Enterprise Financial Performance Data Analysis Tools Platform

Modelling Financial Processes with Process Mining

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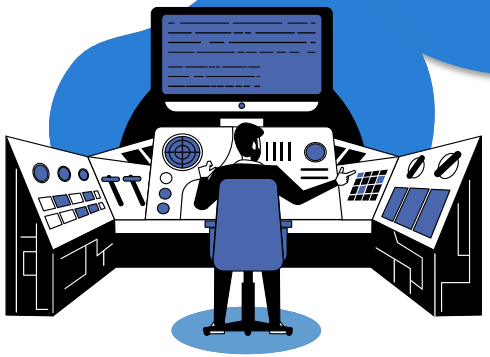
- *Project no.: 01.2.1-LVPA-T-848-02-0004*

- *Period of project implementation: 2020-06-01 - 2022-05-31*

01
Introduction



Introduction

- Financial data analysis is challenging process, but it helps to evaluate company's performance and form possible trends
- The major source of data are company's annual reports, financial statements, balance sheet and/or general ledger
- This data, explaining company's processes, may be collected in different ways by using different tools or information systems
- According collected data the analyst can choose different type of analysis, in example: summary data, development trend, data comparison, composition, progress map and etc.
- It depends on main financial analysis purpose and from data quality

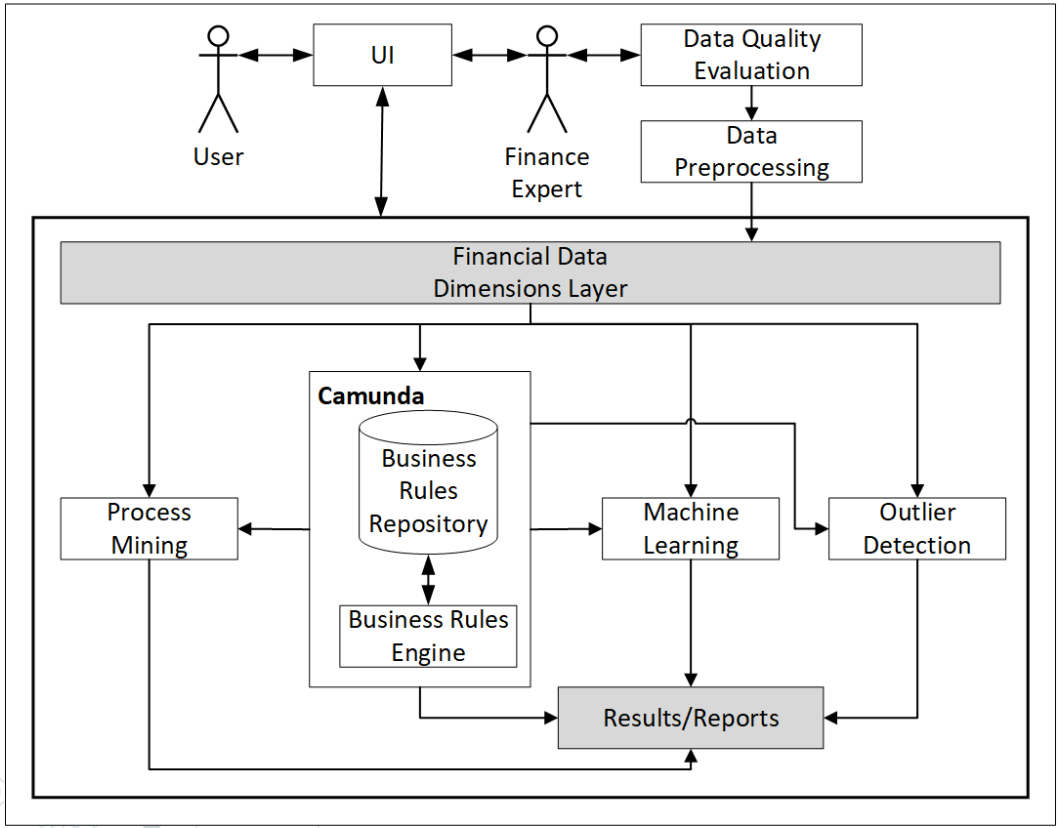
Introduction

- Process mining as a bridge between process-centric approaches and more data-centric approaches like data mining and machine learning
- There are many process mining tools, technologies and applications which can provide fact-based support process enrichments and solutions
- Business process mining is a quite new and increasing research field, which concentrates on analysis of business processes by approaching different data mining methods on event data

Introduction

- The idea of process cubes explains that events and process models are organized using different dimensions
- The process cube is very like the data cube – online analytical processing (OLAP)
- The process cube much like the data cube in which is applied in OLAP systems
- Each cell corresponds to a set of events and can be used to discover a process model, to check conformance with consideration to some process model

Introduction



Meta-model of the research

Related Works

- Process mining is specifically focused on analyzing historical data of process implementation in the form of event logs
- Many process mining technologies, tools, and applications can grant fact-based support process improvements and solutions
- Process mining is a technology that provides analysis of event logs extracted from the enterprise's information system
- Even though process mining has developed very quickly, it is pretty new to the accounting domain, and there are some challenges of its usage in this field, especially for fraud and anomaly detection as well for
- Financial data analysis using PM technology is a challenging process, it helps:
  - to reveal the flow of the financial activities and their characteristics
  - to evaluate the validity of financial processes in the organization
  - to evaluate an organization’s performance
  - to reveal possible fraud in accounting records

02 Multidimensional Financial Space for PM Project Specification

Specification of the PM project

Specification of the PM project requires not only financial data content awareness but also specific knowledge of the PM project specification rules as well as PM tool environment.

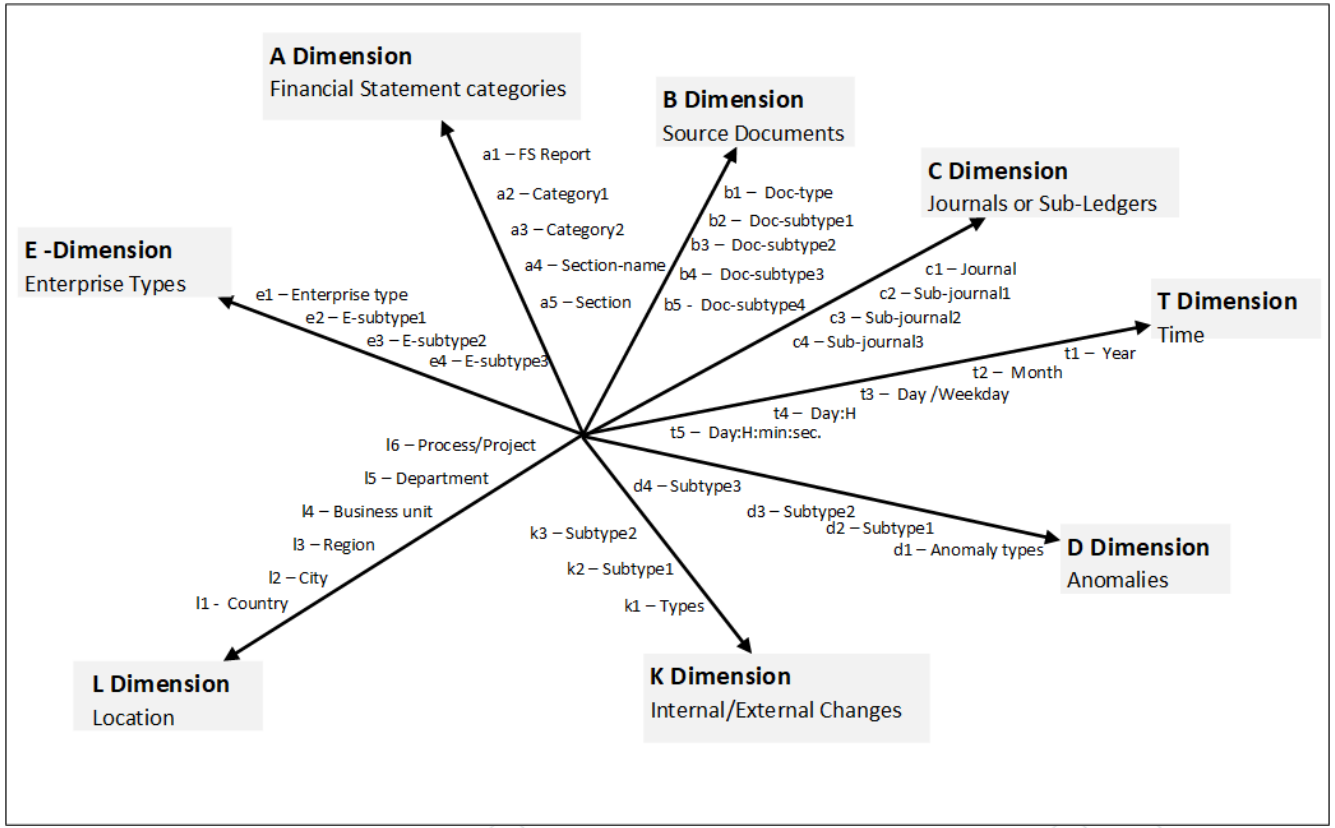
Specification of PM project includes steps as follows:

- *Preparation of initial data for the PM task, creating an event log*
- *Identification of some data record attribute as Case ID*
- *Identification of Activity ID*
- *Identification of Timestamp*
- *Assignment of some other data record attributes is as resources or simple attributes*

Specification of the PM project

- There are many PM tools, their environments are very different, so it is too complicated for a financial specialist to use them directly in formulating data analysis tasks
- Previously we have presented a user-friendly approach to PM technology implementation for financial data analysis using a multi-dimensional space of financial data
- Figure presents financial data space (FDS) dimensions and their members, which can be covered with particular data from General Ledger prepared for the analysis according to transformation algorithms

Specification of the PM project



Financial Data Space (FDS) dimensions and dimension members

Financial Data Cube Dimensions

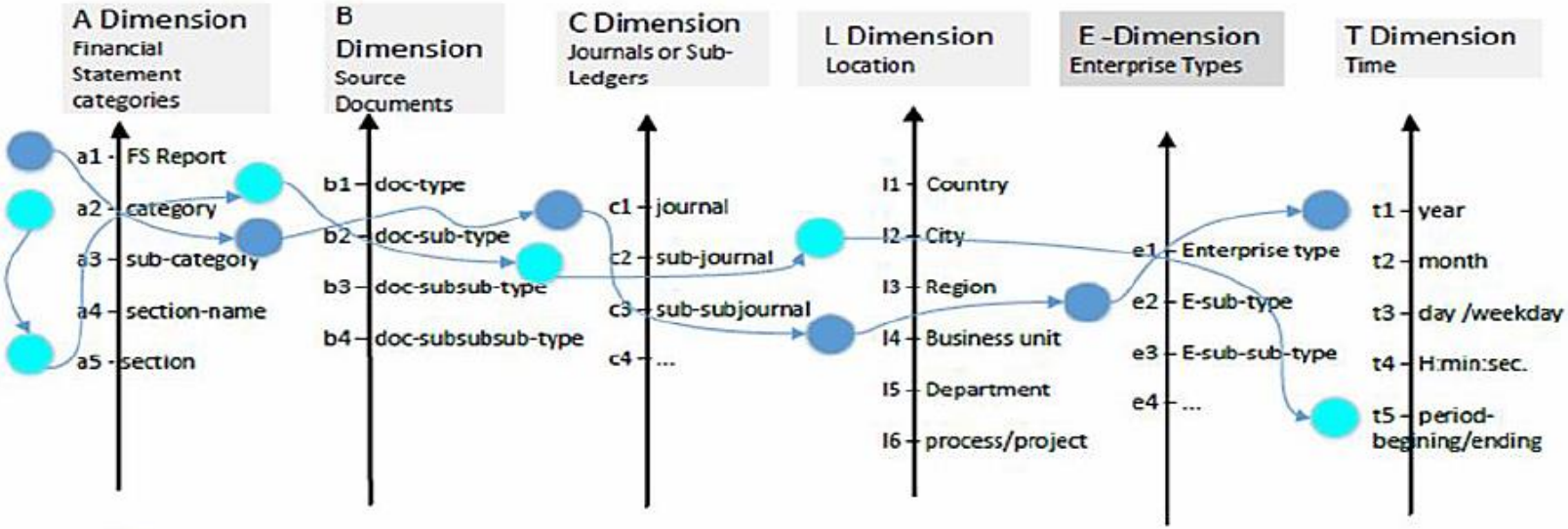
Concepts:

- Financial Accounting Object (FO) – any name of the file field (data record field, i.e. the column name of the excel table), except for time attributes
- Dimension – a type of FO (cluster) that corresponds to an aspect of financial accounting or performance management practices
- There can be several dimensions of FO, it depends on the experts who provide the FO classification
- Each dimension corresponds to one axis of the Space of Financial Objects

Financial Data Cube Dimensions

Concepts:

- Dimensions consist of dimension members that specify the hierarchical structure of the FO, i.e. identifies a more detailed classification of the FO type
- Dimension members are assigned attributes (identifiers) that correspond to the data record fields (quantities, values or codes) and they may vary regarding provided data
- Members of different dimensions can form combinations if they have at least one common attribute (identifier)



Dimensions can form combinations specifying a Process Mining project

Financial process mining aspects

- The specification of Financial Process Mining tasks (projects) quite often has fundamental differences from traditional Process Mining

- Financial processes refer to the methods and procedures completed by the Office of Finance

- Since each finance department function has a list of finance business processes involved, drawing up process maps can bring a clear understanding of the tasks and people involved

- Finance Process definition in terms of process mining technology: Finance process is fixed as a set of finance data records in the company's database and can be discovered, visualized and linked to static indicators using Process Mining (PM) technology

Basic concepts of Finance Process Mining

- Financial (accounting) object (FO)
- Source data
- Case
- Case ID
- Activity ID
- Event
- Outcome of finance PM
- Current problem
- Relevant
- Process Cube

Financial Data Cube Dimensions

- According a particular financial data a cube view defines which dimensions are visible and which events are selected
- In order to apply standard process mining techniques, it is necessary to create an event log (to prepare financial data) for every cell in the cube view
- At any point in time it is possible generate an event log per cell and compare the process mining results
- To be able to apply process mining per cell, the classical requirements need to be satisfied, i.e.:
  - *events need to be (partially) ordered (e.g., based on some timestamp)*
  - *one needs to select a case identifier to correlate events and an event classifier to determine the activities*

Specification of the PM project

- A – Dimension – Financial Statement (FS) categories: *a1-FS type (Report), a2-CreditCategory1, a3-CreditCategory2, a4-CreditCategory3, a5-SectionCode*
- B – Dimension – *Source documents: b1-Doc-Type, b2-Doc-Subtype1, b3-Doc-subtype2, b4-Doc-subtype3, ...*
- C – Dimension – *Journals or Sub-Ledgers: c1-Journal, c2-Sub-Journal1, c3-Sub-journal2, c4-Sub-journal3, ...*
- E – Dimension – *Enterprise Types: e1-Enterprise Type, e2-E-SubType1, e3-E-SubType2, e4-E-SubType3, ...*
- L – Dimension – *Location: l1-Country, l2-City, l3-Region, l4-Business Unit, l5-Department, l6-Process /Project, ...*
- T – Dimension – *Time-Period: t1-Year, t2-Month, t3-Day / week day, t4-Day: Hour: min: sec, t5-Hour: min: sec, t6-Period Beginning, t7-Period-Ending*
- D – Dimension – *Anomalies: d1-Anomaly type, d2-subtype1, d3-subtype2, d4-subtype3, ...*
- K – Dimension – *Changes: Internal / External Internal Changes (IC): k1-types, k2-subtype1, k3-subtype2, ...; External Changes (EC): k1-types, k2-subtype1, k3-subtype2, ...*

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Specification of a Financial Process Mining Project

Kaunas Faculty

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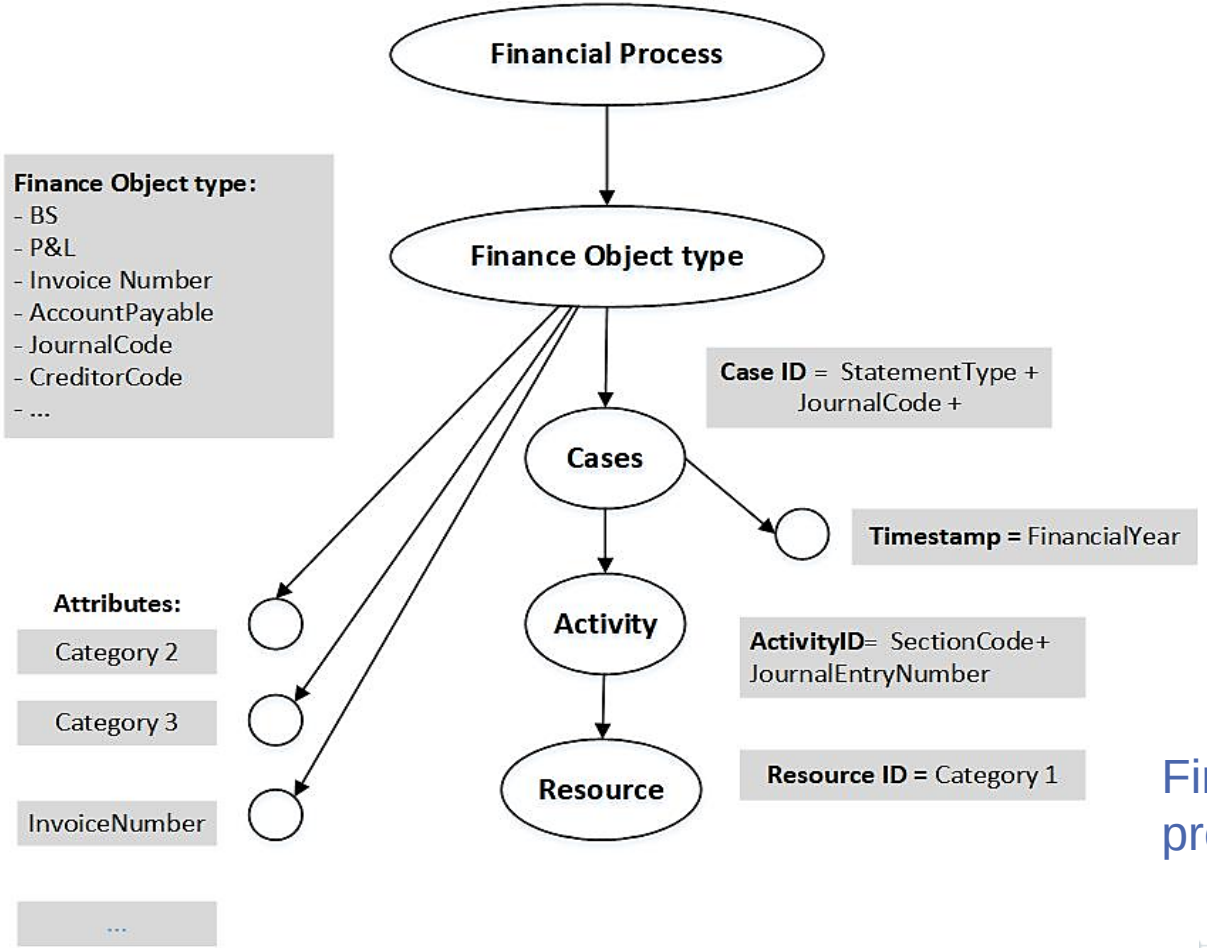
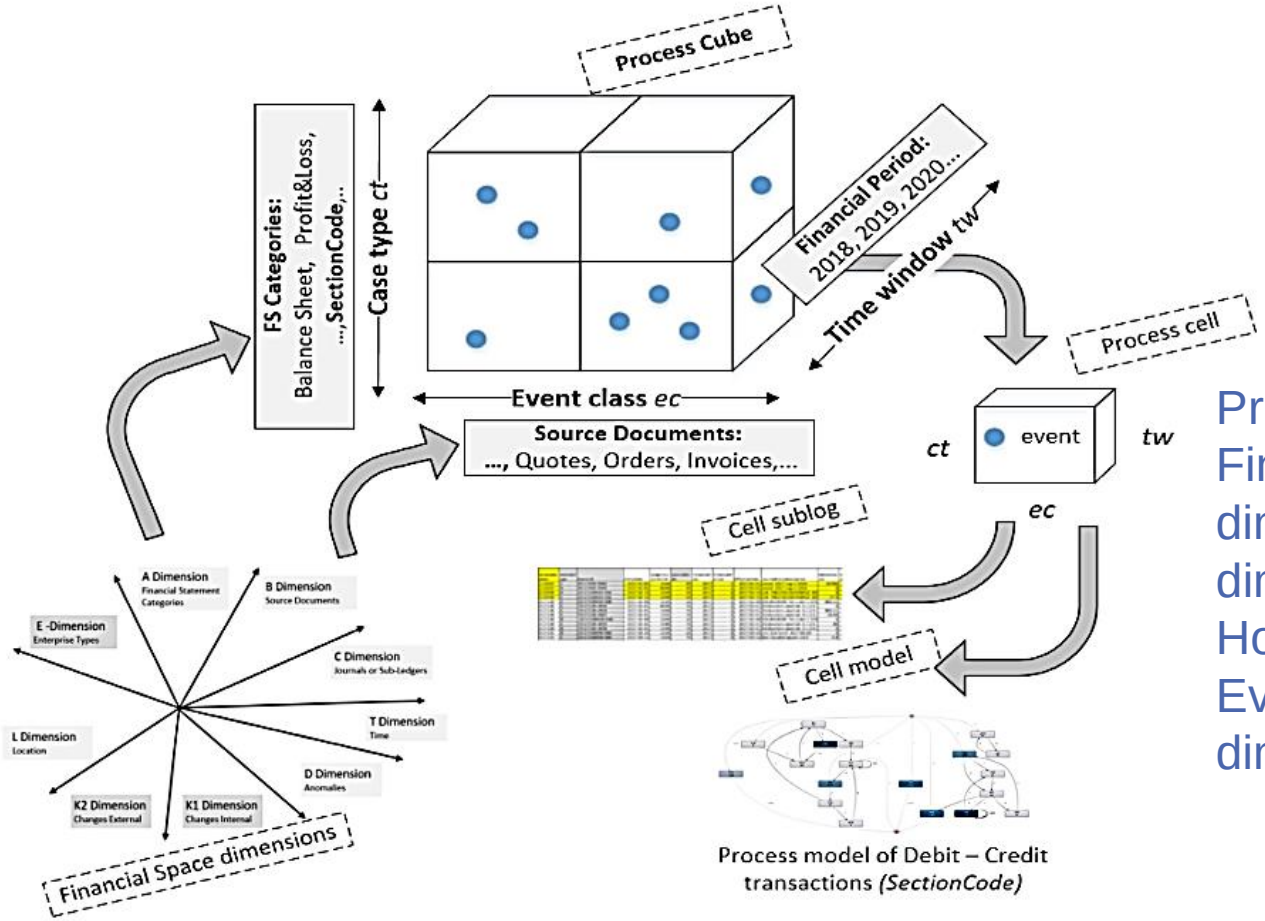


Financial Process Mining (PM) project specification (example)



Process Mining Project Financial Process Cube dimensions: Vertical dimension – Case type; Horizontal dimension – Event class, Diagonal dimension – Time stamp

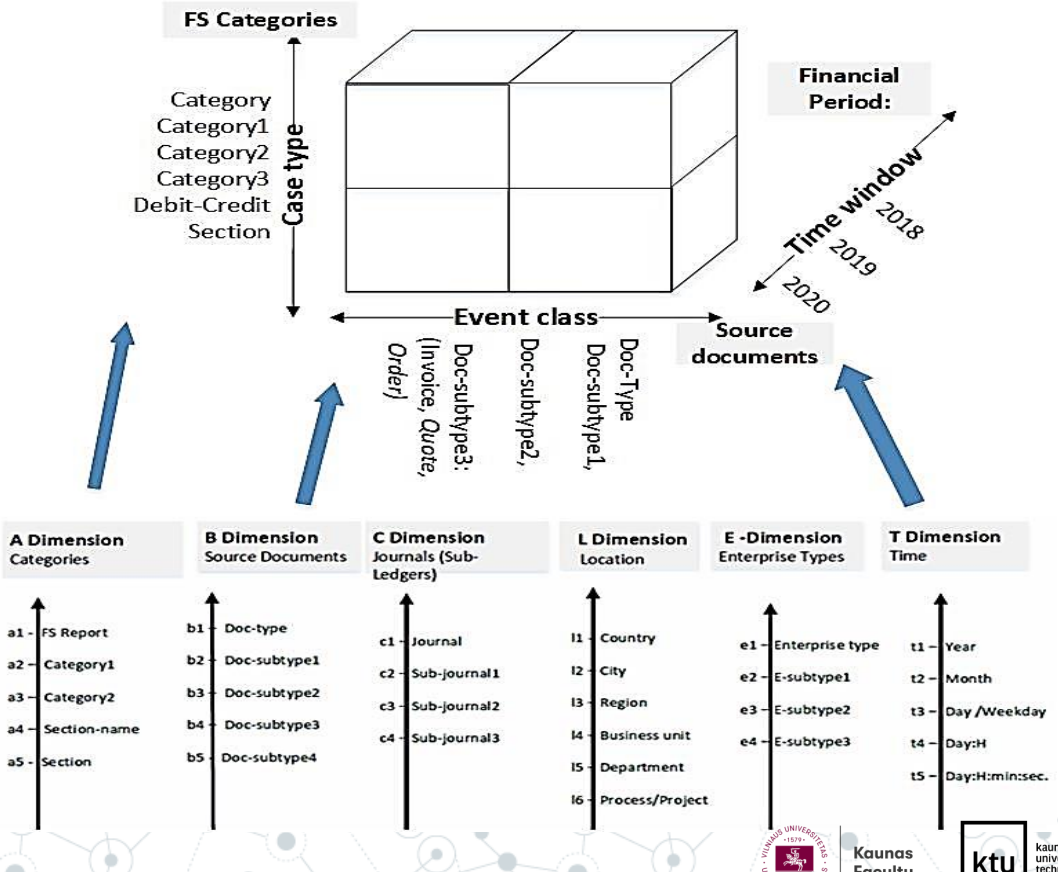
Operation	Classical OLAP operations	Process Cube Operations	Financial Process Cube Operations
Slice	The Slice OLAP operations take one specific dimension from a cube given and represent a new sub-cube. It can create a new sub-cube by choosing one or more dimensions. Example: Slice (dimension = Location) for (dimension = TIME = (Year = 2020, Quarter = Q1))	The slice operation produces a new sub-cube view by allowing the analyst to filter (pick) specific values for attributes within one of the dimensions, while removing that dimension from the visible part of the cube. Slice: {Dim Country= (Netherlands)}	Given a Cube where Dimensions = {(Case ID= FS Categories), Time = Financial Year), (Event ID = JournalType)} Specification of SLICE operation: SLICE on {FS Category (Case type = (FS Category AND Section)}
Dice	Dice (Select) emphasizes two or more dimensions from a cube given and suggests a new sub-cube, as well as Slice operation does. In order to locate a single value for a cube, it includes adding values for each dimension. Example: Given a Cube where Dimensions = {(Location = Cities), Time = Quaternar-ies), (Products types = Items)} then Dice for (Location = „Venice“ or „Florence“) and (Time = Seasons =(„Winter“ or „Spring“) and (Product type = (Item = „components“ or „clothining“)	The dice operation produces a subcube by allowing the analyst to filter (pick) specific values for one of the dimensions. No dimensions are removed in this case, but only the selected values Dice: {Dim Country= (Netherlands); gran(Location)= City)}	Given a Cube where Dimensions = {(Case ID= FS Categories = (a1, a5), Time = Financial Year, (Event ID = JournalType)} Specification of DICE operation: DICE on {Document Type= (doc-subtype3) AND Financial Period = (t3 – Financial Year)}

Operation	Classical OLAP operations	Process Cube Operations	Financial Process Cube Operations
Drill Down (Roll Down)	OLAP Drill-down is an operation opposite to Drill-up. It is carried out either by descending a concept hierarchy for a dimension or by adding a new dimension. It lets a user deploy highly detailed data from a less detailed cube. Example: Given a Cube where Dimensions = {(Location = Cities), (Time = Seasons), (Products = Product types)} then Drill Down on Dimension ={(Time) from Seasons to Month)}	The roll up and drill down operations do not remove any dimensions or filter any values, but only change the level of granularity of a specific dimension [p826]. Drill down (Roll Down) operation is intended to show the same data with more detail (granularity).	Given a Cube, where Dimensions = {(Case ID= FS Categories = ((Debit-Credit), Category3, Category2, Category1, Statement Type), Time = Financial Year, (Event ID = Source documents)} Specification of DRILL DOWN (ROLL DOWN) operation: DRIL DOWN on {FS Category (from Case type = (Debit – Credit) to Case type = Section)}. Results are sub-cube: Dimensions = {(Case ID= FS Categories = (Section code, Debit-Credit), Category3, Category2, Category1, Statement Type), Time = Financial Year, (Event ID = Source documents)}
Drill Up (Roll Up)	Summarize data: Climbing up hierarchy or by dimension reduction in order to receive measures at a less detailed granularity. Example: Given a Cube where Dimensions = {(Location = Cities), Time = Seasons), (Products = Product types)} then Drill Up on Dimension = (Location = Country).	The roll up and drill down operations do not remove any dimensions or filter any values, but only change the level of granularity of a specific dimension [p826]. Roll Up (Drill Up) operation is intended to show the same data with less detail (granularity).	Given a Cube, where Dimensions = {(Case ID= FS Categories = (Section code, Debit-Credit), Category3, Category2, Category1, Statement Type), Time = Financial Year, (Event ID = Source documents)} Specification of ROLL UP (DRILL UP) operation: ROLL UP on {FS Category (from Case type = Section to Case type = (Debit – Credit))}. Results are sub-cube

Step 1. Mapping of Finance Data Space dimensions to the Process Cube dimensions

- Financial Process Cube dimensions in the example are associated with the Financial Data Space dimensions as follows:
  - Case type dimension is associated with the Financial Statement Category (dimension A) and etc.
  - Event class dimension is associated with the Document Type (dimension B)
  - Time window dimension is associated with the Financial Period (dimension T)

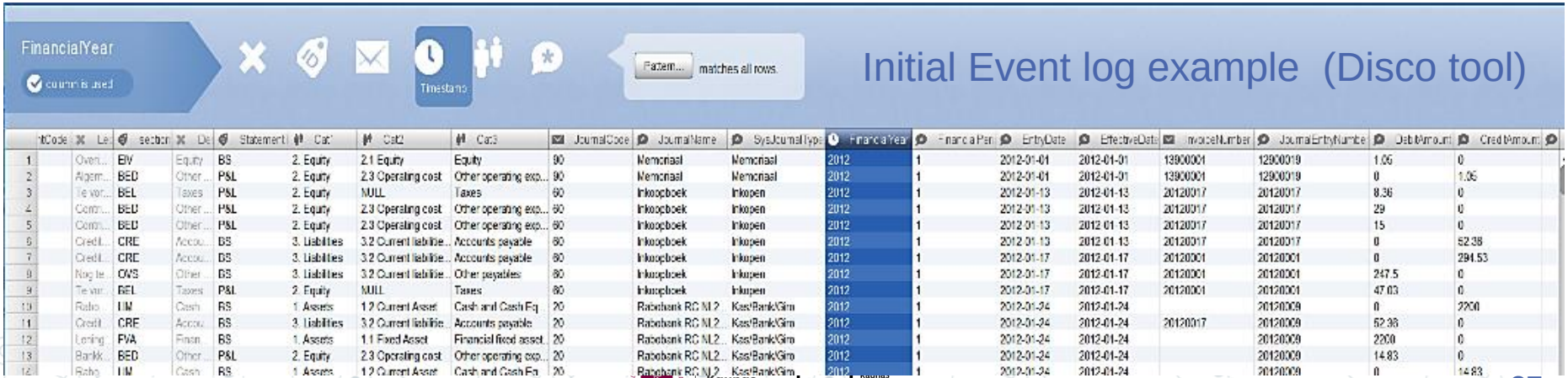
Step 2. Specification and visualization of the required Finance Process Cube



The Financial Process Cube required by the user includes dimensions A = Case type, B = Source Document and T = Time Window

Step 3. Specification of Process Mining project

- We select Case ID, Activity ID, and Timestamp ID from existing cube dimensions and their members. The example of PM project specification is as follows:
  - Dimension FS Category: Case ID: a1 – Category, a5 – Section Code;
  - Dimension Document types: Activity ID: b3 – Doc-subtype3 (Invoice);
  - Dimension TimeWindow: Timestamp: t3 – Financial Year.



Initial Event log example (Disco tool)

	ntCode	Le	section	De	Statement	Cat	Cat2	Cat3	JournalCode	JournalName	SysJournalType	FinancialYear	FinancialPer	EntryDate	EffectiveDate	InvoiceNumber	JournalEntryNumbe	DebitAmount	CreditAmount
1		Overl...	BV	Equity	BS	2. Equity	2.1 Equity	Equity	90	Memoriaal	Memoriaal	2012	1	2012-01-01	2012-01-01	13900001	12900019	1.05	0
2		Algem...	BED	Other ...	P&L	2. Equity	2.3 Operating cost	Other operating exp...	90	Memoriaal	Memoriaal	2012	1	2012-01-01	2012-01-01	13900001	12900019	0	1.05
3		Te ver...	BEL	Taxes	P&L	2. Equity	NULL	Taxes	60	Inkoopboek	Inkopen	2012	1	2012-01-13	2012-01-13	20120017	20120017	8.36	0
4		Comm...	BED	Other ...	P&L	2. Equity	2.3 Operating cost	Other operating exp...	60	Inkoopboek	Inkopen	2012	1	2012-01-13	2012-01-13	20120017	20120017	29	0
5		Comm...	BED	Other ...	P&L	2. Equity	2.3 Operating cost	Other operating exp...	60	Inkoopboek	Inkopen	2012	1	2012-01-13	2012-01-13	20120017	20120017	15	0
6		Credi...	CRE	Accou...	BS	3. Liabilities	3.2 Current liabilitie...	Accounts payable	60	Inkoopboek	Inkopen	2012	1	2012-01-13	2012-01-13	20120017	20120017	0	52.38
7		Credi...	CRE	Accou...	BS	3. Liabilities	3.2 Current liabilitie...	Accounts payable	60	Inkoopboek	Inkopen	2012	1	2012-01-17	2012-01-17	20120001	20120001	0	294.53
8		Nog te ...	OVS	Other ...	BS	3. Liabilities	3.2 Current liabilitie...	Other payables	60	Inkoopboek	Inkopen	2012	1	2012-01-17	2012-01-17	20120001	20120001	247.5	0
9		Te ver...	BEL	Taxes	P&L	2. Equity	NULL	Taxes	60	Inkoopboek	Inkopen	2012	1	2012-01-17	2012-01-17	20120001	20120001	47.03	0
10		Rabo ...	LIM	Cash	BS	1. Assets	1.2 Current Asset	Cash and Cash Eq	20	Rabobank RC NL2...	Kas/Bank/Giro	2012	1	2012-01-24	2012-01-24		20120009	0	2200
11		Credi...	CRE	Accou...	BS	3. Liabilities	3.2 Current liabilitie...	Accounts payable	20	Rabobank RC NL2...	Kas/Bank/Giro	2012	1	2012-01-24	2012-01-24	20120017	20120009	52.38	0
12		Loning	FVA	Finan...	BS	1. Assets	1.1 Fixed Asset	Financial fixed asset	20	Rabobank RC NL2...	Kas/Bank/Giro	2012	1	2012-01-24	2012-01-24		20120009	2200	0
13		Bankk...	BED	Other ...	P&L	2. Equity	2.3 Operating cost	Other operating exp...	20	Rabobank RC NL2...	Kas/Bank/Giro	2012	1	2012-01-24	2012-01-24		20120009	14.83	0
14		Rabo ...	LIM	Cash	BS	1. Assets	1.2 Current Asset	Cash and Cash Eq	20	Rabobank RC NL2...	Kas/Bank/Giro	2012	1	2012-01-24	2012-01-24		20120009	0	14.83

Step 4. Specification of project EventLog

- In this step, according to the project specification, the PM tool creates a project EventLog from the existing data set (i.e. Initial Event), on the basis of which the PM process will be started:
  - CaseID =(CaseID1=StatementType AND CaseID2=SectionCode),
  - ActivityID = InvoiceNumber (i.e. doc-subtype3),
  - Timestamp= FinancialYear.

An example of a project EventLog generated by the PM tool Disco

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
1	Case ID	Activity	Resource	Complete	Variant	Variant index	LedgerAcc	Cat1	Cat2	Cat3	JournalCode	JournalNa	SysJournal	FinancialP	EntryDate	EffectiveDate	JournalEnt	DebitAmo	CreditAmo	DebtorCo	CreditorCod
2	BS-EIV	13900001	2. Equity-2.	00:00.0	Variant 1	1	750	2. Equity	2.1 Equity	Equity	90	Memoriaa	Memoriaa	1	2012-01-01	2012-01-01	12900019	1.05	0		
3	BS-EIV	15900010	2. Equity-2.	00:00.0	Variant 1	1	750	2. Equity	2.1 Equity	Equity	90	Memoriaa	Memoriaa	3	2015-03-05	2015-03-05	15900010	40000	0		
4	BS-EIV	15900011	2. Equity-2.	00:00.0	Variant 1	1	750	2. Equity	2.1 Equity	Equity	90	Memoriaa	Memoriaa	3	2015-03-05	2015-03-05	15900011	40000	0		
5	BS-EIV	16900002	2. Equity-2.	00:00.0	Variant 1	1	750	2. Equity	2.1 Equity	Equity	90	Memoriaa	Memoriaa	12	2015-12-31	2015-12-31	15900024	4.11	0		
6	BS-EIV	16900001	2. Equity-2.	00:00.0	Variant 1	1	750	2. Equity	2.1 Equity	Equity	90	Memoriaa	Memoriaa	4	2016-05-12	2016-05-12	16900001	62500	0		
7	BS-EIV	16900024	2. Equity-2.	00:00.0	Variant 1	1	750	2. Equity	2.1 Equity	Equity	90	Memoriaa	Memoriaa	12	2016-12-31	2016-12-31	16900024	1.19	0		
8	BS-EIV	17900013	2. Equity-2.	00:00.0	Variant 1	1	750	2. Equity	2.1 Equity	Equity	90	Memoriaa	Memoriaa	1	2017-01-17	2017-01-17	17900013	45000	0		
9	BS-EIV	17900014	2. Equity-2.	00:00.0	Variant 1	1	750	2. Equity	2.1 Equity	Equity	90	Memoriaa	Memoriaa	12	2017-12-31	2017-12-31	17900014	1.34	0		
10	BS-EIV	18900004	2. Equity-2.	00:00.0	Variant 1	1	750	2. Equity	2.1 Equity	Equity	90	Memoriaa	Memoriaa	12	2018-12-31	2018-12-31	18900004	1.39	0		
11	BS-EIV	18900004	2. Equity-2.	00:00.0	Variant 1	1	750	2. Equity	2.1 Equity	Equity	90	Memoriaa	Memoriaa	12	2018-12-31	2018-12-31	18900004	60000	0		
12	BS-EIV	19900005	2. Equity-2.	00:00.0	Variant 1	1	750	2. Equity	2.1 Equity	Equity	90	Memoriaa	Memoriaa	12	2019-12-31	2019-12-31	19900005	50000	0		
13	P&L-BED	13900001	2. Equity-2.	00:00.0	Variant 2	2	5550	2. Equity	2.3 Operat	Other ope	90	Memoriaa	Memoriaa	1	2012-01-01	2012-01-01	12900019	0	1.05		
14	P&L-BED	20120017	2. Equity-2.	00:00.0	Variant 2	2	5552	2. Equity	2.3 Operat	Other ope	60	Inkoopboe	Inkopen	1	2012-01-13	2012-01-13	20120017	29	0		2
15	P&L-BED	20120017	2. Equity-2.	00:00.0	Variant 2	2	5552	2. Equity	2.3 Operat	Other ope	60	Inkoopboe	Inkopen	1	2012-01-13	2012-01-13	20120017	15	0		2
16	P&L-BED		2. Equity-2.	00:00.0	Variant 2	2	5560	2. Equity	2.3 Operat	Other ope	20	Rabobank	Kas/Bank/	1	2012-01-24	2012-01-24	20120009	14.83	0		
17	P&L-BED	20120003	2. Equity-2.	00:00.0	Variant 2	2	5552	2. Equity	2.3 Operat	Other ope	60	Inkoopboe	Inkopen	2	2012-02-01	2012-02-01	20120003	122.81	0		6
18	P&L-BED	20120016	2. Equity-2.	00:00.0	Variant 2	2	5552	2. Equity	2.3 Operat	Other ope	60	Inkoopboe	Inkopen	2	2012-02-10	2012-02-10	20120016	15	0		2

Step 5. Specification of constraints for Vertical dimension (Case type)

- Case type (CaseID1 and CaseID2,..) can be associated with financial process rules (constraints) defined through data record attributes and their values.

- These rules of the financial process make it possible to distinguish between permissible and non-permissible transactions.

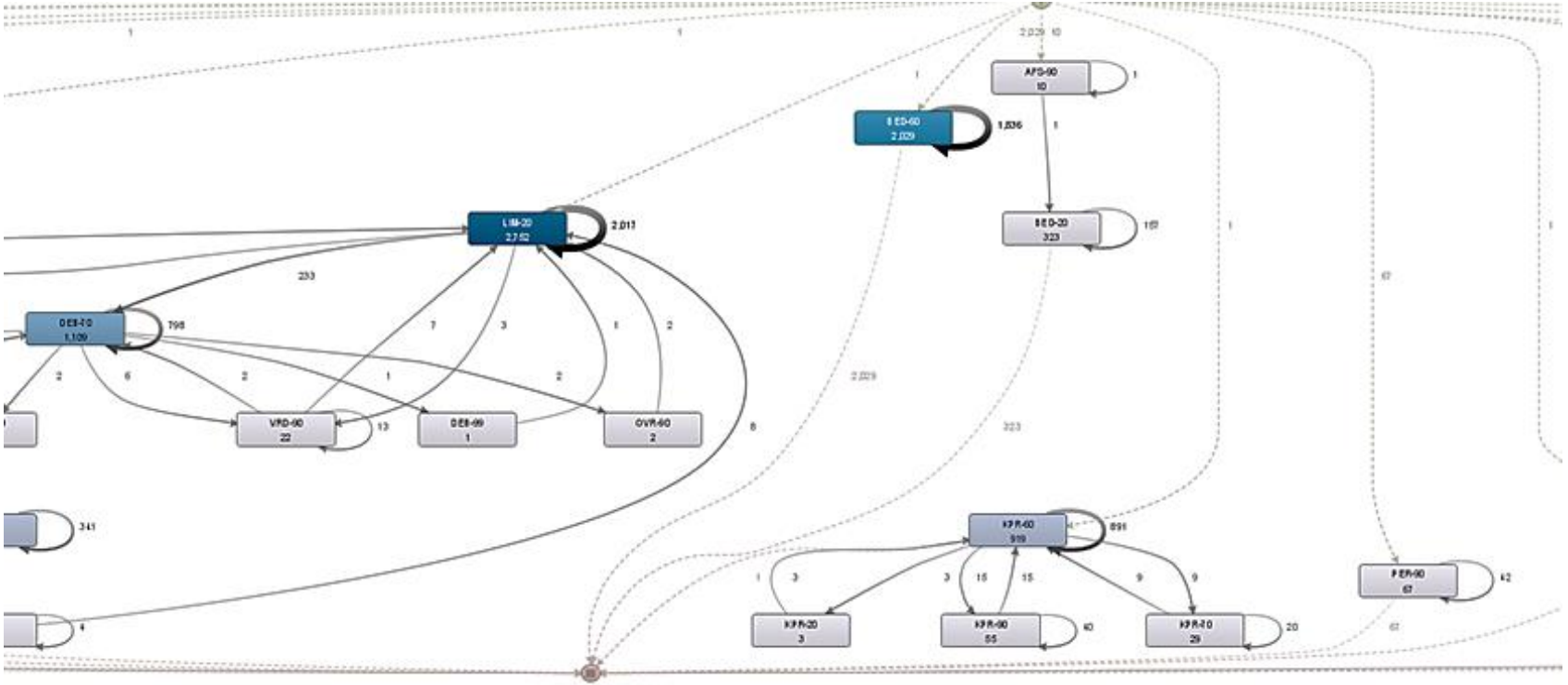
- The rules of financial processes (constraints) are based on the expert knowledge presented in natural language and then formally specified using expression IF (conditions) THEN (Action) and decision tables.

Step 6. Specification of constraints for Horizontal dimension (Activity type)

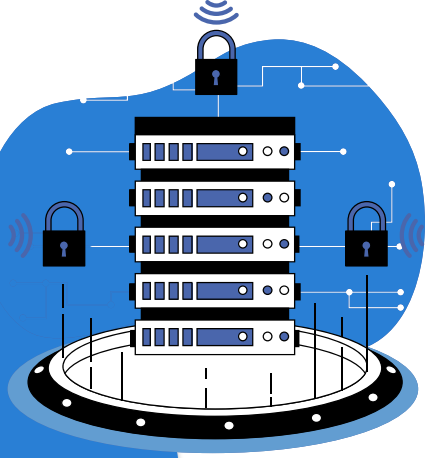
- Constraints for Horizontal dimension (= Activity type) members (ActivityID = doc-subtype3, ...) are based on the expert knowledge.

- The list of doc-subtype3 possible values:
  - doc-subtype3 = (Invoice, Quote, Order, …)
  - Example of the Decision table for ActivityID = doc-subtype3 when Transaction type = (DebitSectionCode – CreditSectionCode):
  - Decision table for ActivityID = doc-subtype3

Step 7. Execution of Process Mining



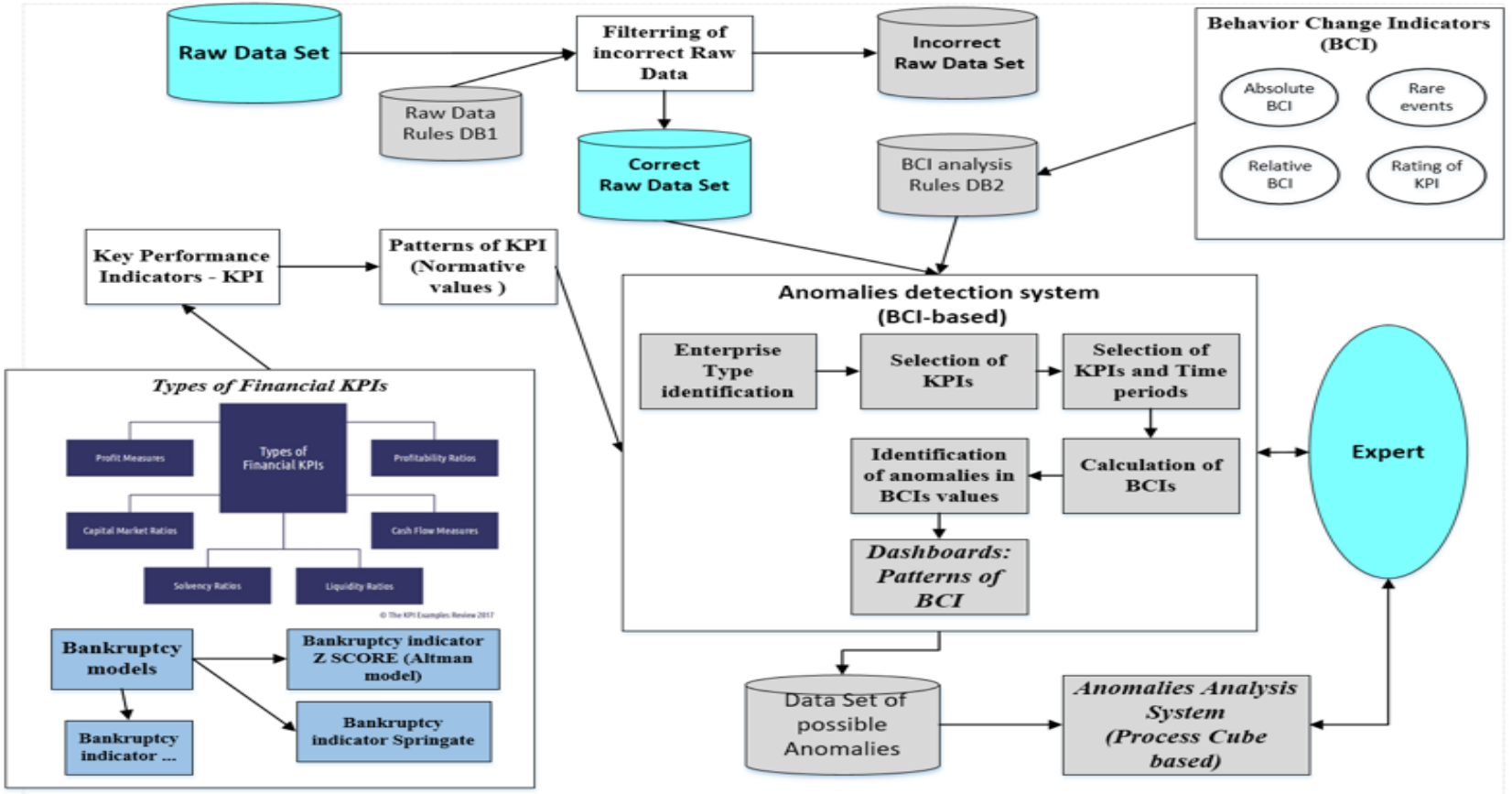
An example of discovered process model



04

Decomposition of BCI-based subsystem

Architecture of large-scale data analysis system for anomaly detection // Decomposition of BCI-based subsystem



Benefits for the Auditor using the Proposed Solution Prototype (1)

- The list of required financial criteria (KPIs) is in the system (compiled in advance):

FinancialIncome_YTD
Taxes
Taxes_YTD
GrossProfit
GrossProfit_YTD
OperatingProfit
OperatingProfit_YTD

EBITDA
EBIT%
EBITDA_YTD
EBIT
EBIT_YTD
EBT
EBT_YTD

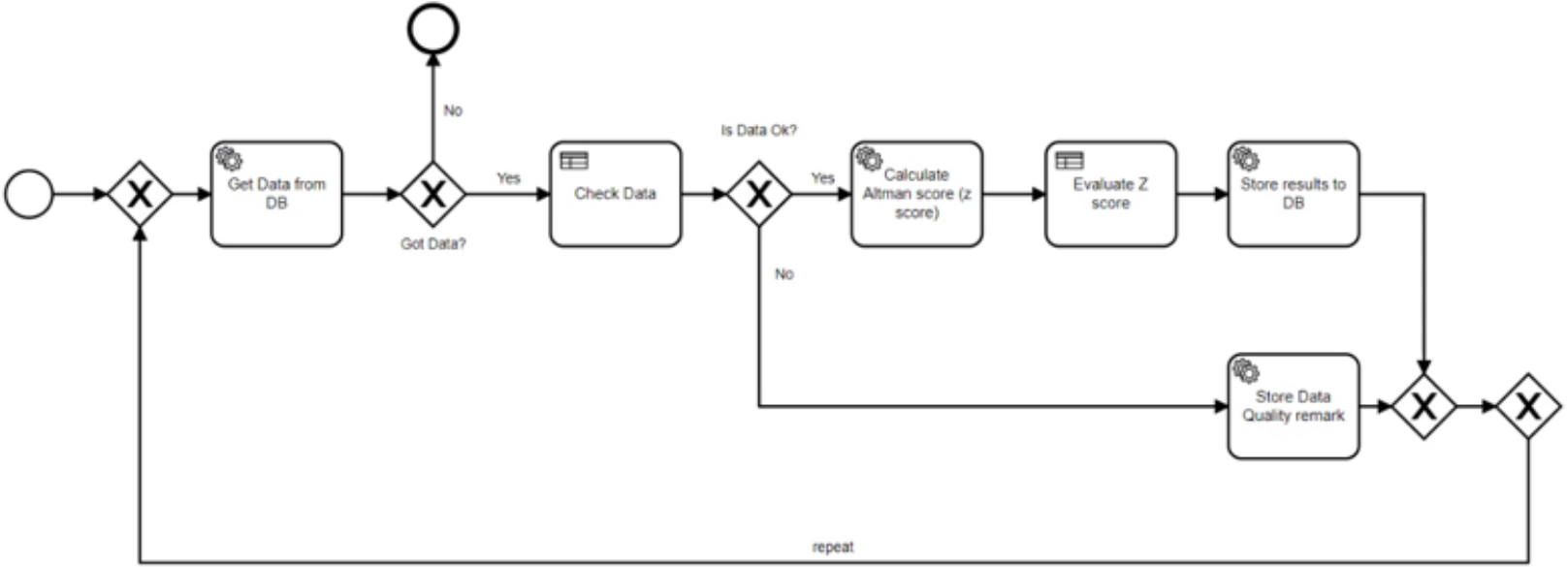
NetProfit
Inventory
NetProfit_YTD
Gross Margin%
Gross Margin%_YTD
EBITDA%
EBITDA%_YTD
EBIT%_YTD

NetMargin%
NetMargin%_YTD
ROA_YTD
ROE_YTD
Cash_Position
Cash_Ratio
Working_Capital
Current_Ratio

Acid_Test
Debt/Equity Ratio
Debt/Assets Ratio
OPEX%
Intangible_Fixed_Asset_Ratio
AR
AP

Benefits for the Auditor using Proposed Solution (2)

- The system provides a list of process templates for the KPI calculation.
- Altman ZScore Calculation Process



Benefits for the Auditor using the Proposed Solution (3)

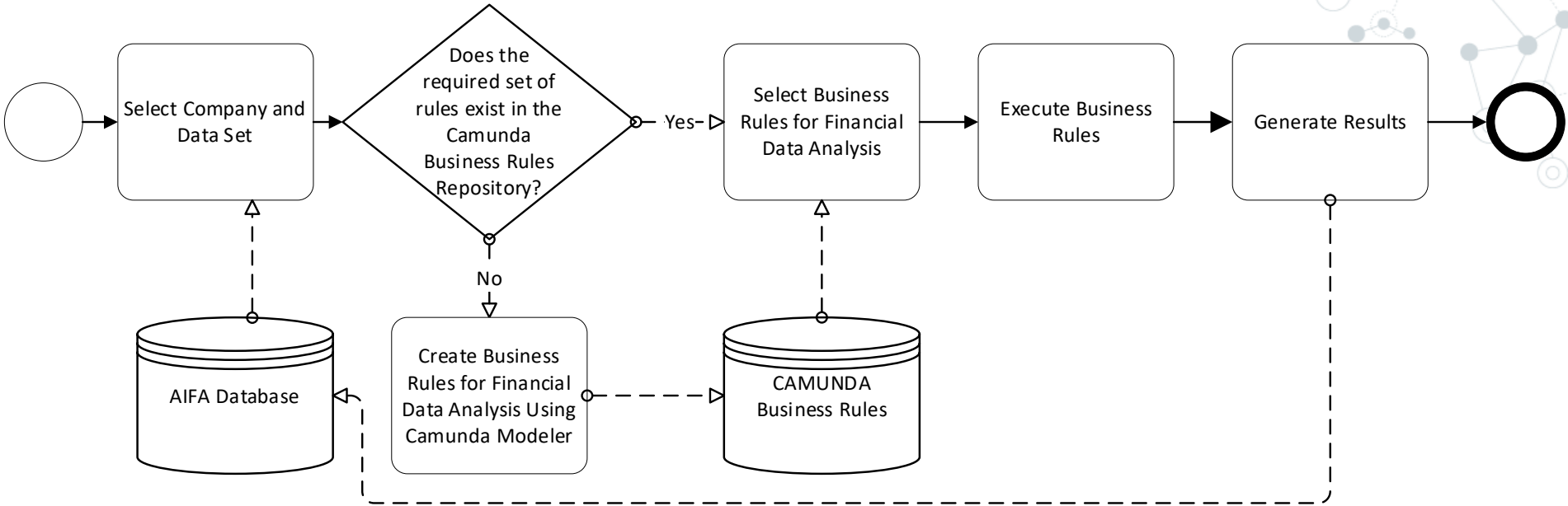
- Auditor has possibility to create new analysis process templates using Camunda modeler (including pre-prepared criteria, templates or processes according their needs avoiding (or having minimal) developer‘s support)
- User friendly interface of Financial Analysis KPI‘s specification and modification proposed in provided solution
- Behaviour Change Indicators (BCI) for anomaly detection are provided and can be implemented by auditor himself by demand

Z SCORE robustness BCI-RO calculation: prototype using EXCEL

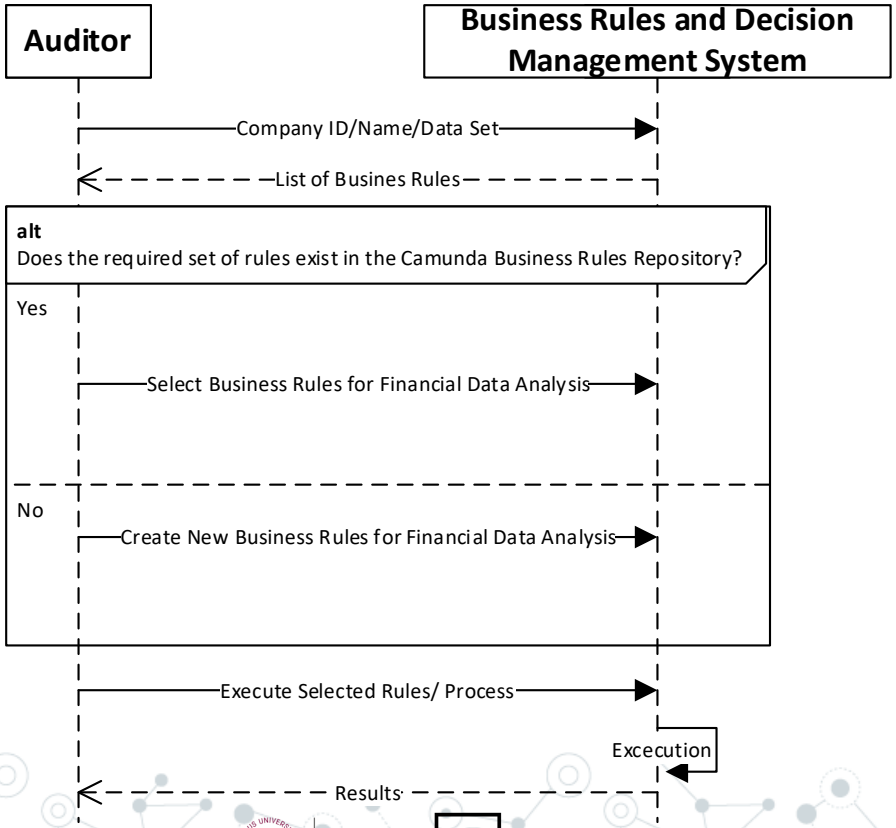
- The aim of calculations: evaluation of the Company state and trends using Z Score and BCI indicators

	Z = 0.717(X1) + 0.847(X2) + 3.107(X3) + 0.420(X4) + 0.998(X5)										
DBID	FinancialYear	Financial Period	X1	X2	X3	X4	X5	Z Score	Distress Zone	Grey Zone	Safe Zone
DB1_767-1	2012	1	0.30	0.03	0.04	0.23	0.27	**0.75**	Distress		
DB1_767-1	2012	2	0.34	0.04	0.04	0.28	0.26	**0.79**	Distress		
DB1_767-1	2012	3	0.38	0.07	0.07	0.36	0.29	**1.00**	Distress		
DB1_767-1	2012	4	0.40	0.05	0.05	0.41	0.25	**0.91**	Distress		
DB1_767-1	2012	5	0.47	0.02	0.02	0.53	0.21	**0.86**	Distress		
DB1_767-1	2012	6	0.58	0.17	0.14	0.89	0.29	**1.65**	Distress		
DB1_767-1	2012	7	0.59	0.07	0.10	0.96	0.25	**1.46**	Distress		
DB1_767-1	2012	8	0.55	-0.03	-0.01	0.80	0.17	**0.85**	Distress		
DB1_767-1	2014	10	0.90	0.07	0.07	4.29	0.13	**2.85**		Grey	
DB1_767-1	2014	11	0.90	0.05	0.05	4.28	0.11	**2.74**		Grey	
DB1_767-1	2014	12	0.91	0.07	0.06	4.73	0.13	**3.03**			Safe
DB1_767-1	2015	1	0.92	0.02	0.03	5.06	0.08	**2.97**		Grey	
DB1_767-1	2015	2	0.91	0.04	0.04	4.88	0.09	**2.94**		Grey	
DB1_767-1	2015	3	0.91	0.02	0.03	4.96	0.08	**2.92**		Grey	
DB1_767-1	2015	4	0.91	0.04	0.03	5.01	0.08	**2.98**		Grey	
DB1_767-1	2015	5	0.92	0.04	0.03	5.26	0.08	**3.08**			Safe
DB1_767-1	2015	6	0.92	0.03	0.03	5.61	0.07	**3.21**			Safe
DB1_767-1	2015	7	0.93	0.04	0.04	6.01	0.09	**3.44**			Safe
DB1_767-1	2015	8	0.92	0.03	0.04	5.76	0.08	**3.29**			Safe

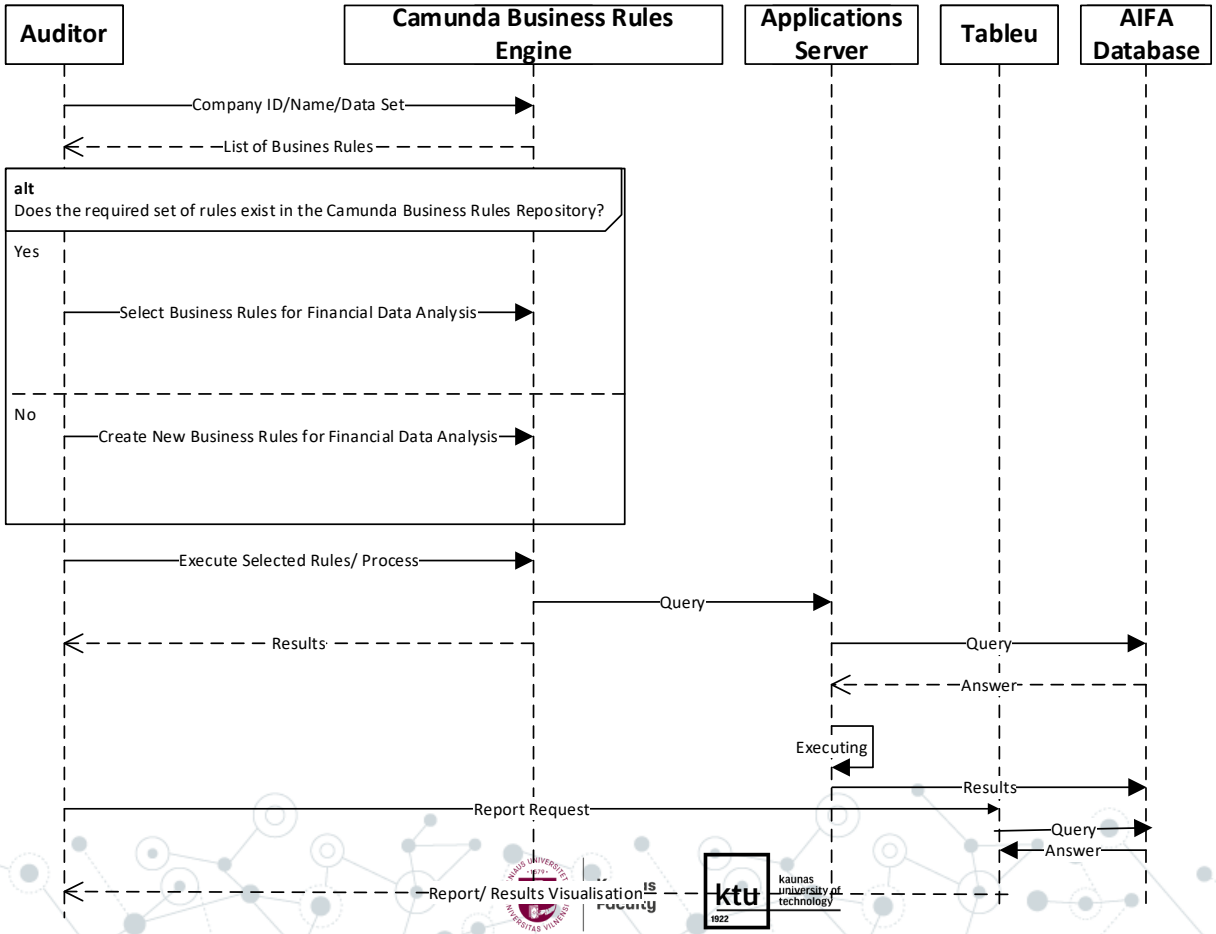
The main steps of Financial Analysis Process



Front End: UI of propose Solution Prototype



Interaction Flows Among System‘s Components



Create Business Rules for Financial Data Analysis Report Using Camunda Modeler

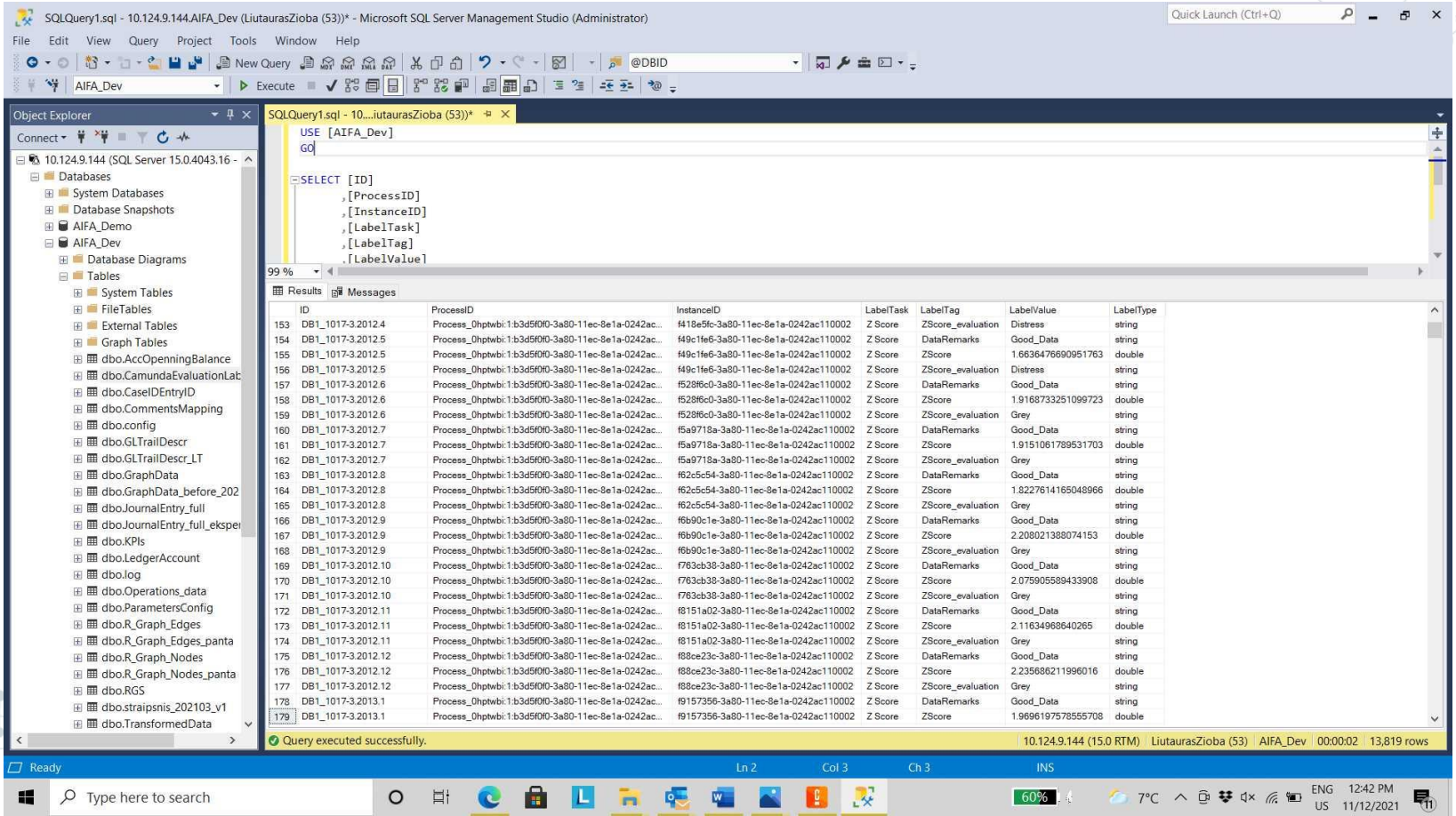
EvaluateZScore — **Hit Policy:** First

	When	And	Then	
	ZScore (double)	ZScore (double)	ZScore_Evaluation (string)	Annotations
1	<=1.8	-	"Distress"	
2	>1.8	<=3	"Grey"	
3	>3	-	"Green"	
+	-	-		

KPI_Data_Validation — **Hit Policy:** First

	Total_Equity (double)	And Total_Liabilities (double)	And Total_Assets (double)	And Fixed Assets (double)	And Current Assets (double)	And Non-current liabil… (double)	And Current liabilities (double)	Then DataRemarks (string)
1	>0	>0	>0	>=0	>=0	>=0	>=0	"Good_Data"
2	<=0	-	-	-	-	-	-	"Total_Equity_Negative"
3	-	<=0	-	-	-	-	-	"Total_Liabilities_Negative"
4	-	-	<=0	-	-	-	-	"Total_Assets_Negative"
5	-	-	-	<0	-	-	-	"Fixed Assets_Negative"
6	-	-	-	-	<0	-	-	"Current Assets_Negative"
7	-	-	-	-	-	<0	-	"Non-current liabilities_Negative"
8	-	-	-	-	-	-	<0	"Current liabilities_Negative"
+	-	-	-	-	-	-	-	

Results Sample



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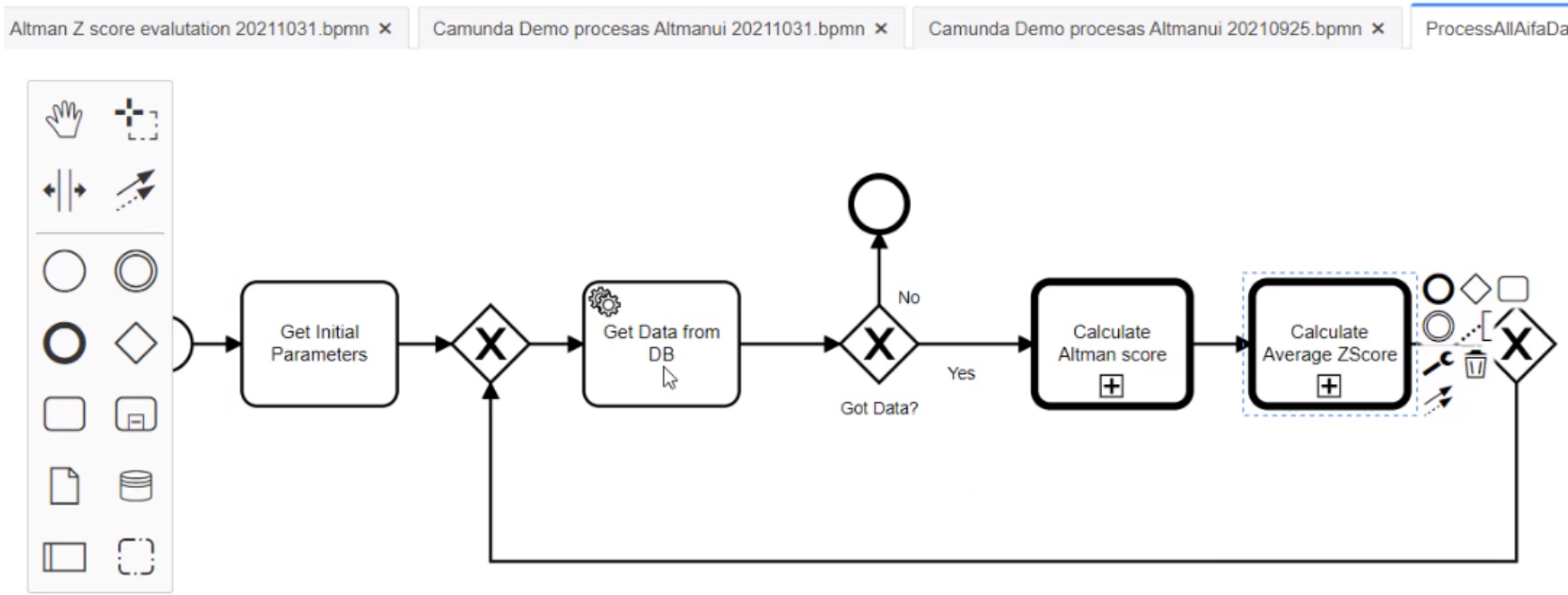
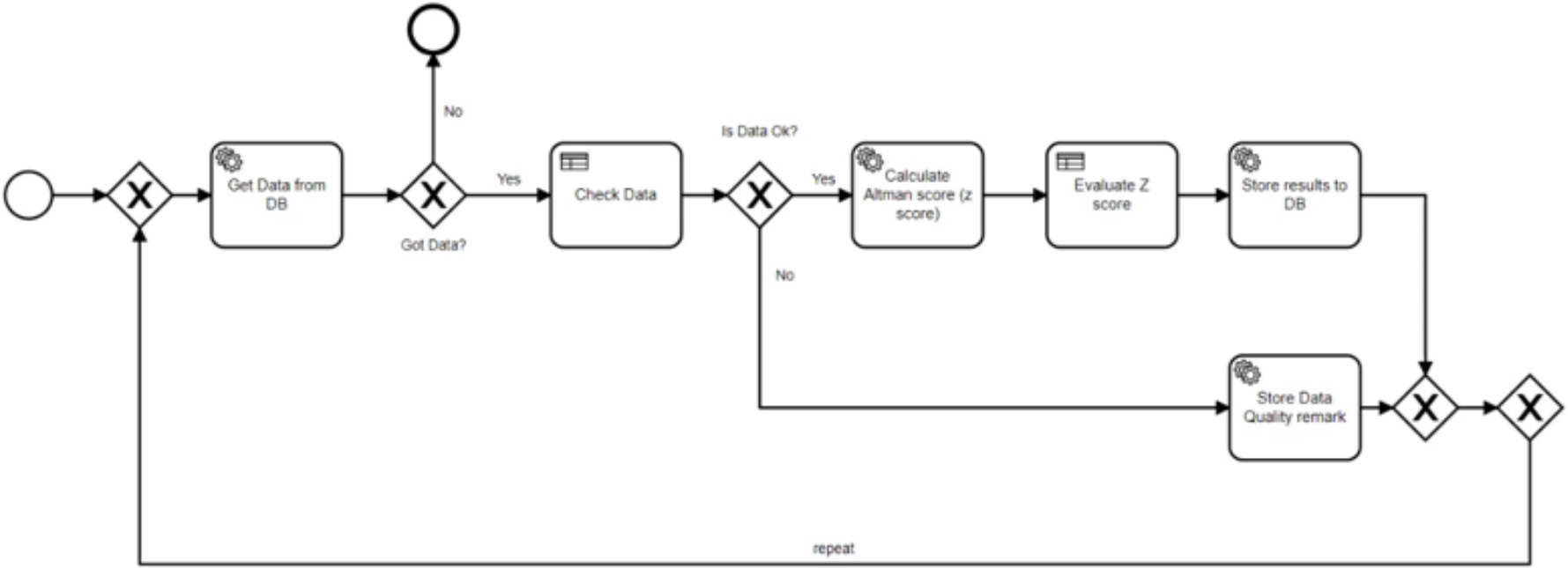
Demonstration of Prototype

Altman ZScore Calculation Process



Altman ZScore Calculation Process



Check Data (Decission Table)

Edit DRD | Open Overview

KPI_Data_Validation | Hit Policy: First

	Total_Equity (double)	And Total_Liabilities (double)	And Total_Assets (double)	And Fixed Assets (double)	And Current Assets (double)	And Non-current liabil… (double)	And Current liabilities (double)	Then DataRemarks (string)
1	>0	>0	>0	>=0	>=0	>=0	>=0	"Good_Data"
2	<=0	-	-	-	-	-	-	"Total_Equity_Negative"
3	-	<=0	-	-	-	-	-	"Total_Liabilities_Negative"
4	-	-	<=0	-	-	-	-	"Total_Assets_Negative"
5	-	-	-	<0	-	-	-	"Fixed Assets_Negative"
6	-	-	-	-	<0	-	-	"Current Assets_Negative"
7	-	-	-	-	-	<0	-	"Non-current liabilities_Negative"
8	-	-	-	-	-	-	<0	"Current liabilities_Negative"
+	-	-	-	-	-	-	-	

Evaluate Z Score (Decission Table)

Edit DRD | Open Overview

KPI_Data_Validation | Hit Policy: First

	Total_Equity (double)	And Total_Liabilities (double)	And Total_Assets (double)	And Fixed Assets (double)	And Current Assets (double)	And Non-current liabil... (double)	And Current liabilities (double)	Then DataRemarks (string)
1	>0	>0	>0	>=0	>=0	>=0	>=0	"Good_Data"
2	<=0	-	-	-	-	-	-	"Total_Equity_Negative"
3	-	<=0	-	-	-	-	-	"Total_Liabilities_Negative"
4	-	-	<=0	-	-	-	-	"Total_Assets_Negative"
5	-	-	-	<0	-	-	-	"Fixed Assets_Negative"
6	-	-	-	-	<0	-	-	"Current Assets_Negative"
7	-	-	-	-	-	<0	-	"Non-current liabilities_Negative"
8	-	-	-	-	-	-	<0	"Current liabilities_Negative"
+	-	-	-	-	-	-	-	

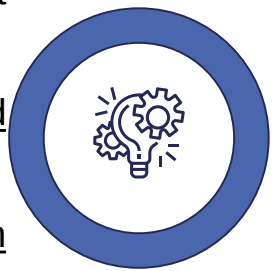
06
Conclusions

Conclusions

- Process mining aims to discover, monitor and improve real processes by extracting knowledge from event logs readily available in today's information systems
- Process mining gathers data from these event logs taken from a business's systems or a data warehouse
- The minimum data requirements needed to map a process are the activity name, a unique case ID, and a timestamp for each case
- The event log in this kind of PM project is some list of the meta-events indicating allowed transitions between financial transaction entities (journal types, document types, account names, etc.), i.e., this meta-event-log
- PM technology allows you to discover two types of visual models: dependency models (and statistical characteristics) of financial process entities and workflow models and its characteristics of financial process entities

Conclusions

- It is necessary to emphasize that the aim of PM project was to discover the pattern of the financial transaction (meta-model) based on the meta-event log comprising summarized expert knowledge
- The peculiarity of such a PM task is that the timestamp value in this summary event log line is symbolic, it does not indicate real time, it is conditional time, indicates only permitted logical sequence of financial transactions
- When discovering financial transaction meta-models (patterns), it became clear that standard PM tools provide redundant information
- From the obtained results, it can be seen that GL and Inventory Ledger are repeated several times in the Activity column, so the expert himself has to summarize
- Such a case shows the possible improvements of PM tools, applying the process pattern discovery based on the knowledge recorded in the meta-event-log
- The normative meta-model of financial transaction could be further used as a pattern in analyzing validity of financial data records, detecting anomalies in financial transactions



Kaunas Faculty

ktu kaunas university of technology 1922

Thank You!

Any questions?

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