Chapter

Business Process Linguistic Modeling: Theory and Practice Part II: BPLM Business Process Designer

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Abstract

The business activities provided within any firm or company should be checked and controlled continuously, while two principal approaches should be applied: (a) qualitative monitoring, (b) quantitative evaluations and getting to know the rules, which regulate structure and functionality of business processes (BPs) implemented and operated there plays a role of principle importance and they are derived based on actual BP models. Therefore we have designed a conceptual model of application denoted as BPLM Process Designer in form of expert system (ES) operating based on principles closely related to business process linguistic modeling approach, where linguistic sets and PBPL Equation play a role of principle importance. Our contribution contains such application description from qualitative, quantitative and design point of view. The ES qualitative description contains references to appropriate math relations and algorithms postulated within subsequent sections. Those sections are accompanied by the case study, which indicates how the math relations and algorithms might be applied within BPLM Process Designer functionality. However, those sections are accompanied by ES structure and functionality description as well, which represent the BPLM Process Designer mean or facility.

Keywords: business, process, linguistic, modeling, designer

1. Introduction

Nowadays, business competition causing companies to optimize existing business processes within the organization. Analysis the business process modeling is a tool to evaluate and make improvements over the business process (BP) there. Through the analysis of business they can decide which one is optimal or not optimal run and give attention to it. Business process modeling is that activity aimed at the representation of all or some elements in order to produce a cohesive model of the behavior required to deliver a service and/or product to a customer or another part of the organization [1]. There are some techniques to model the business process. In practice it is not easy to determine which techniques are suitable and easily understood by stakeholders. However, the similar situation might happen, when considering relations among business process analysts and the people who provide BP implementation and execution as well, while requires research on comparative of business process modeling techniques to overcome the above problems. This research is limited in four business process modeling techniques which often used the comparative analysis phase. Four business process modeling techniques are: (a) Data Flow Diagram (DFD), (b) Business Process Modeling Notation (BPMN), (c) Activity Diagram, or (d) Integration Definition for Function Modeling (IDEF0) and all the above-mentioned techniques together with ARIS methodology [2–4] create an integral part of so called BP modeling standardized approach. On the other hand there are a lot of BP modeling methods and techniques based on semantic and ontology approach or based on analysis of texts in natural language [5–7] (TNL texts), which describe the BP structure and functionality, while BP modeling based on semantic and ontology [5, 8–11] principles play a role of significant importance too. However, there is another one group of BP modeling approaches and methodologies, which are based on so called linguistic set [12, 13] and Principle Businesses Process Linguistic Modeling Equation (PBPL Equation) [14–16], which regulates relations among them. This approach is denoted as business process linguistic modeling (BPLM Modeling) covered by BPLM Process Modeling System, which consists of Business Process Strategy Creator [4, 17–20] and BPLM Designer, the design of its conceptual model seems to be the main goal of that contribution, while adequate BP model views should be respected, it means functional, process, information and knowledge-based support BP model view.

In order to achieve, the main goal four partial and subordinated aims should be postulated and fulfilled. The first partial aim is closely related to BPLM Process Designer qualitative proposal design (see also Section 4.1). The second partial aim is closely related to quantification of BPLM Designer structure and functionality, where adequate linguistic sets and PBPL Equation is applied (see also Section 4.2). The third partial aim is concerned with derivation of BP function (BPF) rules, which regulate the BP and BPF functionality (see also Section 4.3) and the fourth partial aim deals with BPLM Process Designer - implementation and operation (see also Section 4.5). However, an appropriate case study creates an integral part of that contribution, the aim of which is to show how the derived math relations and algorithms should be applied related to BPLM Process Designer functionality as well (see also Section 4.4).

2. State of the art

2.1 Business process modeling -standardized, semantic and ontology approach

2.1.1 Standardized approach

At present, business process management becomes a matter of principal importance all over the world and the development trends indicate leaving for the isolated business process (BP) e. g. sales or purchase and investigation of business process complexity is considered to be more and more important. After WW2, the systems related to managerial quality have been aimed to features of articles in most cases. A need to stabilize a quality of products has flown into management of those business processes, which were closely related to production of products. At present, the firms or companies investigate not only internal processes; however they pay an appropriate attention to external business processes as well [21], while an understanding of BP structure and functionality incl. Creating of appropriate models (modeling) creates an integral part of business process management too. When looking at business process modeling (BPM) modern history, the first steps in these branches are closely related to ARIS methodology created by prof. Scheer [2, 4] who developed an adequate application for those purposes denoted as ARIS System, while that methodology seems to be a standard utilized round the world and this modeling approach is denoted as standardized BP modeling approach [3, 22]. This approach has been applied in seventies of twentieth century, while it was based on the principle that a quality of products is determined by quality of production business process and their check and control and management is considered to be a matter of principal importance. However, there are other approaches based on symbolic, semantic and linguistic methodologies [12] where a text in natural language (English, Slovak, Czech, etc.) – TNL Text, together with methodologies based on BP ontologies play a role of principle importance as well and create basis for establishment of so called BP modeling symbolic, semantic and ontology approach, are very briefly discussed within Section 2.1.2.

2.1.2 Business process models based on symbolic, semantic and ontology approach

In current business process models, the functional perspective (also can be referred to in the literature as business capability, functionality or business function) for each process activity is limited to its label [23, 24], while an appropriate symbol, which creates basis for business process modeling. On the other hand a single label is not enough to describe properly the capability of a particular process element (i.e. activity, fragment or entire process). Using labels only prevents stakeholders from easily and quickly understanding business processes or identifying the differences and commonalities between them in terms of business properties [23–26]. When required, stakeholders need to read the business process documentation in order to find out what a process element does, expressed in terms of business properties. All the above-mentioned create basis for business process modeling symbolic approach. However, in the literature, several languages for BP have been proposed. Such languages can be sketchily gathered in three large groups (a) Descriptive languages, (b) Procedural languages and (c) ontology-based process languages, such as those declared in [6, 7, 24, 26]. This group of languages have a wider scope, aiming at modeling semantically rich processes in an ontological context, and have been conceived not directly connected to the business world [27, 28].

2.2 Business process modeling -linguistic approach: theory

In general, the linguistic modeling approach described and discussed in that contribution is based on the business process, the qualitative and quantitative aspects might be described via standardized TNL text logical sentences, a content of which is quantified via specialized types of sets denoted as linguistic sets, and relations among them are being quantified via PBPL Equation, and any BP to be modeled is represented via specialized linguistic sets closely related to its external and internal metrics [29]. On the other hand, the fact that the modeled BP horizontal structure is created by business process functions, which the BP to be modeled consists of plays a role of principle importance and might be quantified by one linguistic set, which contains three subordinated ones: (a) transformation rules, transformation functions and (c) BPF external and internal metrics. An establishment of transformation rules and transformation functions together with relations among BPF internal and external metrics and BPF transformation functions is discussed within Section 4. However, that section deals with that application implementation and operation as well, while that application is an expert system, where the knowledge stored in an appropriate knowledge base are represented with the use of reference databases (RDBs) and sematic networks (SNWs). This approach is denoted as BP modeling linguistic approach (BPLM Approach) and will be discussed within further sections of that contribution [15].

2.3 Business process modeling -linguistic approach—application programs

Business Process Management (BPM) has been receiving increasing attention in recent years. Many organizations have been adapting their business to a process-centered view since they started noticing its potential to reduce costs, improve productivity and achieve higher levels of quality. However, implementing BPM in organizations requires time, making the automation of process identification and discovery highly desirable. To achieve this expectation, the application of Natural Language Processing (NLP) techniques and tools has emerged to generate process models from unstructured text. However, no BPLM functional application programs were found, which would be similar to system ARIS or Bizagi application programs and which could be tested for practical purposes.

There are techniques applied to the BPM life-cycle phases of process identification, process discovery and process analysis as well as tools to support process discovery. The results of the present study may be valuable to support research in extraction of business process models from natural language text [6, 7, 24, 25, 30].

3. Research methods

In order to achieve, the main goal four partial and subordinated aims a set of adequate research methods should be postulated and applied:

- Business process linguistic modeling (BPLM) approach, where linguistic set seem to be elements of principle importance and the PBPL Equation as well.
- With respect to pre-defined partial aims, functional, process, information and knowledge based support views should be postulated and quantified via linguistic sets and PBPL Equation
- As a result of that, the BPF main linguistic set together with transformation rules and transformation functions should be defined as well as subsets related to internal BPF metrics.
- A set of reference databases (RDBs) and SNWs should be designed in order be possible to generate valid rules, which regulate BP and BPF structure and functionality
- An appropriate expert system - ES (knowledge base and inference engine) should be designed, where the above-mentioned rules could be stored and accessible to authorized users via inference engine components, while the ES should be implemented with the use of Ontotext components.

4. Results and discussion

4.1 BPLM process designer – structure and functionality BPLM process designer – structure and functionality – qualitative view

4.1.1 General overview

A real business is getting started, after an appropriate business strategy creation and implementation. However, any business might be running properly and efficiently without running adequate business process (BP) as well, while their structure and functionality plays a role of principle importance. The BP structure represents BP static aspects, however the BP functionality is closely related to BP dynamics and performance, the result of which are being compared with KPI indicators established within evaluation of the or company business strategy. As a result of that, we have to know the BP structure and functionality, where business process modeling and BP modeling tools seem to be very significant important matter. However, there exist many different approaches BP modeling, incl./ methods and techniques as well, while the ARIS methodology designed by prof. Scheer [2, 4] seems to be the standard applied round the globe. On the other hand, many other approaches and methodologies related o business process modeling exist, while one of the is denoted as business process linguistic modeling (BPLM) based on existence of so called linguistic sets, which create basis for BP static aspects quantifying, while they create basis of Principle Businesses Process Linguistic Modeling Equation (PBPL Equation), which enables quantifying BP functionality aspects. We shall discuss those principles within, next subsections.

4.1.2 Business process model views

However, the ARIS methodology creates basis for BPLM approach as well, while there are defined BP model four views: (a) functional view, (b) process view, (c) data view and (d) organizational view as well, we shall apply and modify them as follows: (a) functional view, (b) process view, (c) information support view, (d) knowledge-based view and (e) organization support view and all those views will be respected, when creating the BPLM Designer, which creates an integral part of the entire business process linguistic modeling system (BLM System). On one hand, the BPLM Designer seems to a subsystem closely related to the BPLM System, while it consist of the following components: (a) BPLM Process Analysis and Design, (b) BPLM Process simulation and (c) BPLM Optimization component, while the BP Architecture model seems to be the main result of BPLM Designer functionality.

4.1.3 Business process model functional view

Business process model functional view represents a functionality of core, main, subordinated, and elementary business processes implemented and operated within actual firm or company and indicates appropriate relations among them, however that view does not indicate any BP outposts and BP inputs. The adequate BPs are being quantified via appropriate linguistic sets and relations among the is quantified via PBPL Equation with respect o Consideration no 1 (see also Section 4.2.1).

4.1.4 Business process model process view

The ARIS methodology describes the BP model process view as a sequence of business process functions (BPFs), which the actual business process consists of and does not consider about BPF structure and functionality. In general, any BPF provides conversion (transformation) of BP inputs to BP pre-defined outputs and consist of: (a) transformation rules, (b) transformation tools and BP internal metrics items, while the BP internal metrics items and values are closely related to BP transformation tools as well and they are quantified via appropriate linguistic subsets, which create an integral part of the actual BPF linguistic set {[BPF (i, j)]}, while formula (1) might be postulated.

$$\{[\text{BPF }(i,j)]\} = \{[\text{BPF\_TR }(i,j1)], [\text{BPF\_TT }(i,j2)], [\text{BPF\_IM }(i,j3)]\} \tag{1}$$

where

i = 1, 2 ... n is the index which indicates the BP, which an appropriate BPF is beingassigned to.

[BPF_TR (i, j1)] - Transformation rule linguistic set – the set elements represent math rules and algorithms, which regulate the BPF transformation process

[BPF_TT (i, j2)] - Transformation tool linguistic set – the set elements represent closely related to human resources HRs, production technological device resources PDEV and production technological tool resources PTOOL, while formula (2) might be postulated

$$[\text{BPF\_TT }(i,j2)] = [(\text{HRs }(i,j21), \text{PDEV }(i,j22), (\text{PTOOL }(i,j23)) \tag{2}$$

where

(HRs (i, j22), – the linguistic set, which contains data closely related to human resources, which participate at transformation operations within actual BPFfunctionality.

(PDEV (i, j21), – the linguistic set, which contains data closely related to production technological device resources, which participate at transformation operations within actual BPF functionality.

(PTOOL (i, j21), – the linguistic set, which contains data closely related to production technological tool resources, which participate at transformation operations within actual BPF functionality.

[BPF_IM (i, j3)]} - BP internal metrics linguistic set, the content of which represent subsets, which contain data closely related to operational and technical parameters of to production technological device resources and theoretical knowledge and practical skills of human resources

However, any BP is represented by external metrics items, which are closely related to actual BP inputs and outputs as well. The actual linguistic sets and algorithms concerned with relations among them are described in Section 4.2.2 via Consideration no. 2.

4.1.5 Business process model information support view

In general, no business process proper and efficient functionality is possible without appropriate information support. At that level, the information support deals with reference database (RDBs) functionality and corresponds with their conceptual, logical and physical model. All linguistic seta related to BPF structure and functionality are stored in those RDBs and are closely related to BPF knowledge based support, while they contain pointers to appropriate semantic networks (SNWs), which create basis of BP knowledge-based support. However, they contain pointers to external data or information support resources (SAP components especially).

The actual linguistic sets and algorithms concerned with relations among them are described in Section 4.2.3 via Consideration no. 3.

4.1.6 Business process model knowledge-based support view

In a previous section, we have postulated that no business process proper and efficient functionality is possible without appropriate information support. However, the same is concerned with the BP knowledge-based support. The BP knowledge-based support provides interconnection between the BP process and information support view at two levels: (a) internal level and (b) external level. On one hand, the internal level is closely related to BPF transformation rules and transformation tools, while the BPF rules regulate the BP tools and the semantic networks are interconnected to RDBs within knowledge representation process. On the other hand, the external level is related to external data sources and transformation of selected from them in order to be possible a generation of new knowledge based on existing one and the above-mentioned data selected and transferred from external data resources. However, at that level adequate linguistic sets and relation among them play a role of principle importance as well, while they are described within Section 4.2.4 and Consideration no. 4 too.

4.2 BPLM process designer – structure and functionality BPLM process designer – structure and functionality – quantitative view

4.2.1 BP functional view consideration no. 1

The functional view deals with the BP vertical structure, which is created by core business processes (CBP), main business processes (MBP), subordinated business processes (SBP) and elementary business processes[1] (EBP).

The view on a process as a structured chain of activities has a direct coupling to coordination as defined by Malone & Crowston. Coordination is simply the management of the dependencies between these activities. This implies that coordination is an activity in itself carried out by some actors. The work object of the coordination activity is coordination manifested as various tangible and intangible elements in the organization.

Now, we shall try quantifying those aspects with the use of PBPL Equation [25, 26].

BP Model Functional view quantification with the use of PBPL Equation.

Let us consider a core business process CBP (0, I) Utility Glass Production represented by the {CBP (I, j)} linguistic set being decomposed into CBP (0, 1) Utility Glass Production Preparation denoted as CBP (i’, j’) represented by {CBP (i’, j’)} linguistic set i’ = 1… … n’ j = 1… ..$m_{1'}$ and CBP (i”, j”) i’ = 1… .n”, j = 1… .$m_{1''}$ Utility Glass Production Management represented by {CBP (i”, j”)} linguistic set, while the {CBP (i’, j’)} and {CBP (i”, j”)} are considered to be the linguistic subsets relating to the {CBP (I, j)}, while formula (3) might be postulated.

$$\{CBP\ (I, j)\} = \{[CBP\ (i', j')\}], [CBP\ (i'', j'')]\} \tag{3}$$

However, the CBP (0, I) business process is represented by its own internal and external metrics as well, while formulas (4) and (5) might be postulated.

$$\{CBP\ (I, j)\} \equiv \{CBP_m\ (I, j)\} \tag{4}$$

$$\{CBP_m\ (I, j)\} = \{[CBP_{mint}\ (I, j)], [CBP_{miext}(I, j)]\} \tag{5}$$

Where index i’ represents a hierarchic level of BP to be investigated and j’ index represents a number subordinated processes relating to the BP investigated.

Now, we shall try to investigate how the superior core business process together with its internal and external metrics should be decomposed related to lower levels of management. With respect to this issue, we shall postulate two important questions.

[1] The BP, which cannot be decomposed in other subordinated one or its further decomposition is meaningless from practical point of view is denoted as the elementary process.

(A) How the superior business process C (0, I) represented by {[CB (I, j)]} linguistic set should be decomposed to subordinated core business processes related to lower management levels, it means from strategic to tactic and operational management level and how the superior core business functional model should be created.

At first, we shall try to find an answer related to (A) question. In order to achieve that, we have to define the superior core business process in form of adequate linguistic set {CBP (I, j)} and to assign to that set an appropriate linguistic set $\{b_{0I}\}$ = $\{[b_{0hl}], [b_{nbp}],[b_{inm}])$, denoted as BP Functional View Control Linguistic Set (BP-FWC Linguistic Set), while.

$[b_{0hl}]$ – is a linguistic subset element, which indicates a hierarchic level of BP to be decomposed.

$[b_{nbp}]$ – is a linguistic subset element which indicates a number of business process stored at subordinated level

$[b_{inm}]$ – is a linguistic subset element which indicates a serial number of that BP at appropriate hierarchic level, which should be decomposed.

Example:

Let us consider a core business process stored at hierarchic level one $[b_{nbp}] = 1$, while a serial number of that BP within appropriate hierarchic level is =1 $[b_{inm}] = 1$ and that BP should be decomposed in 3 subordinated business processes $[b_{nbp}] = 3$. For that case, linguistic set {b0I} elements are represented by formula (6).

$$\{b_{0I}\} = \{b_{0I}\} = \{[b_{0hl}], [b_{nbp}], [b_{inm}]\} = \{b_{0I}\} = \{[1], [3], [1]) \tag{6}$$

Now, let us consider the superior core CBP (I, j) business process represented by {CBP (I, j) linguistic set, which should be decomposed in two subordinated core processes[2], which operate at strategic management level, while the $\{b_{0I}\}$ linguistic set[3] elements are postulated via formula (7).

$$\{b_{0I}\} = \{b_{0I}\} = \{[b_{0hl}], [b_{nbp}], [b_{inm}]\} = \{b_{0I}\} = \{[1], [2], [1]) \tag{7}$$

and the $\{b_{0I}\}$ set elements create basis for {[Petx (I, j)]} linguistic set, while formulas (8) and (9) might be postulated.

$$\{[\text{Petx } (I, j)]\} = \{b_{0I}\} \tag{8}$$

$$\{[\text{Petx } (I, j)]\} = \{[b_{0hl}], [b_{nbp}], [b_{inm}]\} \tag{9}$$

When applying the PBPL Equation formula (10) might be postulated.

$$\begin{aligned} &\{[\text{Petx } (I, j)]\} \otimes \{[\text{Pe } (I, j) \\ &= \{[b_{0hl}], [b_{nbp}], [b_{inm}]\} \otimes \{\text{CBP } (I, j) \\ &= \{[\text{CBP } (1, i_1, j_1)], [1]\} \otimes \{[\text{CBP } (1, i_2, j_2)], [2]\} \end{aligned} \tag{10}$$

This equation corresponds to the first hierarchic level shown in **Figure 1**.

Subsequently, we shall try to decompose the subordinated BP represented by $\{[\text{CBP } (1, i_1, j_1)]\}$ into hierarchic level 2, where three subordinated BP should be stored and a number of the BP to be decomposed is 1. The $\{b_{0I}\} = \{b_{0I}\}$ = $\{[b_{0hl}],$ $[b_{nbp}],[b_{inm}]\}$linguistic set content might be postulated as follows:

$$\{b_{0I}\} = \{b_{0I}\}_= \{[b_{0hl}], [b_{nbp}], [b_{inm}]\} = \{b_{0I}\} = \{[2], [3], [1]\} \tag{11}$$

[2] The terms business process and process are considered to be equivalent from semantic point of view.

[3] The terms linguistic set and set are considered to be equivalent from semantic point of view.

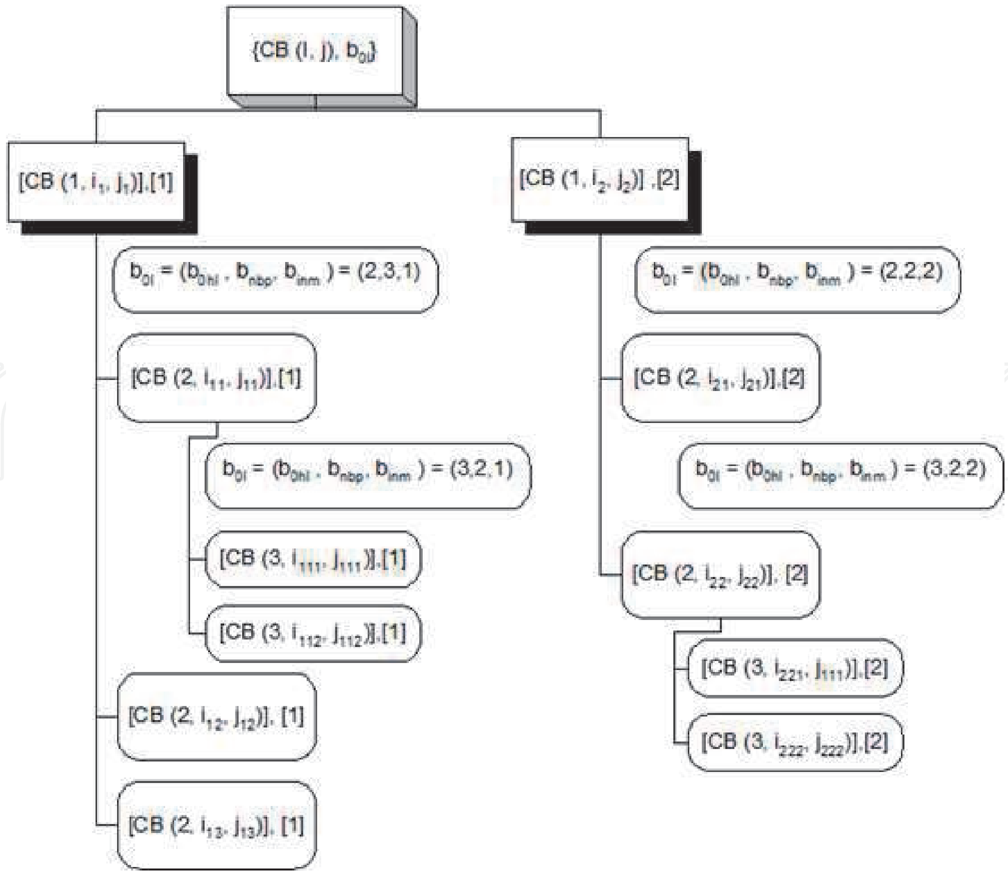

Figure 1.
An example of BP functional model source: The authors.

When applying PBPL Equation, the following result might be generated.

$$\begin{aligned}&\{[2],[3],[1]\}\otimes\{[\text{CB}\ (1,i_1,j_1)],[1\}]\\&=\{[\text{CB}\ (2,i_1,j_1)],[1]\}\otimes\{[\text{CB}\ (2,i_2,j_2)],[2\}]\}\otimes\{[\text{CB}\ (2,i_3,j_3)],[3\}]\}\end{aligned}\tag{12}$$

Finally, let us consider the business process no.1 located at hierarchic level 2, which should be decomposed into two subordinated business processes located at hierarchic level 3, while two subordinated processes should be stored at that level and the $\{b_{0I}\}$ linguistic set elements are postulated with respect two formula (13).

$$\{b_{0I}\}=\{b_{0I}\}_{=}\{[b_{0hl]},[b_{nbp}],[b_{inm}]\}=\{b_{0I}\}=\{[3],[2],[1]\}\tag{13}$$

When applying PBPL Equation, the following result might be generated $\{[3],[2],[1]\} \otimes \{[\text{CB}\ (2, i_2, j_2)],[2\}]\} = \{[\text{CB}\ (3, i_2, j_2)],[1\}]\} \otimes \{[\text{CB}\ (3, i_2, j_2)],[2\}]\}$ see also **Figure 1.**

The above-mentioned formulas and relations create basis for BP functional view without BP internal and external metrics linguistic sets.

4.2.2 Process view consideration no. 2

BP Model Process view quantification with the use of PBPL Equation.

However, the BPLM Process View deals with BP horizontal structure as well, an appropriate BP to be investigated and modeled, is selected from set of BP with adequate vertical structure (functional view) and the BP internal and external metrics plays a role of principle importance. Furthermore, a significant role plays BP Input Metrics, which creates an integral part of BP External Metrics {BPEXM (i, j4)} as well (see also formula (14). On the other hand, the BP internal metrics

{BPINM (i, j4)} (see also formula (15) is created by those linguistic sets, which make basis for BP Function (BPF) definition.

$$
\begin{aligned}
?F\ (i, j2)\ (j2 = 1 \ldots .m2) &= \ > [F\ (i, j2)]?[Petxj2\ (i, j1,)]?\{[Petx\ (i, j1,)]\} \\
&= \ > [Petxj2\ (i, j1,)]?[F\ (i, j2)] \\
&= [Res1j2\ (i, j3,)]?\{[Res1\ (i, j3,)]\}
\end{aligned} \tag{14}
$$

$$
\begin{aligned}
?Pe\ (i, j2)\ (j2 = 1 \ldots .m2) &== \ > \{Pe\ (i, j2)\}?\{[Petx\ (i, j1,)]\}\&\{[Res1\ (i, j3,)]\} \\
&= \ > \{[Petx\ (i, j1,)]\}\&\{[Res1\ (i, j3,)]\}?\{BPEXM\ (i, j4)\} \\
&\&\{Pe\ (i, j2)\}?\{BPINM\ (i, j5)\}
\end{aligned} \tag{15}
$$

4.2.3 BPM information support view

In general, a proper and an efficient functionality of any business process depends on an adequate information support, however the question is: What the term BP information support related to BP functionality does mean? In general, any BP functionality and performance are closely related to BP external and internal metrics. However, the problems of BP external and internal metrics theory are discussed within Section 2 as well, while at that place we shall discuss aspects closely related to so called two stage BP external and internal metrics (see also **Figure 2**). What the term two stage BP external and internal metrics does mean?

In general, the implemented and operated BP is running and generates pre-defined output products (articles) – denoted as the primary products based on appropriated adequate material, information and financial inputs. On the other hand, the investigated BP operates with a set of input and output information generated based on detailed data, e.g. number of good articles $n_{Artgood}$ – a quality of which corresponds to pre-defined requirements, number of repaired articles n_{Artrep} - number of produced articles their quality does not correspond to pre-defined requirements and should be repaired, and number of waste articles $n_{Artwaste}$ - number of produced articles their quality does not correspond to pre-defined requirements – cannot be repaired and should be considered to be a waste. They are considered to be detailed data and have no level of aggregation. The same is concerned with other data closely related to BP external or internal metrics and they are being measured at

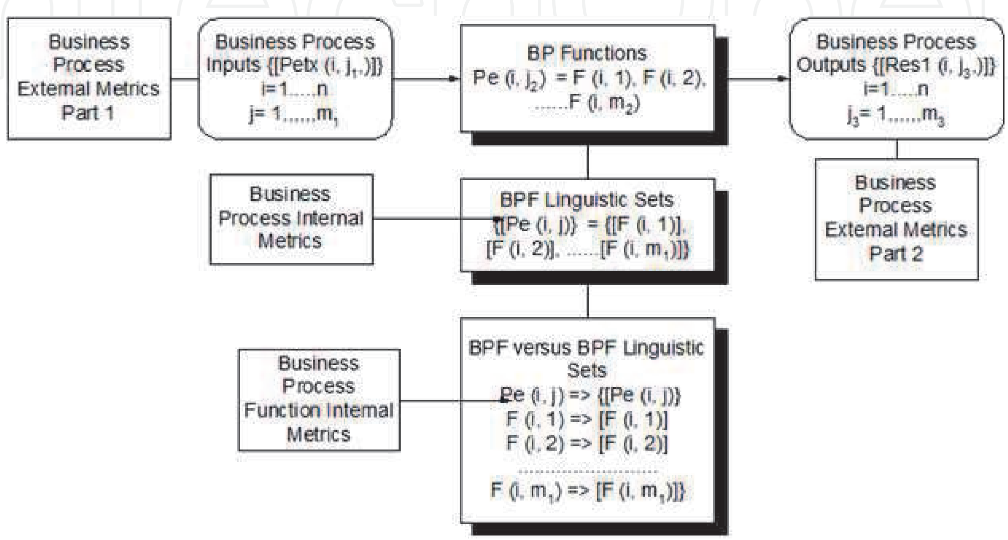

Figure 2.
Business process horizontal structure source: The authors.

pre-defined time points, it means they are time dependent and are called BP external and internal metrics primary data generated at the first stage.

However, that data are undertaken to an appropriate statistic evaluation and analysis as well, while adequate statistic values are being calculated (average and extend of variation) and a predefined time interval should be respected, when calculating those values. Those values are of an aggregated nature and are called BP external and internal metrics secondary data. In the next sections, we shall discuss about that data quantification.

Consideration no. 3a.

BP external metrics primary data – quantification via linguistic sets.

Let us consider the business process, which is of a technological nature[4] and operates with selected material inputs[5] represented by linguistic set {[Petx (i, j)]}, while that set consists of subsets[6] [Petx (i, 1)], [Petx (i, 2)] … … [Petx (i, m_1)], which represent one part of BP external metrics.

Where

i. is index closely related to BP serial number with set of processes

j_1- is index, which represents number subsets, the linguistic set {[Petx (i, j_1)]} consists of

However, that BP external metric is represented by adequate outputs as well, while they are quantified via {[Res1 (i, j_3,)]} linguistic set, which contains values concerned with $\mathbf{n}_{\mathbf{Artgood}}$, $\mathbf{n}_{\mathbf{Artrep}}$, and $\mathbf{n}_{\mathbf{Artwaste}}$ items.

With respect to the above-mentioned issues, the PBPL Equation actual version might be postulated.

$$\{[\mathrm{Petx}\ (\mathrm{i},\mathrm{j})]\} \otimes \{[\mathrm{Pe}\ (\mathrm{i},\mathrm{j}_2,)]\} = \{[\mathrm{Res1}\ (\mathrm{i},\mathrm{j}_3,)]\} \tag{16}$$

A fictive data, which create conted of {[Petx (i, j)]} and {[Res1 (i, j_3,)]} will be discussed within Case study section.

Now, let us have a look at {[Pe (i, j_2,)]} linguistic set, which represents the business process Pe, while that process provides transfer of material input represented by {[Petx (i, j)]} linguistic set into final products (glass articles) represented by {[Res1 (i, j_3,)]} linguistic set.

However, the {[Pe (i, j_2,)]} linguistic set contains subsets, which quantify BPFs, the BP quantified via {[Pe (i, j_2,)]} linguistic set consist of. When selecting one BPF, we can assign to it the linguistic set {[BPF (i, jf)]}, which consists of three subsets, while formula (17) might be postulated.

$$\{[\mathrm{BPF}\ (\mathrm{i},\mathrm{jf})]\} = \{[\mathrm{BPF\_TR}\ (\mathrm{i},\mathrm{jf}_1)], [\mathrm{BPF\_TT}\ (\mathrm{i},\mathrm{jf}_2)], [\mathrm{BPF\_TM}\ (\mathrm{i},\mathrm{jf}_3)]\} \tag{17}$$

Where

the subset = [BPF_TR (i, jf_1)] = {[BPF_TR (i, j_1)]} and the content might be quantified via formula (16).

the subset = [BPF_TT (i, jf_1)] = {[BPF_TT1 (i, j_1)]} and the content might be quantified via formula (19)

the subset = [BPF_TM (i, jf_1)] = {[BPFEM (i, j_1)], [BPFIM(i, j_2)]} and the content might be quantified via formulas (14) and (15).

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[4] Glass Article Primary Production- GAPP

[5] Glass Melt - GM

[6] The terms linguistic set and set are considered to be the same from semantic point of view

$$\{[\mathrm{Pe}\ (\mathrm{i}, \mathrm{j}_2,)]\}' = \Pi\ \{[\mathrm{BPF}\ (\mathrm{i}, \mathrm{j}_f)]\} \tag{18}$$

i = 1,2 … .n

j_f = 1, 2 … .m1 - number of BPFs, the Pe business process, consists of.

Finally, we shall specify the {[Res1 (i, j_3)]}, the content of which is closely related to number of good articles $\mathbf{n}_{\mathbf{Artgood}}$, number of repaired articles $\mathbf{n}_{\mathbf{Artrep}}$, and number of waste articles $\mathbf{n}_{\mathbf{Artwaste}}$, while formulas (25) and (26) and (28) and (29) might be postulated.

$$\{[\mathrm{Res1}(\mathrm{i}, \mathrm{j}_3)]\} = \{[\mathrm{Pop}(\mathrm{i}, \mathrm{j}_3)], [\mathrm{Article\_good}], [\mathrm{Article\_repair}], [\mathrm{Article\_waste}]\} \tag{19}$$

$$\mathbf{n}_{\mathbf{Artgood}} \in [\mathrm{Article\_good}], \tag{20}$$

$$\mathbf{n}_{\mathbf{Artrep}} \in [\mathrm{Article\_repair}], \tag{21}$$

$$\mathbf{n}_{\mathbf{Artwaste},} \in [\mathrm{Article\_waste}]\} \tag{22}$$

[Pop (i, j_3)] subset contains elements closely related to article type, article class, article name, article, measure unit.

When applying the PBPL Equation in a basic form (see also formula (16), formula (23) might be postulated

$$\{[\mathrm{Petx}\ (\mathrm{i}, 1)], [\mathrm{Petx}\ (\mathrm{i}, 2)] \dots \dots [\mathrm{Petx}\ (\mathrm{i}, \mathrm{m}_1)]\} \otimes \Pi\ \{[\mathrm{BPF}\ (\mathrm{i}, \mathrm{j}_f)]\} = \mathrm{i} = 1, 2 \dots .\mathrm{n}; \mathrm{j}_f = 1, 2 \dots .\mathrm{m1} - = \{[\mathrm{Pop}\ (\mathrm{i}, \mathrm{j}_3)], [\mathrm{Article\_good}], [\mathrm{Article\_repair}], [\mathrm{Article\_waste}]\} \tag{23}$$

It should be noted that those linguistic set content is time depended and formula (24) might be postulated.

$$\begin{aligned}\{[\mathrm{Petx}\ (\mathrm{i}, 1, \mathrm{t})], [\mathrm{Petx}\ (\mathrm{i}, 2, \mathrm{t})] \dots \dots [\mathrm{Petx}\ (\mathrm{i}, \mathrm{m}_1, \mathrm{t})]\} \otimes \Pi\ \{[\mathrm{BPF}\ (\mathrm{i}, \mathrm{j}_{f,}\ \mathrm{t}]\} = \\ \mathrm{i} = 1, 2 \dots .\mathrm{n}; \\ \mathrm{j}_f = 1, 2 \dots .\mathrm{m1} - \\ = \{[\mathrm{Pop}\ (\mathrm{i}, \mathrm{j}_3)], [\mathrm{Article\_good}\ (\mathrm{t})], [\mathrm{Article\_repair}\ (\mathrm{t})], [\mathrm{Article\_waste}\ (\mathrm{t})]\}\end{aligned} \tag{24}$$

Formula (24) quantifies relation among BP input and output parameters and the actual content of the above-mentioned linguistic set will be discussed within Case study section.

4.2.4 BPM knowledge support view consideration no. 4

The knowledge related to BPM knowledge support view are derived based on appropriate item statistic values mentioned within previous section.

Let us consider the {[Petx (i, j)]}, which contains subsets [Petx (i, 1)], [Petx (i, 2)] … … [Petx (i, m_1)], while any of those subsets contains time depended items and values concerned to actual material input.

$$\begin{aligned}[\mathrm{Petx}\ (\mathrm{i}, 1\mathrm{a})], = [(\mathrm{mat}\ (1)11\ (\mathrm{t}((\mathrm{k})), \mathrm{mat}\ (1)12\ (\mathrm{t}\ (\mathrm{k}))), (\mathrm{mat}(1)\ 21(\mathrm{t}\ (\mathrm{k})), \\ \mathrm{mat}\ (1)\ 22(\mathrm{t}) \dots .\ \ \mathrm{mat}(1)\ (\mathrm{m11}\ (\mathrm{t}(\mathrm{k})), \mathrm{mat}(1)\ (\mathrm{k})\ (\mathrm{m12})]\end{aligned} \tag{25}$$

$$\begin{aligned}[\mathrm{Petx}\ (\mathrm{i}, 2\mathrm{a})], = [(\mathrm{mat}\ (2)11\ (\mathrm{t}(\mathrm{k})), \mathrm{mat}\ (2)12\ (\mathrm{t}(\mathrm{k})), (\mathrm{mat}(2)\ 21(\mathrm{t}(\mathrm{k})), \\ \mathrm{mat}\ (2)\ 22(\mathrm{t}) \dots .\mathrm{mat}(2)\ (\mathrm{m11}\ (\mathrm{t}(\mathrm{k})), \mathrm{mat}(2)\ (\mathrm{m12})]\end{aligned} \tag{26}$$

$$[\text{Petx (i, m2a)}], = [(\text{mat (m2)11 (t (k)), mat (m2)12 (t(k))), (mat(m2) 21(t), mat (m2) 22(t(k)) ... .mat(m2) (m11 (t(k)), matm2) (m12)}] \tag{27}$$

Now, let us select [Petx (i, 1)] and undertake its content to statistic evaluation[7], while formula (28) and (29) might be postulated[8]

$$[\text{Petx (i, 1b)}] = [(\text{mat (1)11 (mat (1)12Avg, (mat (1)12MMin, (mat(1)12MMax), (mat (1)12Vrp}] \tag{28}$$

$$[\text{Petx (i, 1ab)}] = [\text{Petx (i, 1a)}], [\text{Petx (i, 1b)}] \tag{29}$$

where

m2a – index, which indicates a serial number of input record within Petx linguistic set.

m12 – index, which indicates a serial number of item and value input record.

Formula (28) indicates statistic values of items assigned to selected input, while formula (29) indicates an extension of [Petx (i, 1a)] linguistic set.

Now let us consider the {[Res1 (i, j_3)]} and let us suppose that the $\mathbf{n}_{\mathbf{Artgood}}$, $\mathbf{n}_{\mathbf{Artrep}}$ $\mathbf{n}_{\mathbf{Artwaste}}$ are time dependent, while formulas (30), (31), and (32) might be postulated.

$$\mathbf{n}_{\mathbf{Artgood}} = \mathbf{n}_{\mathbf{Artgood}}\ (t) \tag{30}$$

$$\mathbf{n}_{\mathbf{Artrep}} = \mathbf{n}_{\mathbf{Artrep}}\ (t) \tag{31}$$

$$\mathbf{n}_{\mathbf{Artwaste}} = \mathbf{n}_{\mathbf{Artwaste}}\ (t) \tag{32}$$

With respect to those issues, appropriate statistic values might be calculated.

$$[\text{Article\_goodst}] = \left[n_{\text{Artgoodawg}}, n_{\text{Artgoodmin}}, n_{\text{Artgoodmax}}, n_{\text{ArtgoodVrp}}\right] \tag{33}$$

$$[\text{Article\_repairst}] = \left[n_{\text{Artrep}} = \quad n_{\text{Artrepawg}}, n_{\text{Artrepmin}}, n_{\text{Artrepmax}}, n_{\text{ArtrepVrp}}\right] \tag{34}$$

$$[\text{Article\_wastest}] = \left[n_{\text{Artwasteawg}}, n_{\text{Artwastemin}}, n_{\text{Artwastemax}}, n_{\text{ArtwasteVrp}}\right] \tag{35}$$

Let us demonstrate previous relations at business process, which deals with forming of glass articles (Ga) from glass melt (Gm), which is represented by three variables: (a) glass melt temperature (Gmtep), glass melt viscosity (Gmvis), and glass melt quantity (Gmquant) and generated glass articles (Gas) represented by three items and values: (a) number of good Gas (n_{Artgood}), number of repaired Gas (n_{Artrep}) and number of waste Gas. The relations among statistic values of selected variables might be defined via: (a) partial rules (see also formulas (36), (37), and (38), (b) complex rule (see also formula (31) and (c) set of complex rules (see also formulas (40), (41), and (42). However, all the above-mentioned rules might be time dependent as well, while they might create pairs (time interval (T(int)), Y (int) and create linguistic subsets, which could quantify a development trend (see also formula (43)).

Partial rules

$$\{[\text{Gmtemp\_awg, GmVrp}]\} = \{\left[n_{\text{Artgoodawg}}, n_{\text{Artgoodmin}}, n_{\text{Artgoodmax}}, n_{\text{ArtgoodVrp}}\right], \tag{36}$$

[7] Statistic evaluation = determination of Avg, Min, Max and extent of variation

[8] Vrp – extend of variation

$$\left[n_{Artrepawg}, n_{Artrepmin}, n_{Artrepmax}, n_{ArtrepVrp}\right],$$
$$\left[n_{Artwasteawg}, n_{Artwastemin}, n_{Artwastemax}, n_{ArtwasteVrp}\ \right]\}$$

$$\{[\text{Gmtvis\_awg, GmVrp}]\} = \{\left[n_{Artgoodawg}, n_{Artgoodmin}, n_{Artgoodmax}, n_{ArtgoodVrp}\right], \tag{37}$$
$$\left[n_{Artrepawg}, n_{Artrepmin}, n_{Artrepmax}, n_{ArtrepVrp}\right],$$
$$\left[n_{Artwasteawg}, n_{Artwastemin}, n_{Artwastemax}, n_{ArtwasteVrp}\ \right]\}$$

$$\{[\text{Gmtquant\_awg, GmVrp}]\} = \{\left[n_{Artgoodawg}, n_{Artgoodmin}, n_{Artgoodmax}, n_{ArtgoodVrp}\right], \tag{38}$$
$$\left[n_{Artrep} = \ n_{Artrepawg}, n_{Artrepmin}, n_{Artrepmax}, n_{ArtrepVrp}\right],$$
$$\left[n_{Artwasteawg}, n_{Artwastemin}, n_{Artwastemax}, n_{ArtwasteVrp}\ \right]\}$$

Complex rule

$$\begin{aligned}&\{[\text{Gmtemp\_awg, GmVrp}], \{[\text{Gmtvis\_awg, GmVrp}], [\text{Gmtvis\_awg, GmVrp}]\}\\ &= \{\left[n_{Artgoodawg}, n_{Artgoodmin}, n_{Artgoodmax}, n_{ArtgoodVrp}\right],\\ &\left[n_{Artrepawg}, n_{Artrepmin}, n_{Artrepmax}, n_{ArtrepVrp}\right],\\ &\left[n_{Artwasteawg}, n_{Artwastemin}, n_{Artwastemax}, n_{ArtwasteVrp}\right]\}\end{aligned} \tag{39}$$

$$\begin{aligned}&Y(1) = \{[\text{Gmtemp\_awg }(1), \text{ GmVrp }(1)], \{[\text{Gmtvis\_awg}(1), \text{ GmVrp }(1)],\\ &[\text{Gmtvis\_awg }(1), \text{ GmVrp }]\} = \{[n_{Artgoodawg}(1), n_{Artgoodmin}, (1), n_{Artgoodmax}, (1),\\ &n_{ArtgoodVrp}(1),], [\ n_{Artrepawg}, (1), n_{Artrepmin}, n_{Artrepmax}, (1), n_{ArtrepVrp}(1),], [n_{Artwasteawg}(1), ,\\ &n_{Artwastemin}(1), n_{Artwastemax}(1), n_{ArtwasteVrp}(1)\ ]\}\end{aligned} \tag{40}$$

$$\begin{aligned}&Y(2) = \{[\text{Gmtemp\_awg }(2), \text{ GmVrp }(2)], \{[\text{Gmtvis\_awg}(2), \text{ GmVrp }(2)],\\ &[\text{Gmtvis\_aw }(2), \text{ GmVrp }]\} = \{[n_{Artgoodawg}(2), n_{Artgoodmin}, (2), n_{Artgoodmax}, (2),\\ &n_{ArtgoodVrp}(2),], [\ n_{Artrepawg}, (2), n_{Artrepmin}, n_{Artrepmax}, (2), n_{ArtrepVrp}(2),],[n_{Artwasteawg}\\ &(2), n_{Artwastemin}(2), n_{Artwastemax}(2), n_{ArtwasteVrp}(2)]\}\end{aligned} \tag{41}$$

$$\begin{aligned}&Y(m3) = \{[\text{Gmtemp\_awg }(m3), \text{ GmVrp }(m3)], \{[\text{Gmtvis\_awg}(m3), \text{ GmVrp }(m3)],\\ &[\text{Gmtvis\_awg }(m3), \text{ GmVrp }]\} = \{[n_{Artgoodawg}(m3), n_{Artgoodmin}, (m3), n_{Artgoodmax}, (m3),\\ &n_{ArtgoodVrp}(m3),], [\ n_{Artrepawg}, (m3), n_{Artrepmin}, n_{Artrepmax}, (m3), n_{ArtrepVrp}(m3),],\\ &\left[n_{Artwasteawg}(m3), n_{Artwastemin}(m3), n_{Artwastemax}(2), , n_{ArtwasteVrp}(m3)\ \right]\}\end{aligned} \tag{42}$$

$$\{[(\text{DevlTrend}]\} = \ [(T(1), Y\ (1)], [(T(2), Y\ (2)], \ldots ..[(T(m3), Y\ (m3)]\} \tag{43}$$

In general, the knowledge stored with ES knowledge base are represented by semantic networks (SNWs), while partial rules might be compared **with partial SNWs**, complex rules might be compared with **ordinary SNWs** and development trends (DevlTrend) might be compared with **superior SNWs**. This approach will be discussed within Case study in more details and applied when designing and implemented an appropriate knowledge-based or expert system as well.

4.3 Derivation of BPF functionality rules

4.3.1 General overview

In general, a horizontal structure of any business process (BP) is being created via appropriate set of business process functions (BPFs), while the BPF seems to be the principle component of any business process. On the other hand, any BPF might be quantified via multi-layer linguistic set, while at the first layer three significant linguistic subsets might be observed:

- {[BPF_TR (i, j1)]} – a content of which create rules, which regulate a progress related to transformation of BPF inputs into pre-defined outputs

- {[BPF_TT (i, j2)]} – a content of which create transformation functions, which provide transformation of BPF inputs into pre-defined outputs

- {[BPM (i, j3)]} – a content of which create subsets closely related to BPF6external and internal metrics, while BPF external metrics linguistic set and

- [BPFEM (i, j1)]} deals with BPF external metrics and consists of [BPINP (i, j11)] subset the content of which is created by elements closely related to BPF inputs and [[BPOUTP (i, j12), the content of which is created by elements closely related to BPF outputs (see also formula (14) and the {[BPFIM (i, j2)]} deals with BPF internal metrics with respect to formula (15)

However, both the above-mentioned linguistic sets are very closed to {[BPF_TT1 (i, j1)]} the content of which is created by elements closely related to transformation of BPF inputs to predefined BPF outputs as well.

4.3.2 BPF inputs versus BPF outputs

Let us consider the {[Petx (i, j1)]}, which contains a finite number of elements denoted as pt.(i, 1), pt.(i, 2), … pt.(i, m1), while each of them is created by the element average and element extend of variations value (see also formula (44).

pt.(i, j1), = ((pt(i, j1)avg., (pt(i, j1)vrp)

$$pt.(i, j2), = ((pt(i, j2)avg., (pt(i, j2)vrp) \quad (44)$$

pt.(i, jm1), = ((pt(i, jm1)avg., (pt(i, jm1)vrp)

4.4 Case study

Let us consider a statistic file represented by **Table 1** and set of statistic indicators represented by **Table 2**.

Now, let us create a ratio set {Rs} and reference table (**Table 3**), which deals with assignment of words to ratio value intervals (**Table 4**).

$$\begin{aligned} \{Rs\} &= \{^{125}\backslash_{1811,1,}\,^{5,1}\backslash_{4},\,^{10}\backslash_{52,2,}\,^{270}\backslash_{1081,1},\,^{60}\backslash_{49,9}\} \\ &= \{0, 069, 0, 784, 0, 191, 0, 249, 1202\} \end{aligned}$$

Date	Time	Glm_temp	Glm_vis	Glm_quant	Glar_ident	Glart_good	Glart_repair	Glart_waste
21.11.2020	6:00	1790	6,5	50,3	Vyr1	1000		30
21.11.2020	6:30	1760	6,1	51,3	Vyr1	900		20
21.11.2020	7:00	1780	5,8	50,6	Vyr1	1100		25
21.11.2020	7:30	1800	5,3	51,6	Vyr1	1050		35
21.11.2020	7:30	1820	4,8	49,6	Vyr1	1030		45
21.11.2020	8:00	1810	4,9	52,6	Vyr1	1040		40
21.11.2020	8:30	1815	4,8	51,6	Vyr1	1060		35
21.11.2020	9:00	1830	3,8	53,6	Vyr1	1055		48
21.11.2020	9:30	1835	3,5	54,6	Vyr1	1155		68
21.11.2020	10:00	1885	2,5	56,6	Vyr1	1165		78
21.11.2020	10:30	1865	5,4	57,6	Vyr1	1170		80
21.11.2020	11:00	1765	6,4	47,6	Vyr1	1150		75
21.11.2020	11:30	1795	6,1	48,6	Vyr1	1125		65
21.11.2020	12:00	1805	5,1	49,6	Vyr1	1135		55

Source: The Authors.

Table 1.
Glass article forming -statistic file.

Average	**1811,1**	**5,1**	**52,2**	**1081,1**	**49,9**
Minimum	1760	2,5	47,6	900	20
Maximum	1885	6,5	57,6	1170	80
Extend of variation	125	4	10	270	60
Ratio set {Rs}	0,069	0,784	0,191	0,249	1202

Source: The Authors.

Table 2.
Glass article forming -statistic file values.

Ratio value	**Word**
0–0,3	low
0,4–0,7	middle
0,8 - 1,0	high
1,0 and more	very high

Source: The Authors.

Table 3.
A reference table which deals with assignment of words to ratio value intervals.

IF	**Glass melt**	**Glm_ temp**	**Glm_ vis**	**Glm_ quant**	**Glart ident**	**Glartgood**	**Glartrepair**	**Glart_waste**
		0,069	0,784	0,191	Vyr1	0,249		1202
		low	**high**	**low**		**low**		**very high**

Source: The Authors.

Table 4.
Glass article forming rule table.

4.5 BPLM process designer - implementation and operation

BPLM Process Designer is considered to be the second subsystem related to the BPLM System, while the first one is a subsystem denoted as BPLM Strategy Creator. The BPLM Process Designer consists of three components: (a) BPLM PD_01 Master files, (b) BPLM PD_02 Structure and (c) BPLM_PD_03 Functionality.

4.5.1 BPLM PD_01 master files

However, the BPLM PD_01 Master files component deals with master files needed for BP quantification and modeling as well, while those master files are concerned with production input materials, production output products (articles), production technological devices, production technological tools and production human resources. Each of the above-mentioned master files, which deal with production input materials, production output products, production technological devices and tools are represented by five subsets, which contain adequate types of parameters: (a) general parameters material, product, device or tool identifier, name, text description, drawing or image, (b) technical - height, volume, etc. (c) Operational - temperature, viscosity, quantity, etc. and (d) economic -e.g. different types of prices, and commercial ones, accessibility, vendor, reseller, etc. When considering HR master files, they contain records closely related to personality dispositions, theoretical knowledge and practical skills.

4.5.2 BPLM PD_02 structure

The BPLM PD_02 Structure component deals with modeling of business process static aspects, like business process (BP) transformation rules, BP transformation tools and BP external and internal metrics [30]. Because of that the BPLM Process designer is considered to be the aim oriented knowledge based system (expert system) and the knowledge stored within its knowledge base are represented with the use of appropriate semantic networks and (SNWs) and reference databases (RDBs), the SNWs and RDBs play a role of principle importance within that component. However, the above-mentioned categories create appropriate subordinated modules as well, while they will not be discussed in more details within that contribution. The principal layout of BPL PD_02 component is shown in **Figure 3**.

4.5.3 BPLM PD_03 functionality

However, the BPLM PD_03 Functionality component deals with modeling of business process dynamic aspect modeling as well, while two modules play a role of principle importance: (a) **Static model**, which deals with establishment of new business process or with selection of BP to be modeled from existing business processes (b) Dynamic model, which deals with modeling of primary and secondary external and internal metrics and derivation of transformation rules closely related to selected BP and adequate BPFs. The selected BP and BPFs are considered

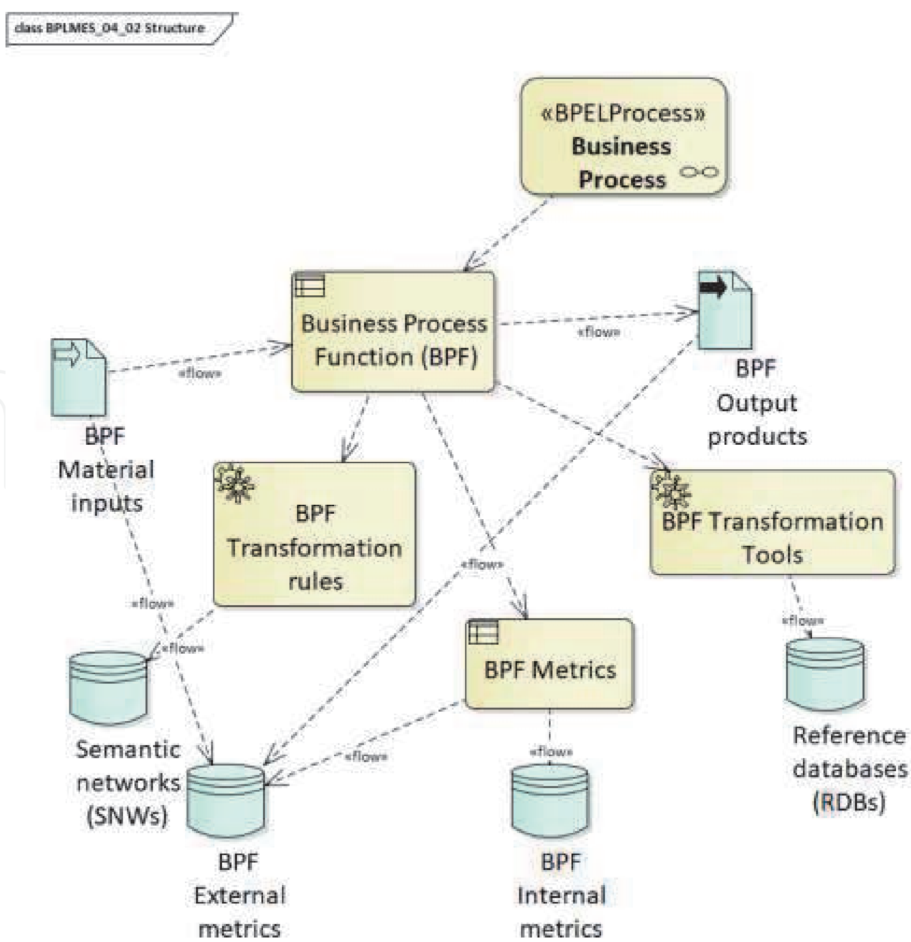

Figure 3.
Principal layout of BPL PD_02 component. Source: The Authors

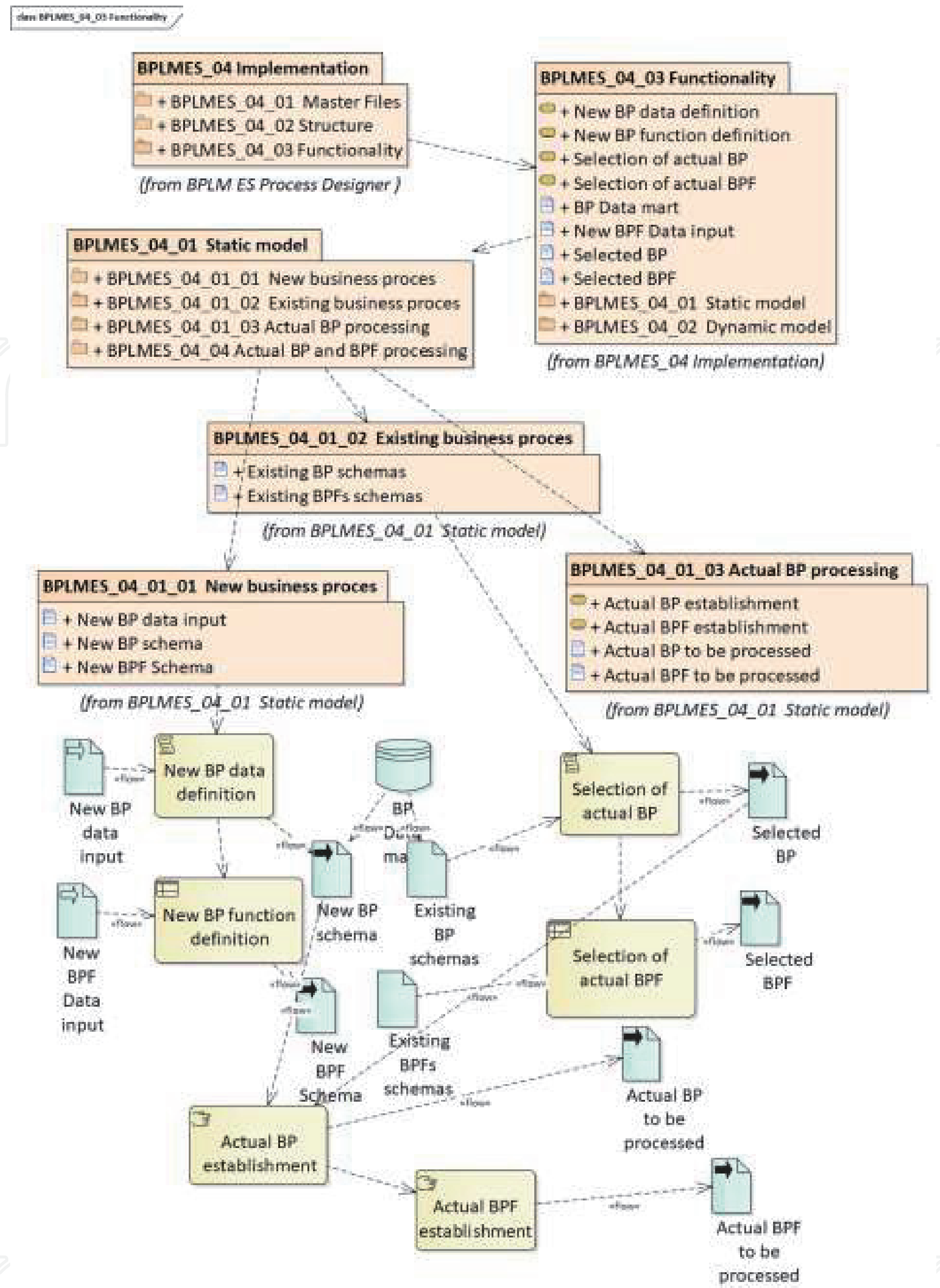

Figure 4.
Principal layout of BPL PD_02 component – Module static model. Source: The authors.

to be outputs from BPLM PD_02 Structure component and module Static model. The principal layout of BPL PD_02 component - module Static model is shown in **Figure 4**.

5. Discussion

We have developed a BPLM Process designer conceptual model, which creates basis for development of tool for analysis and design of business process (BP) models. The conceptual model respects the ARIS methodology, however that methodology is being modified an extended as well, while it operates with business process function (BPF), which creates basis of any BP horizontal structure and seems to be an elements, which provides the BPF input conversion and pre-defined output generation. When quantifying the BPF with use of adequate linguistic set {[BPF (i, j)]}, three subordinated sets (subsets) might be postulated: (a) BPF transformation rule (b) BPF transformation function and (c) BPF external and internal metrics subset, while two types of transformation rules might be postulated: (a) rules overtaken from the firm or company internal or external environment and postulated via text in natural language - *overtaken rules* and (b) rules postulated based on BPF functionality evaluation – *derived rules*. This is the first extension of ARIS methodology. The second one is closely related to BP model views. The ARIS methodology postulates functional, process, data and organizational model view, however the BPLM methodology postulates information and knowledge-based support view (**Figure 5**). When comparing an information support view with standardized data view two principle differences might be observed. *The first difference* is closely related to BPF external and internal metrics, while there is defined so called *primary BPF external and internal metrics* and secondary one, while the primary BPF external and internal metrics deals with detailed data gained within

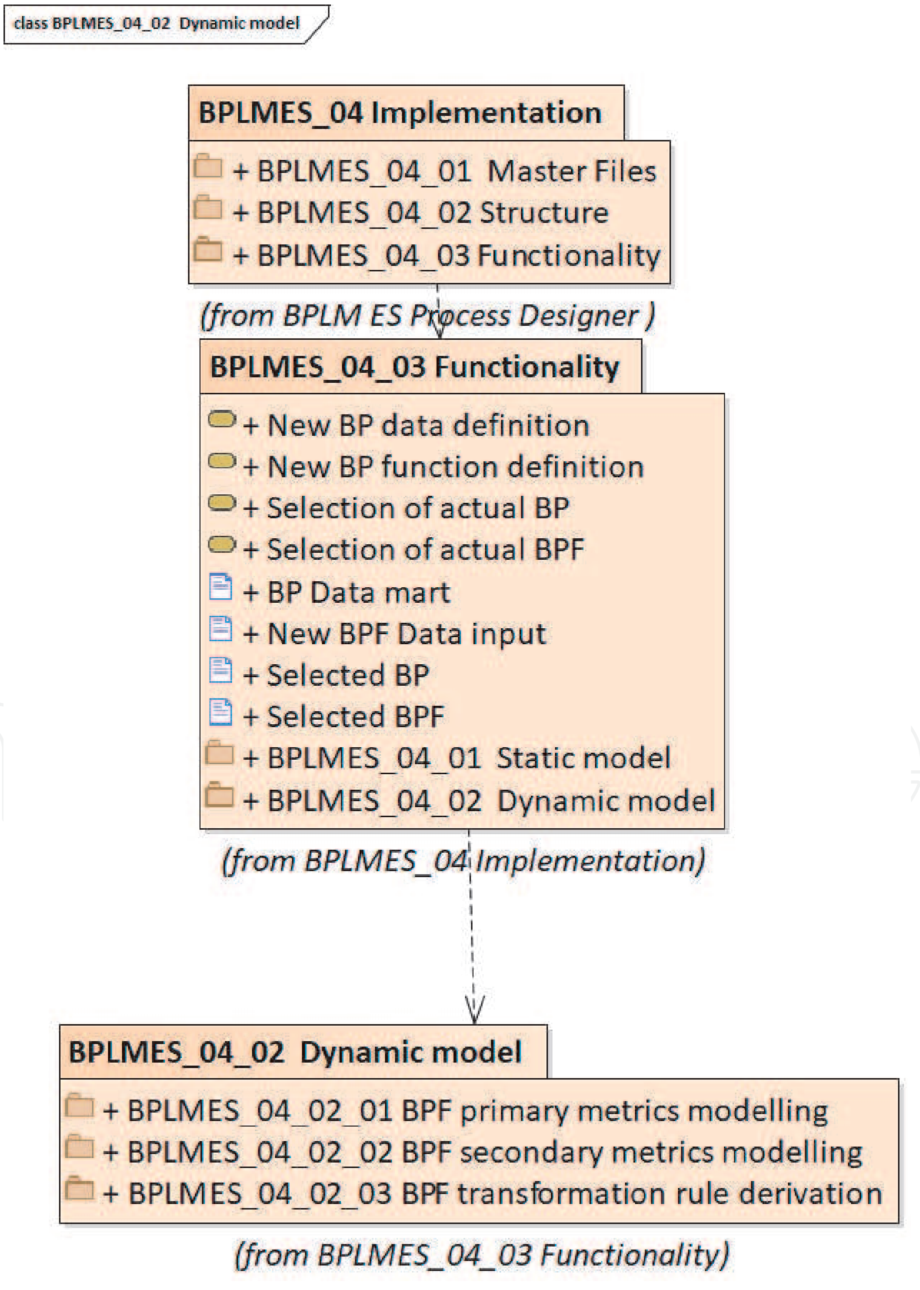

Figure 5.
Principal layout of BPL PD_02 component - module d ynamic model. Source: The authors.

evaluation of BP and BPF functionality and the *secondary BPF external and internal metrics* deals with aggregated data gained as s result of statistic evaluation the above-mentioned detailed data, while that data create basis for derivation of rules within BP and BPF knowledge-based support, which seems to be the next extension of previous BP and model views. However, the second difference is closely related to existence of *reference databases (RDBs)*, which create basis for knowledge representation within BP or BPF knowledge-based support view as well, while the RDBs and semantic networks created based on *secondary BPF external and internal metrics data* might generate knowledge stored in the expert system (ES) knowledge base (KB) and the ES seems to be an application utilized for BP linguistic modeling purposes.

6. Conclusion

The conclusion facts are concerned with modifying and extension of previously developed ARIS methodology and are described within discussion section. We would like to stress the main practical contribution of that system, which deals with a possibility or transformation rule derivation and presentation in form of TNL text, which might read the business analysts and BP managers as well, what generates an easier communication among them too.

Of course, the reader will not find any facts related to BP and BPF simulation and optimization, while those problems are closely related to our research work in the near future. The same is concerned with BP configuration and execution problems being solved within BP implementation and controlling. All the above-mentioned aspects represent objectives of the research work in the near future.

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