powerful tool for applying conditional logic to your data. It allows you to define rules based on conditions and then apply those rules to filter, modify, or create new columns in your dataset.



Double To Integer: node is used to convert numerical values from double precision format to integer format.

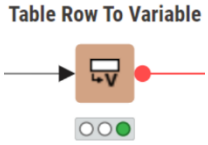
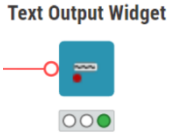


Table Row To Variable: node is used to convert rows from a table into individual variables



Text Output Widget: node is a tool for displaying text-based information within a KNIME workflow. It allows you to generate custom text output that can be viewed directly within the KNIME Analytics Platform interface

The percentage of births supervised by skilled health professionals has increased from 2000 to 2018
The result :
The year : 2000 - 65%
The year : 2018 - 96%

This goal has been achieved

Figure 3.21 the result

Through the utilization of various nodes within the KNIME workflow, data regarding the percentage of births supervised by skilled health professionals was extracted and analyzed. The results indicate a remarkable improvement in the supervision of births by skilled health professionals over the period from 2000 to 2018. Specifically, in the year 2000, 65% of births were supervised by skilled health professionals, whereas by 2018, this figure had surged to an impressive 96%. These findings demonstrate a substantial enhancement in

maternal healthcare services, signifying progress towards ensuring safer childbirth practices and better maternal and newborn health outcomes. Consequently, it can be concluded that the goal of increasing the percentage of births supervised by skilled health professionals has been successfully achieved, reflecting the effectiveness of initiatives aimed at improving maternal healthcare services.

3.5 User interface and design

The process of designing interfaces involves grouping multiple nodes together into a component. This component serves as a modular unit that encapsulates a set of related nodes, allowing for easier organization, management, and presentation within the workflow. By grouping nodes into components, users can create more structured and visually appealing workflows.

Each component can be customized and arranged to suit the specific needs of the workflow. Users can define input and output ports for the component, enabling data flow between the component and other nodes within the workflow.

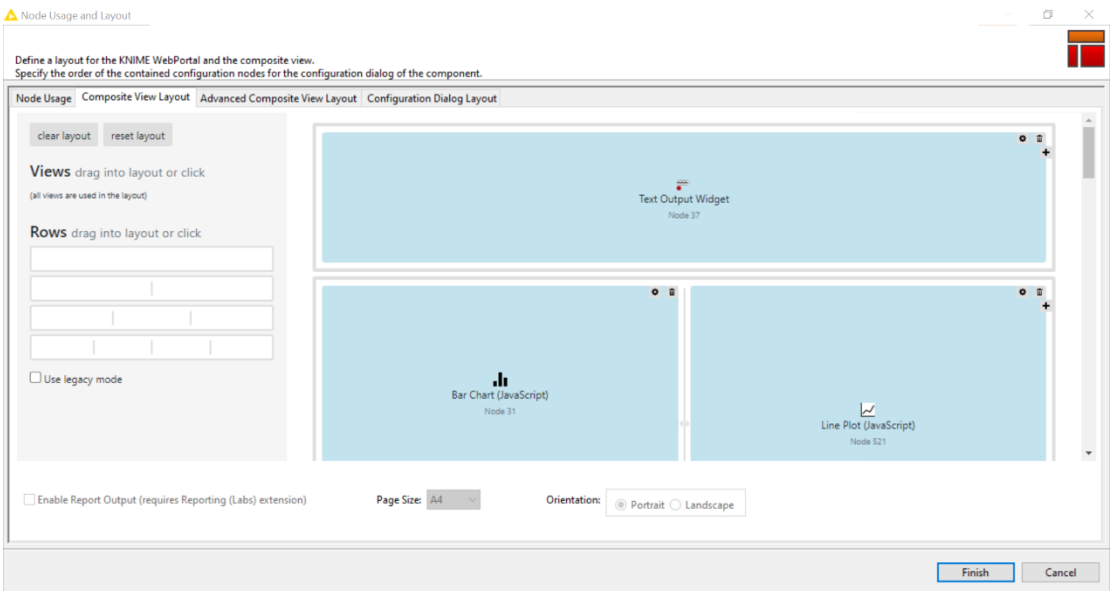


Figure 3.22 Editing layout

Figure 3.23 Component

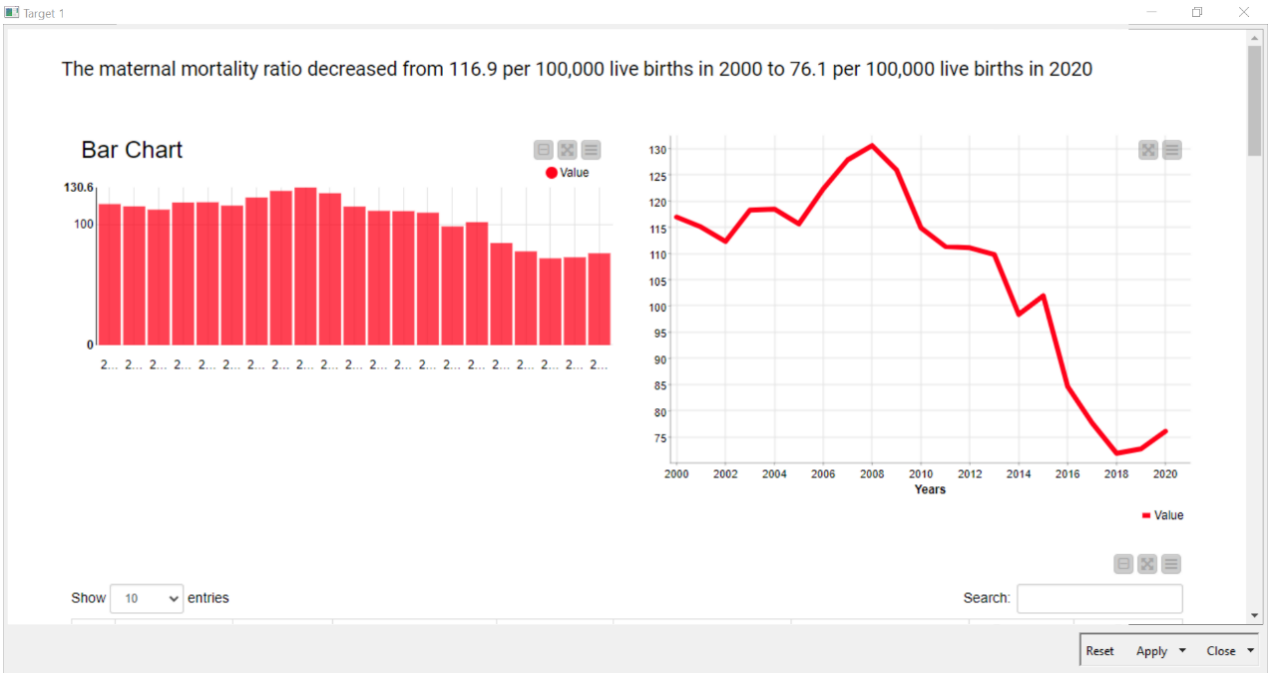


Figure 3.24 User interface

Display images in the interface

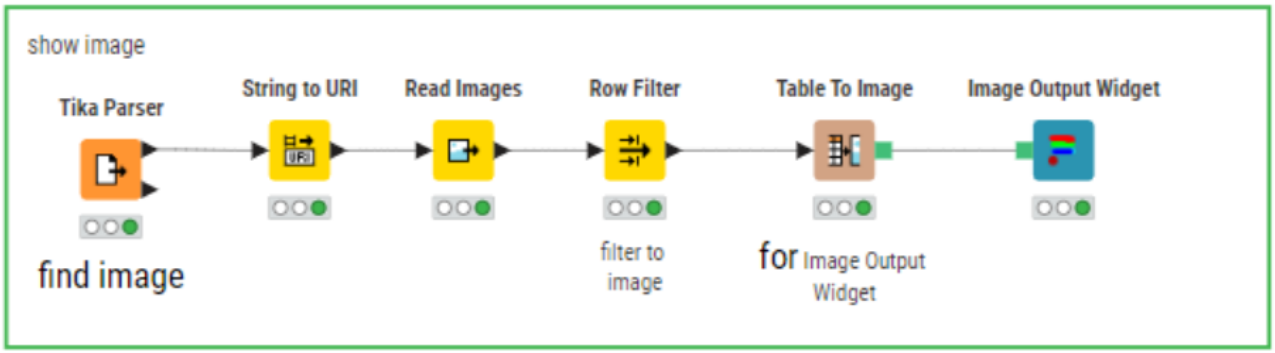
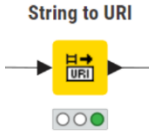


Figure 3.25 Workflow Upload and view an image

Tika Parser: This node is used to parse text files and extract content from them. It can be used to read various file formats such as PDF documents and Word documents.



String to URI: This node converts a string of text into a Uniform Resource Identifier (URI). It is used to convert texts into a URL format acceptable for reading and use in download operations or accessing files over the internet.

Read Images: This node is used to read images from files stored in the file system. When images are loaded into the node, it reads the images and converts them into a processable format within the workflow.

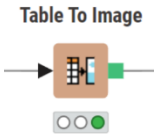


Table to Image: The node is used to convert tabular data from a KNIME table into an image format. It allows you to visualize the data in the form of an image.

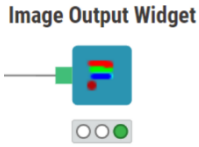


Image Output Widget: node is a tool used for displaying images within the KNIME Analytics Platform interface.

Figure 3.26 Display the image in the interface

Selection component

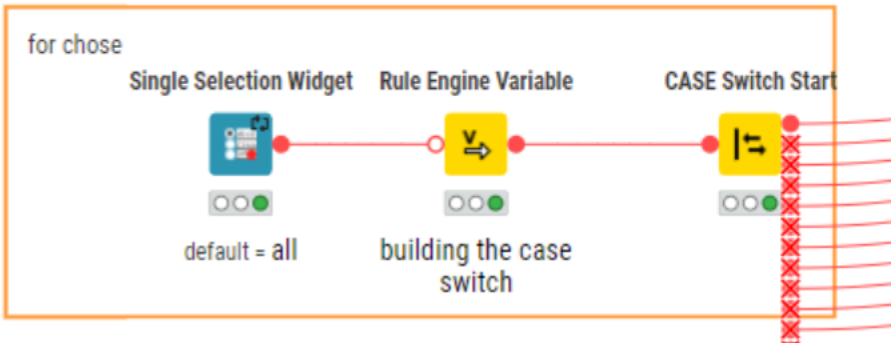


Figure 3.27 Workflow Selection

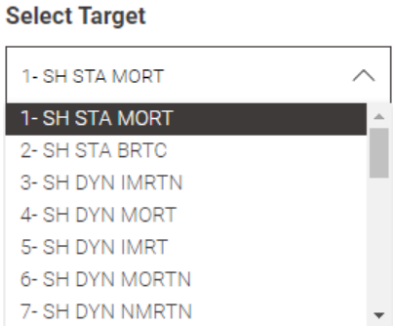


Figure 3.28 Selection in interface

The combination of the Single Selection Widget, Rule Engine Variable, and CASE Switch Start nodes serves to facilitate the selection and switching between different project objectives. Each objective is encapsulated within a component, and through these nodes, users can choose which objective they want to focus on. The Single Selection Widget allows users to make a selection from predefined options, which is then processed by the Rule Engine Variable node to determine the chosen objective. Subsequently, the CASE Switch Start node switches the workflow to the selected objective's component, enabling

users to seamlessly transition between different project objectives. This setup provides a structured and interactive approach to managing and navigating through various project goals.

Workflow design

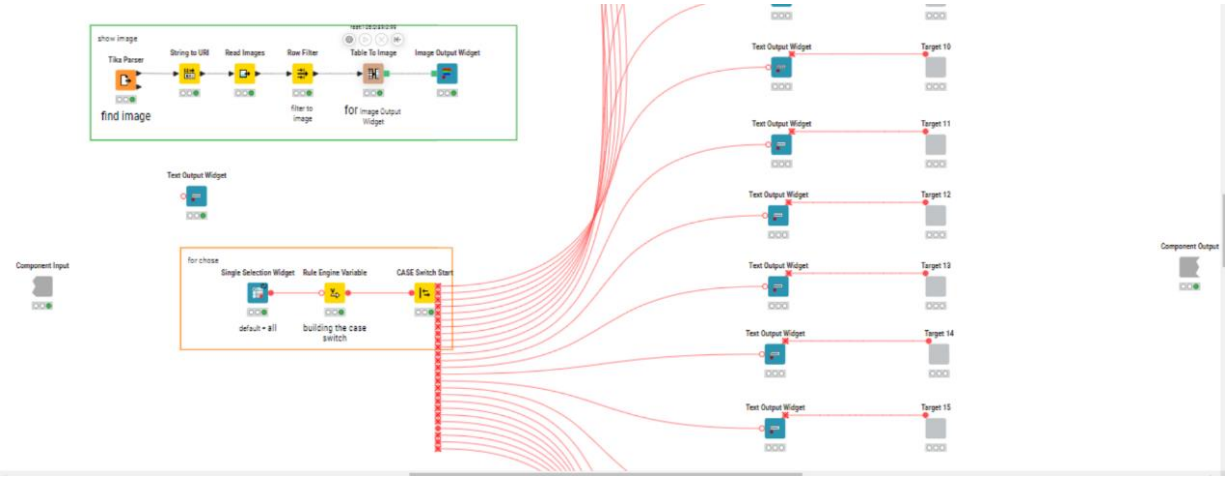


Figure 3.29 Workflow all components

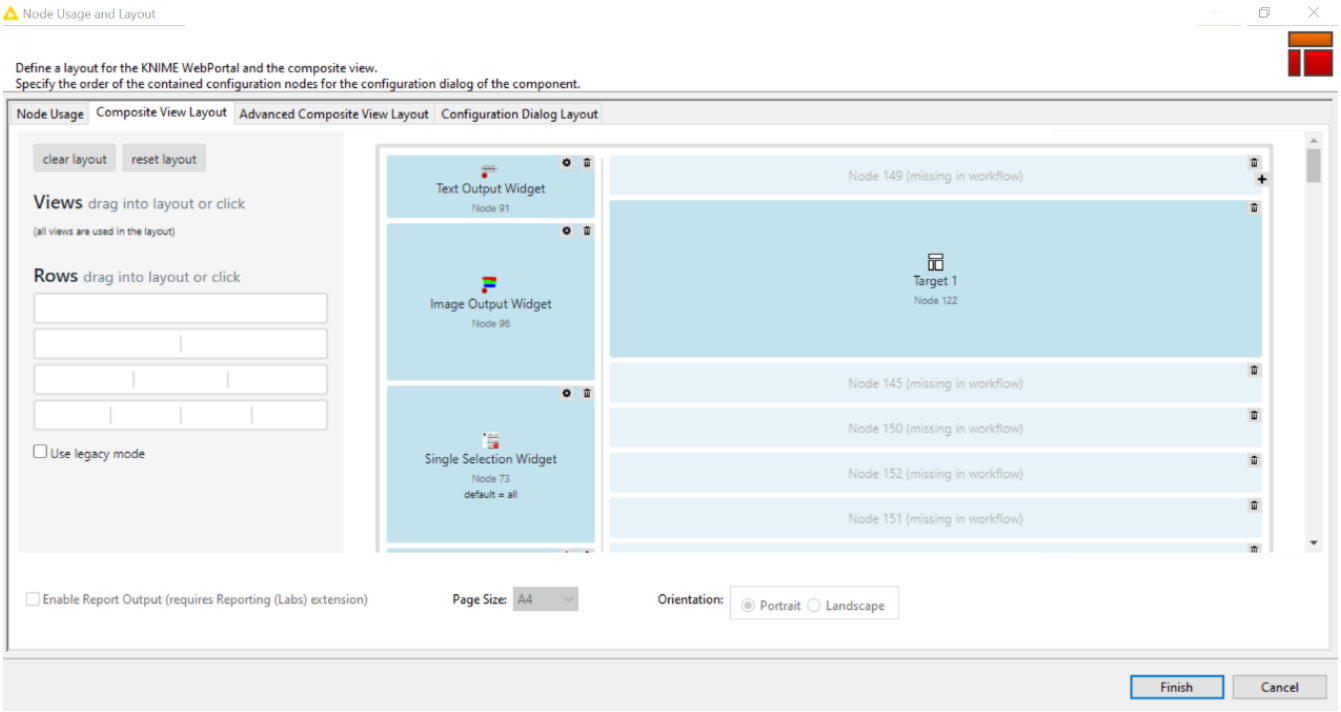


Figure 3.30 Editing layout components

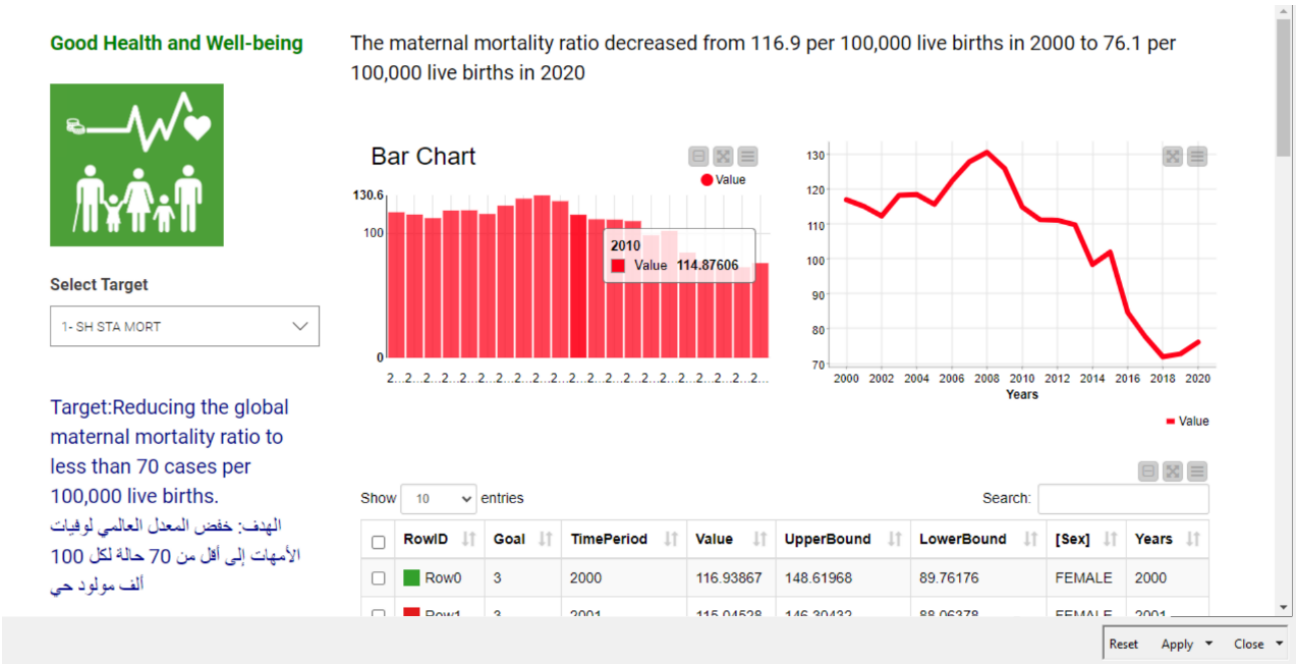


Figure 3.40 User Interface

Design interface of Goals 17

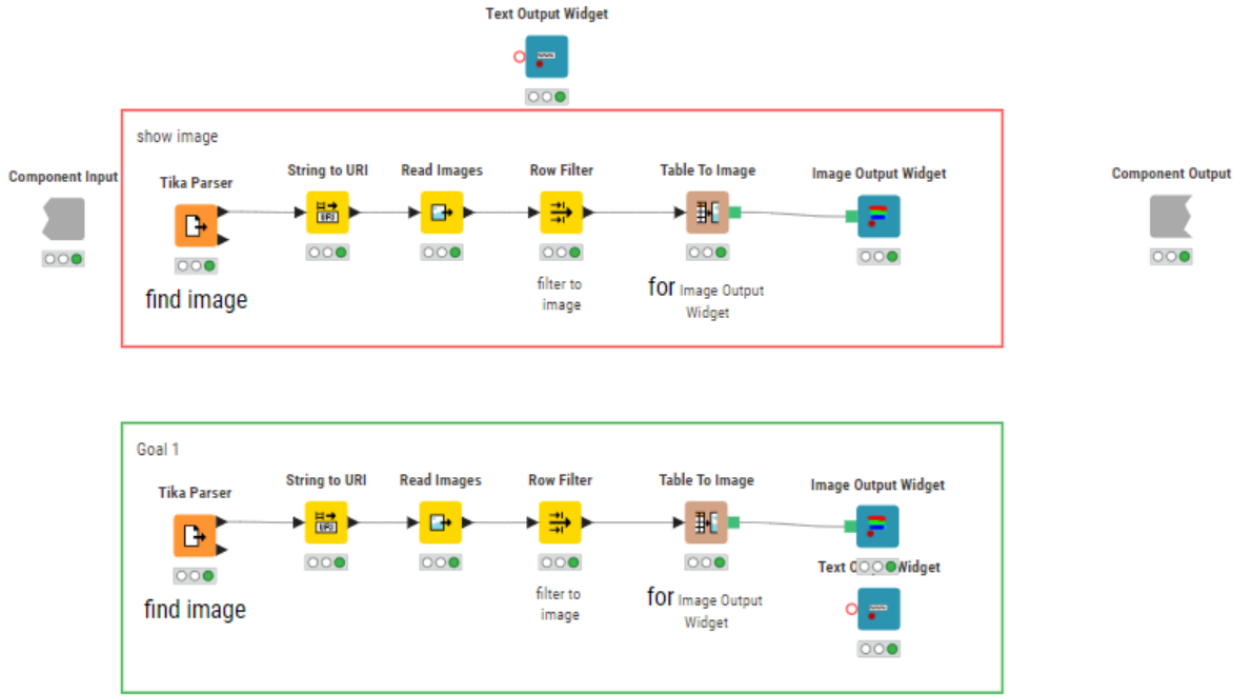


Figure 3.41 Workflow all images of goals

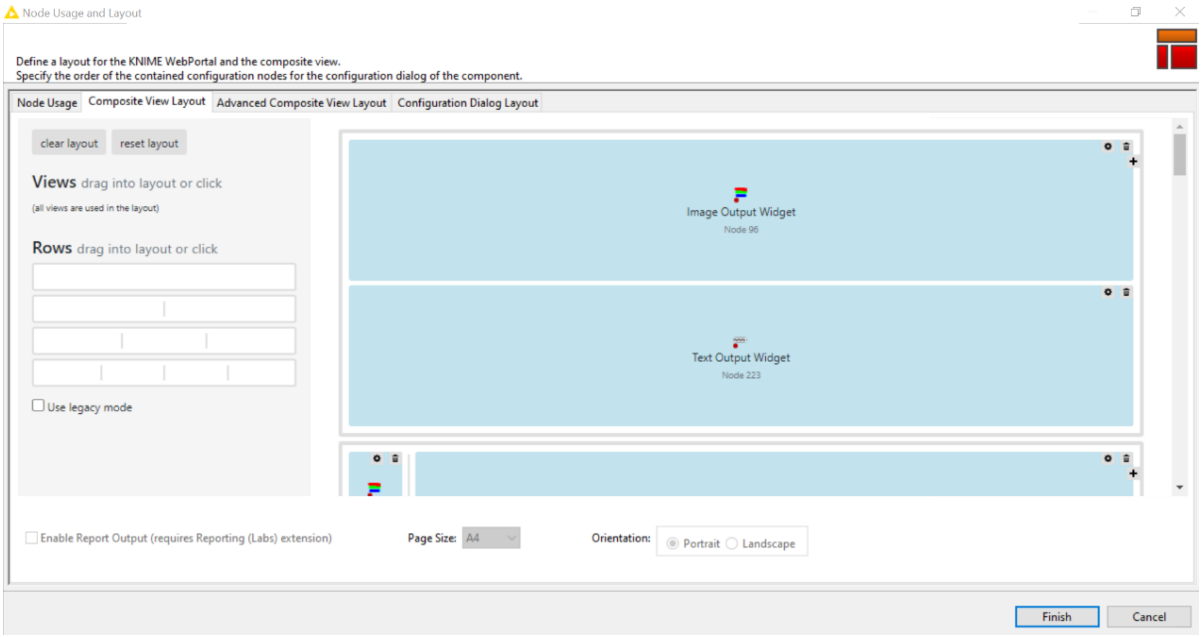


Figure 3.42 Editing layout Images

Figure 3.43 User Interface of Sustainable Development Goals

Conclusions and future work

The KNIME platform was used to analyze and evaluate data for the third goal of sustainable development, assessing and analyzing Iraq's progress in achieving the third goal of good health and well-being. Iraq has made significant progress in reducing maternal mortality, child mortality, vaccination, epidemic control, and health care coverage, as all of these sub-goals, which constitute about a third of our sub-goals, have been achieved or are on their way to being achieved.

The other third suffers from stagnation or a severe lack of data in the region. There was negative progress in the last third of the sub-goals. Suicide and traffic fatality rates have doubled, and the prevalence of tobacco use among 15-year-olds remains very high.

It is worth noting that the weak quantity and quality of data provided by agencies, or its absence, constitutes a major obstacle to our efforts.

The KNIME platform is excellent tools for analysis and implementation in data mining without the need for programming which makes it easier to implement.

In future work, we can analyze the progress of the College of Computer Science and Information Technology at the University of Kerbala in achieving sustainable development goals using machine learning.

References

[1] Transforming our world: the 2030 Agenda for Sustainable Development (2015).

[2] Richard A Roehrl,(2022) . Beyond a black-box approach to artificial intelligence policy – a simple guide to definitions, functions and technology types.

[3] Vincent Pedemonte, V. (2020). AI for Sustainability: An overview of AI and the SDGs to contribute to the European policy-making.

[4] The role of artificial intelligence in achieving the Sustainable Development Goals. Nature communications.

[5] Mark Harris . (2017) .Artificial Intelligence and Decarbonization.

[6] Vijaya Lakshmi, Jacqueline Corbett (2020). How artificial intelligence improves agricultural productivity and sustainability: A global thematic analysis.

[7] NEAL JEAN, M.,et al .(2016).sustainability and artificial intelligence lab.

[8] Michael Hainsworth .(2021)Real AI for Agriculture and Food Security.

[9] Hanspal, A. (2021, February). Here's why robots are actually going to increase human employment. In World Economic Forum (Vol. 26).

[10] Using AI to Achieve Sustainable Development Goals.

[11] Gideon R , Abhishek G , (2018).Artificial Intelligence as a Force for Good.

[12] Zhengjing Ma, Gang Mei, Francesco Piccialli. (2021). Machine learning for landslides prevention: a survey. Neural Computing and Applications.

[13] Jones, N. (2018). Can artificial intelligence help build better, smarter climate models. Yale E360, 10.

[14] IBM's Machine-Learning Crystal Ball Can Foresee Renewable Energy Availability.

[15] KNIME Analytics Platform.

[16] UN's data on sustainable development for Iraq.