

# Towards Performance Modeling for Collaborative Enterprises

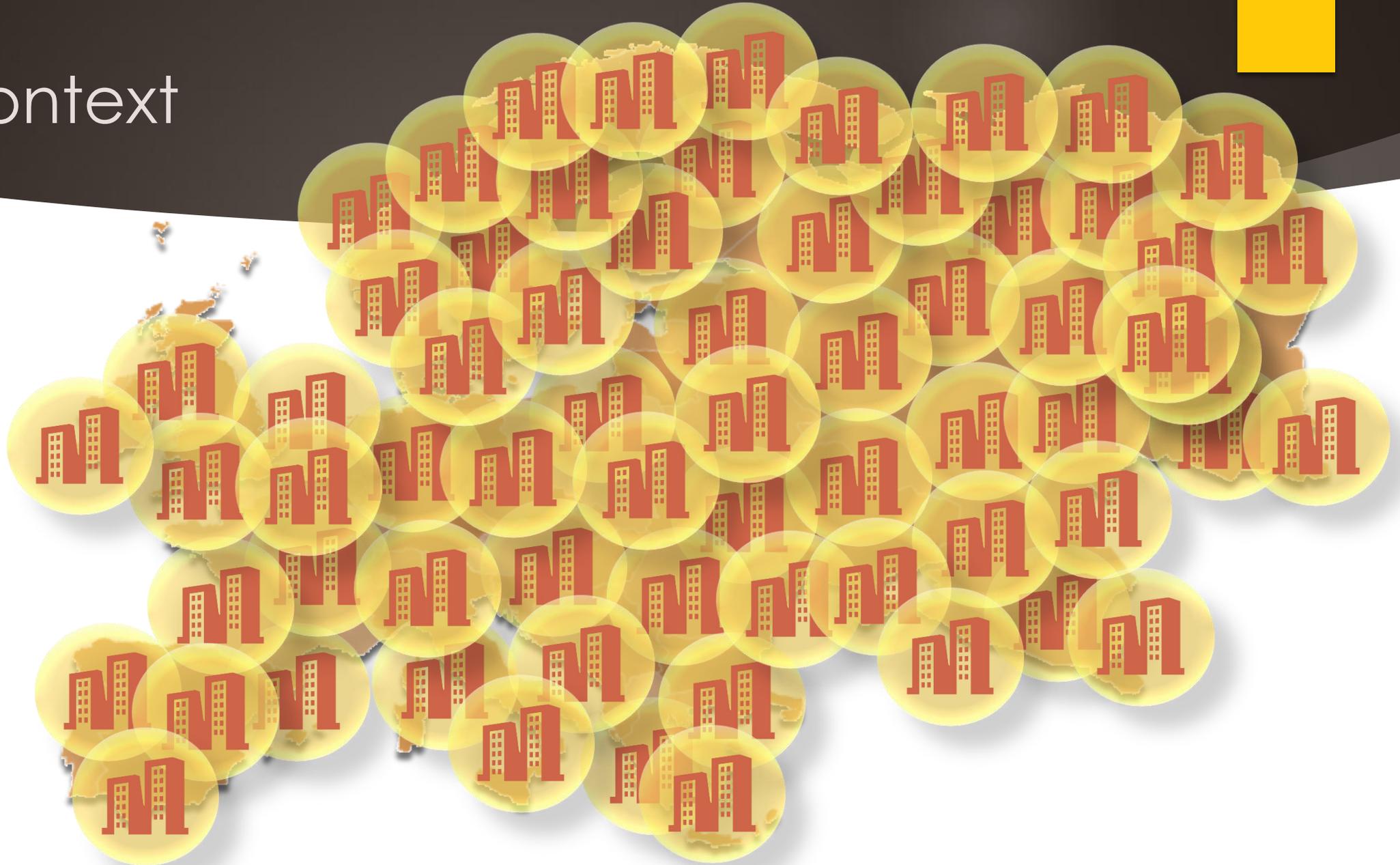
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# Context



# Collaborative enterprises

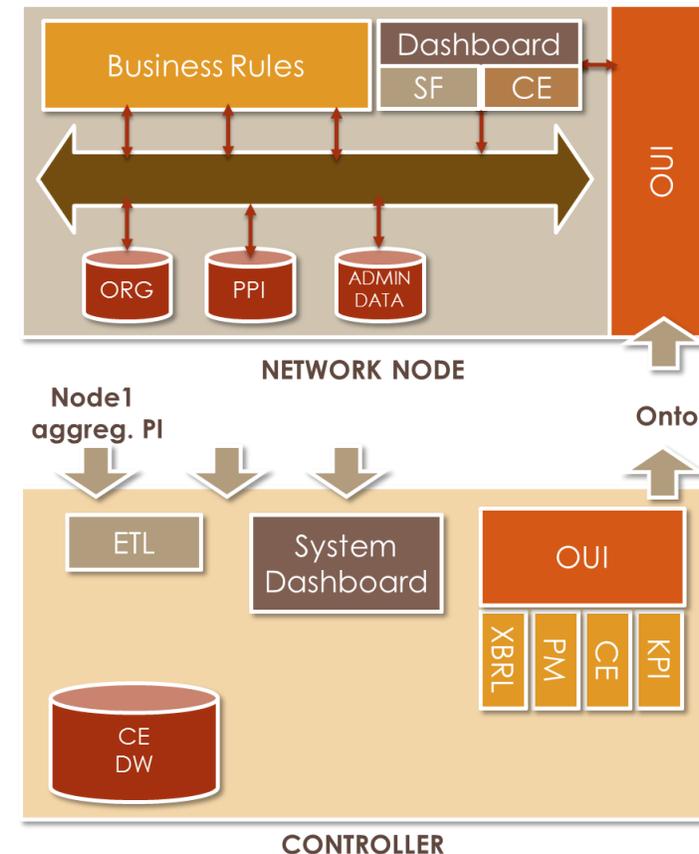
- ▶ **Collaboration** as “a process in which autonomous or semi-autonomous actors interact through formal and informal negotiation, jointly creating rules and structures governing their relationships and ways to act or decide on the issues that brought them together; it is a process involving shared norms and **mutually beneficial interactions**” (Thomson, 2009)
- ▶ Literature on collaboration **vast and multidisciplinary**
  - ▶ **lack of coherence** in the definition and understanding of collaboration
- ▶ In order to abstract from the specific forms of collaboration and to outline the **systematic perspective**, we use the term “collaborative enterprise”.

# Research problem

- ▶ Performance measurement (for CEs and for participating organizations), understood as the monitoring of the fulfillment of goals, is a critical factor in determining the success of collaborative enterprises.
- ▶ Specialized tools to support performance management and decision-making processes,
- ▶ Interoperability issues:
  - ▶ **syntactic heterogeneity**: apply different data formats;
  - ▶ **structural heterogeneity**: different data structure in the IS;
  - ▶ **semantic heterogeneity**: different organizations often use different terms to describe the same concept or the same term to refer to different concepts.

# Research problem

- ▶ Context-based recommender system (to support performance measurement choices). It should:
  - ▶ Suggest relevant KPIs and possible dashboards
  - ▶ Metrics linked to goals, roles and resources
  - ▶ Account for the peculiarities of CEs



# Open issues

▶ ~~Interoperability issues~~

▶ Performance measurement modeling: models not re-usable

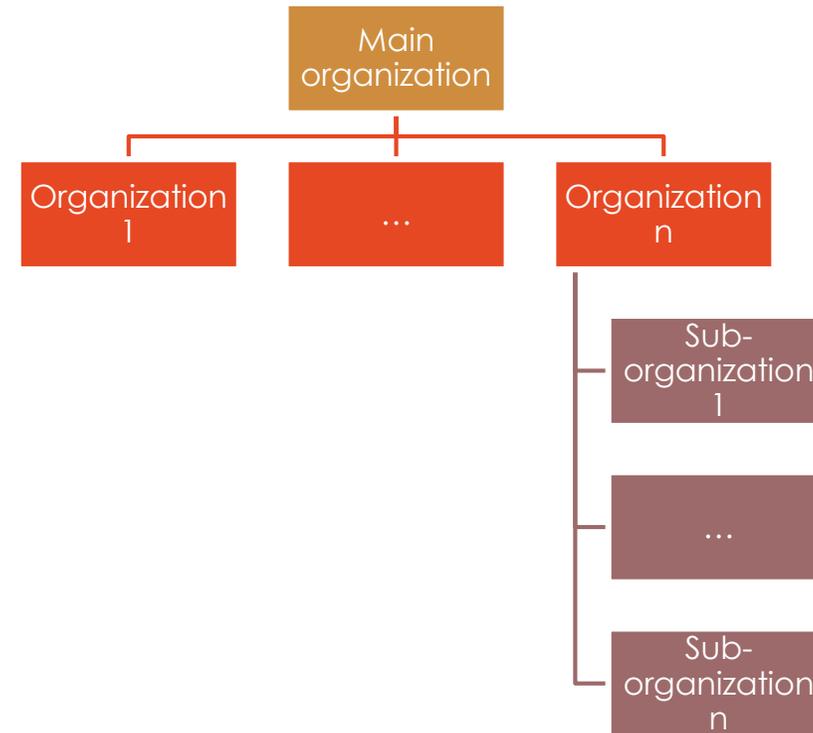
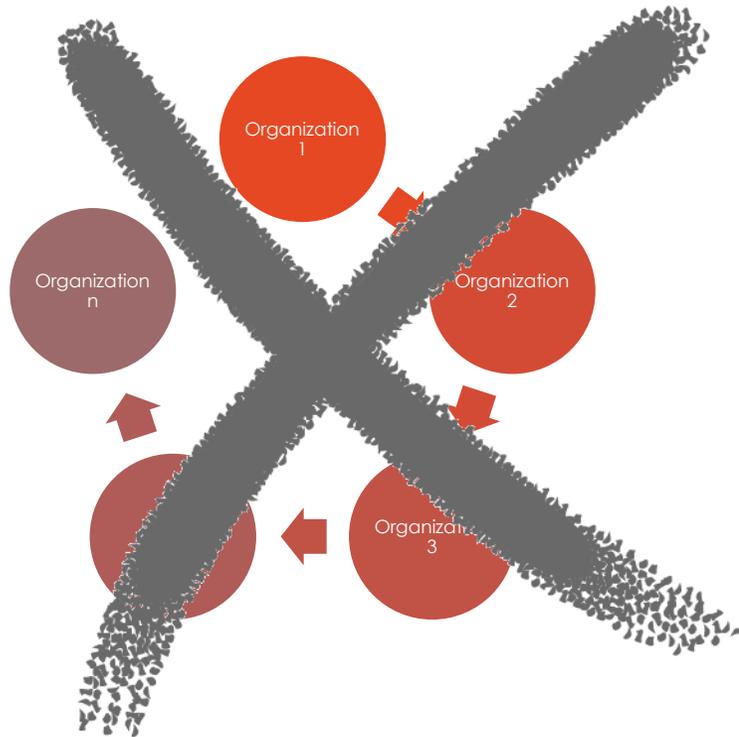
▶ Lack of understanding of what collaboration is

# CE modeling

- ▶ Literature **vast** and **multidisciplinary**:
  - ▶ lacks of coherence in the definition and understanding of collaboration
- ▶ First issue:
  - ▶ Different terms for the same concept;
  - ▶ Same term for different concepts.
- ▶ Second issue:
  - ▶ The classification of collaboration types is based on different perspectives (e.g., temporal, geographical, ...).

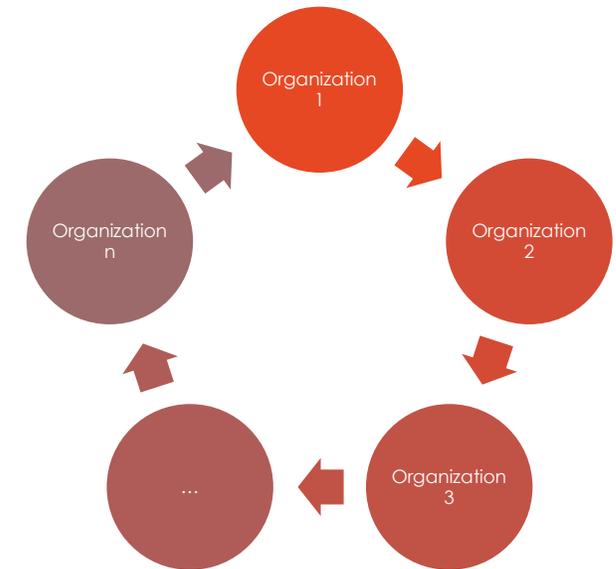
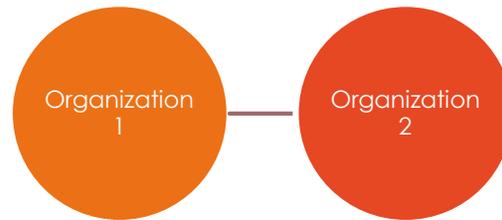
# CE modeling: 1<sup>st</sup> issue

What does "alliance" mean?



# CE modeling: 1<sup>st</sup> issue

How many organizations are needed to constitute an alliance?



Are joint ventures a type of alliance?

# CE modeling: roadmap

- ▶ Identify the different definitions of collaboration and the existing classifications
  - ▶ Identify the main concepts and the mutual relations
- ▶ Based on the classifying variables identified in [1], some relevant concepts can be presented:
  - ▶ Business sector;
  - ▶ Actor;
  - ▶ Role;
  - ▶ Resource.

# Performance modeling

## Scopus and Web of Science

TITLE ( ( "Enterprise monitoring" OR "performance monitoring" OR "performance measurement" OR indicator OR "KPI\*" ) AND ( ontolog\* OR semantic OR modeling OR model OR formal\* ) ) AND TITLE-ABS-KEY ( enterprise OR "Supply chain" OR organization OR "collaborative network" OR "supply network" OR "alliance" OR "virtual enterprise" )



- ▶ Different modeling techniques:
  - ▶ human sense-making and communication;
  - ▶ computer-assisted analysis;
  - ▶ business process management and quality assurance;
  - ▶ model deployment and activation;
  - ▶ modeling techniques used to give context.

# Performance modeling

Scopus: 177 records

(minus duplicates) = 216 records

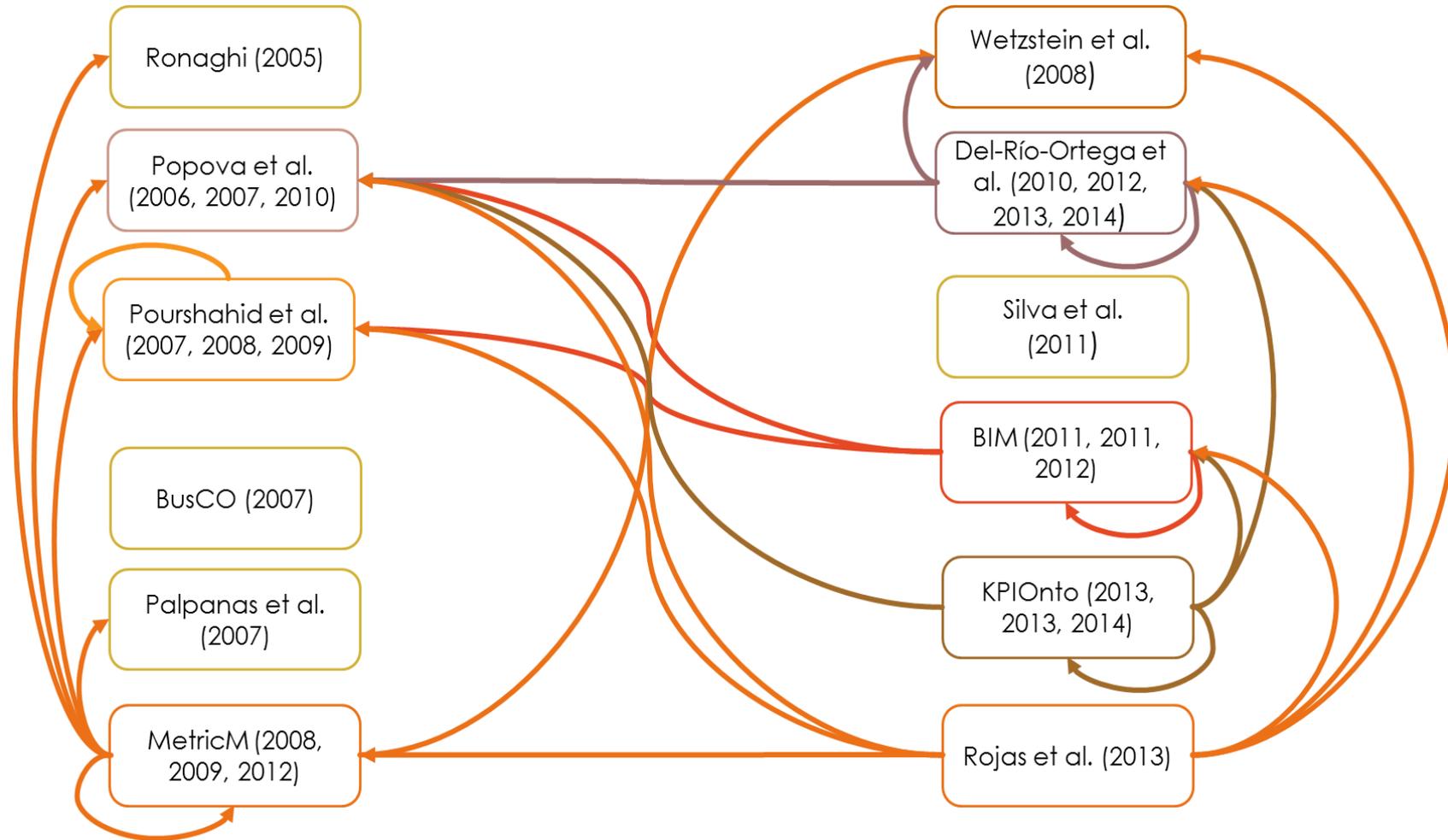
WoS: 123 records

(title and abstract/content based selection) = 25 papers

(modeling approaches) = 12

#	Entrytype	Author	Title	Year	Journal
1	Article	Angerhofer and Angelides	A model and a performance measurement system for collaborative sup...	2006	Decision S...
2	Article	Anhley et al.	Endocrine disrupting chemicals in fish: Developing exposure indicators...	2009	Aquatic Toxic...
3	Article	Arango Serna et al.	Modeling of the supply chain management indicators: A systemic point...	2008	(DYHA) Colomb...
4	Article	Armstrong et al.	A Business Model for Managing System Change Through Strategic Fina...	2012	American Journ...
5	Article	Aydogan	Performance measurement model for Turkish aviation firms using the r...	2011	Expert Systems
6	Inproceedin	Balfu et al.	A performance indicators model to support the organization of an integr...	2008	
7	Book	Baldo et al.	An ontology-based approach for selecting performance indicators for pa...	2007	
8	Book	Baldo et al.	Modeling performance indicators: selection process for (VO) partners'...	2008	
9	Book	Bar and Cook	Modeling for real-time performance measurement: A strategic approach...	2007	Mining Engineer...
10	Article	Barajas-Molina et al.	Explaining the Causes and Effects of Dynamic Capabilities Generation...	2013	British Journal of...
11	Article	Bauer et al.	Advancing a theoretical model for public health and health promotion in...	2003	European Journ...
12	Inproceedin	Berenguer et al.	A set of quality indicators and their corresponding metrics for conceptu...	2005	
13	Article	Beroggi et al.	Designing a model for innovation indicators from a systems perspective	2008	International Jou...
14	Article	Berran and Chivlag	Towards an aggregation performance measurement system model in a...	2007	Computers in In...
15	Article	Bhagwat et al.	Performance measurement model for supply chain management in IS...	2008	International Jou...
16	Article	Bhagwat and Sharma	An application of the integrated (MFP-IPDP) model for performance ma...	2009	Production Plan...
17	Inproceedin	Blanch	Management indicators model to evaluate performance of IT organizati...	2001	
18	Inproceedin	Blanch			
19	Article	Bonif			
20	Article	Borne	Performance Measurement and City Management Innovation: Comparat...	2010	Joint Comm...
21	Article	Borri	CRV's pricing model for performance measurement systems approach...	2002	Revista De Ch...
22	Article	Burri	A Design for Indicators and an Information System for a Research and...	2011	Information Syst...
23	Book	Calet	Life Cycle Model for IT Performance Measurement: A Reference Model I...	2009	Information Syst...
24	Article	de Alencar Silva and Weigand	Enterprise Monitoring Ontology	2011	Conceptual Med...
25	Book	de Aquino et al.	Causality in a Performance Measurement Model: a Case Study in a Braz...	2008	Performance Me...
26	Book	de Araujo et al.	Comparison and rating model of performance indicators	2004	
27	Article	de Araujo et al.	Organization and Indicators of Management - Overwhelmed Or the Crisi...	1995	Sociologia De Tr...
28	Article	de Araujo et al.	Modeling the Impact of the Economic Mechanism on the Indicators of E...	1982	Matekon
29	Article	de Araujo et al.	High Process-Focused Organizational Performance Measurement Mo...	2008	
30	Article	de Araujo et al.	Artistic Organizations in Mexico: Model and Indicators of Intellectual Cap...	2010	Geotica & Prod...
31	Article	de Araujo et al.	Modelo para alinhamento entre a maturidade dos sistemas de mensurac...	2012	
32	Article	de Araujo et al.	A model of supply chain characteristics applied to success factors in B...	2009	
33	Article	de Araujo et al.	Research of entropy - Based overall performance measurement model...	2006	
34	Article	de Araujo et al.	Research of entropy-based overall performance measurement model...	2006	
35	Book	de Araujo et al.	Managing and optimization of complex IT-Service process model based...	2008	
36	Book	de Araujo et al.	A business process activity model and performance measurement usin...	2009	Expert Systems
37	Article	de Araujo et al.	The indicator system of enterprise sustainable development and the e...	2001	Management an...
38	Book	de Araujo et al.	The Creation of the Performance Measurement System - House Model	2011	
39	Book	de Araujo et al.	The Enterprise Performance Measurement Method Balancescorecard	2005	
40	Article	de Araujo et al.	Modelos de Capital Intelectual y sus indicadores en la universidad p...	2010	Cuadernos de A...
41	Book	de Araujo et al.	A confirming model of KPI of supply chain based on QFD	2005	Proceedings of I...
42	Article	de Araujo et al.	Integrating Innovation Indicators in the QFD Model for Automobile Perf...	2012	
43	Book	de Araujo et al.	A methodology to link performance indicators to process models	1999	
44	Book	de Araujo et al.	Antecedents of supply chain management: A performance measureme...	2000	
45	Article	de Araujo et al.	Towards Semantic Performance Measurement Systems for Supply Cha...	2010	On the Move to M...
46	Article	de Araujo et al.	A Mathematical Model of the Innovation Indicator	2009	
47	Article	de Araujo et al.	Quality Management Indicators for Tissue Banks: An Operative Model Fr...	2009	Transportation
48	Article	de Araujo et al.	Modeling Behavioral Manifestations of Coordination and Support over t...	2010	Intelligent Virtual...
49	Article	de Araujo et al.	Modelling of the Supply Chain Management Indicators: a Systemic Point...	2008	Dyna-Colombia
50	Article	de Araujo et al.	Health care model and quality indicators: perceptions of primary health...	2010	Cadernos de Sa...
51	Book	de Araujo et al.	Causal Performance Measurement Models: Myth or Reality?	2009	
52	Article	de Araujo et al.	Maternity care models in a remote and rural network: assessing clinical...	2010	Quality & Safety...
53	Book	de Araujo et al.	A model of multipurpose land information systems development in com...	1996	
54	Article	de Araujo et al.	An integrated model for sustainable performance measurement in sup...	2012	World Conferenc...
55	Article	de Araujo et al.	A participatory evaluation model for healthier communities: Development I...	2008	Public health ren...

<i>Modeling Approaches</i>	<i>Criteria</i>				
	<i>Methodological Approach</i>	<i>N.r cit.</i>	<i>Re – use of Methods</i>	<i>Aim</i>	<i>Type</i>
Pourshahid et al. (2007, 2008, 2009) [33]–[35]	extension of the User Requirements Notation (URN)	125	No	Enable the alignment between business goals and business processes	(3) business process management and quality assurance
Popova et al. (2006, 2007, 2010) [30]–[32]	modeling framework	97	No	Enhance a general framework for organization modeling and analysis by means of performance indicators	(1) human sense making and communication
BIM (2011, 2011, 2012) [39]–[41]	DSML (Business Intelligence Modeling Language) and Eclipse tool	71	No	Building "strategic business models that support evaluation and decision-making" [39]	(2) computer assisted analysis
MetricM (2008, 2009, 2012) [1], [37], [38]	DSML (MetricML)	68	Inspired by Popova et al. and Pourshahid et al.	"Support creating and interpreting performance measurement systems effectively and efficiently by providing differentiated semantics of dedicated modeling concepts and corresponding descriptive graphical symbols that further comprehensible performance measurement systems ( [1], p.244)	(1) human sense making and communication
Wetzstein (2008) [23]	WSML	35	No	Integrate the monitoring activities into the semantic business process lifecycle	(4) model deployment and activation
BusCO (2007)	Language not declared	34	No	provide a specification of the domain in order to develop a framework of the corporate memory	(1) human sense-making and communication and (5) to give context
Del-Ro-Ortega et al. (2010, 2012, 2013) [19]–[21]	OWL DL	34	No	Define commonly used PPIs and their relations with business processes	(3) business process management and quality assurance
Palpanas et al. (2007)	Extension of the business performance modeling framework [43]	26	No	to propose a model-driven framework for dashboard design	(4) model deployment and activation
KPIOnto (2013, 2013, 2014) ([24]–[26])	OWL, MathML and OpenMath, Prolog and XSB as reasoning engine	6	No	Integrate heterogeneous data in the context of VEs and evaluate common KPIs	(2) computer-assisted analysis
Ronaghi et al. [29]	Meta model implemented with ADONIS	5	No	"to get an overview of the necessary objects that are used as a base for modern integrated performance management" ([29], p. 1)	(1) human sense-making and communication and (5) to give context
Enterprise Monitoring Ontology (2011) [27]	Language not declared	3	Enterprise Ontology [44], Reference Ontology [45]	Provide a framework for the monitoring of value constellations	(1) human sense-making and communication
Rojas & Zapata Jaramillo (2013) [42]	Executable pre-conceptual schema	0	No	appropriately represent KPIs, with clear and accurate semantic and syntax, stakeholder understandability, extensibility and computational tractability	(1) human sense-making and communication



# Performance modeling: differences

- ▶ *Semantic differences*
  - ▶ use of synonyms
  - ▶ role assigned in the models to the concept of process (thus, of performance indicator and goal)
- ▶ *Structural differences*
  - ▶ (implicit) difference in the level of abstraction (higher organizational abstraction, that accounts for the whole organization, vs. a lower one that accounts only for a specific object of analysis, i.e., the processes)

# Performance modeling: differences

- ▶ Can these models be integrated?
  - ▶ Overlapping concepts (merging techniques): it should be possible to guarantee the presence of different synonyms whilst adopting the most general meaning;
  - ▶ Non-overlapping concepts (composition techniques):
    - ▶ concepts specific of a model but that not strictly related to the category of modeling techniques or to the aim: they should be included in the domain model.
    - ▶ concepts strictly related to the modeling techniques should not be included
  - ▶ Different modeling choices: attribute or concepts?

Thanks!

QUESTIONS?  
ANY FEEDBACK?

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