Supplementary Material - Literature Review and Statistics

This material presents the research items that derived from the SLR pertaining to the RQ: "Which are the systematic methodologies in literature for assessing the redesign capacity of models prior to BPR implementation?". The review is supplemented with additional information such as demographic statistics, detailed results of the data extraction, basic framework or methodology information, etc.

Section 1. Papers in the final data set

The following table presents the research items (papers) in the final data set, where they have been enumerated in ascending order of their publication year (from 2000 to 2021). Further information is listed (authors, paper title and source).

Table S1. Papers resulting from the SLR.

Number	Authors	Year	Title	Source
Paper 1	Hlupic, Vlatka, Jyoti Choudrie, and Nayna Patel.	2000	Business process re-engineering (BPR): The REBUS approach	Cognition, technology & work
Paper 2	Rodger, James A., and Parag C. Pendharkar.	2001	A BPR case study at Honeywell	Business Process Management Journal
Paper 3	Steve Brown, Kate Blackmon, Paul Cousins and Harvey Maylor (Eds)	2001	Chapter 10: Performance measurement and improvement	Operations Management
Paper 4	Greasley, Andrew	2003	Using business-process simulation within a business-process reengineering approach	Business Process Management Journal
Paper 5	Zhou, Yonghua, and Yuliu Chen	2003	The methodology for business process optimized design	29th Annual Conference of the IEEE Industrial Electronics Society (IECON'03)
Paper 6	Reijers, Hajo A., and Wil MP Van Der Aalst	2005	The effectiveness of workflow management systems: Predictions and lessons learned	International Journal of Information Management
Paper 7	Mansar, S. L., & Reijers, H. A.	2005	Best practices in business process redesign: validation of a redesign framework	Computers in industry
Paper 8	Paul Harmon	2007	chapter 13: The BPTrends Process Redesign Methodology	Business Process Change (2nd Edition)
Paper 9	Doomun, Razvi, and Nevin Vunka Jungum.	2008	Business process modelling, simulation and reengineering: call centres	Business Process Management Journal
Paper 10	Greasley, Andrew.	2008	Enabling Simulation–Simulation and Process Improvement Methodology	Enabling a Simulation Capability in the Organisation
Paper 11	Lee, Sangjae, and Hyunchul Ahn.	2008	Assessment of process improvement from organizational change	Information & management
Paper 12	Seethamraju, Ravi, and Olivera Marjanovic.	2009	Role of process knowledge in business process improvement methodology: a case study	Business Process Management Journal
Paper 13	Chen, Liang, Tao Xue, and Ali Yang.	2009	Business Process Continuous Improvement System Based on Workflow Mining Technology	World Congress on Computer Science and Information Engineering (2009 WRI)
Paper 14	Kock, N., Verville, J., Danesh-Pajou, A., & DeLuca, D.	2009	Communication flow orientation in business process modeling and its effect on redesign success: Results from a field study	Decision Support Systems
Paper 15	Mansar, Selma Limam, Hajo A. Reijers, and Fouzia Ounnar.	2009	Development of a decision-making strategy to improve the efficiency of BPR	Expert Systems with Applications
Paper 16	Raschke, R. L., Sen, S., Bradford, R. L., & Howlett, K.	2010	An Activity Based Framework for Business Process Evaluation: Case Study of a County's Evaluation of an	43rd Hawaii International Conference on System

	M.		Integrated Court System	Sciences (2010)
Paper 17	Ostadi, B., M. Aghdasi, and A. Alibabaei.	2011	An examination of the influences of desired organisational capabilities in the preparation stage of business process re-engineering projects	International Journal of Production Research
Paper 18	Mahfouz, A., Shea, J., & Arisha, A.	2011	Simulation based optimisation model for the lean assessment in SME: a case study	Winter Simulation Conference (WSC) 2011
Paper 19	French, K. E., Albright, H. W., Frenzel, J. C., Incalcaterra, J. R., Rubio, A. C., Jones, J. F., & Feeley, T. W.	2013	Measuring the value of process improvement initiatives in a preoperative assessment center using time-driven activity-based costing	Healthcare
Paper 20	Ram, Jiwat, David Corkindale, and Ming-Lu Wu	2013	Implementation critical success factors (CSFs) for ERP: Do they contribute to implementation success and post-implementation performance?	International Journal of Production Economics
Paper 21	Mohapatra, Sanjay	2013	Change Management Approach in Implementing BPR	Business Process Reengineering
Paper 22	Guimaraes, Tor, and Ketan Paranjape	2013	[PDF] Testing success factors for manufacturing BPR project phases	The International Journal of Advanced Manufacturing Technology
Paper 23	Al-Balushi, S., Sohal, A. S., Singh, P. J., Al Hajri, A., Al Farsi, Y. M., & Al Abri, R.	2014	[HTML] Readiness factors for lean implementation in healthcare settings–a literature review	Journal of health organization and management
Paper 24	Johannsen, Florian, Fill, Hans-Georg	2014	Codification of Knowledge in Business Process Improvement Projects	European Conference on Information Systems, AIS (ECIS 2014)
Paper 25	Palma-Mendoza, Jaime A., Kevin Neailey, and Rajat Roy	2014	Business process re-design methodology to support supply chain integration	International Journal of Information Management
Paper 26	Paul Harmon	2014	Chapter Thirteen: The BPTrends Process: Redesign Methodology	Business Process Change (Third Edition)
Paper 27	Uriarte, A. G., Moris, M. U., Ng, A. H., & Oscarsson, J.	2015	Lean, simulation and optimization: a win-win combination	Winter Simulation Conference (WSC) 2015
Paper 28	Palma-Mendoza, Jaime A., and Kevin Neailey	2015	A business process re-design methodology to support supply chain integration: Application in an Airline MRO supply chain	International Journal of Information Management
Paper 29	Lohrmann, Matthias, and Manfred Reichert.	2016	Effective application of process improvement patterns to business processes	Software & Systems Modeling
Paper 30	Calabrò, A., Lonetti, F., Marchetti, E., & Spagnolo, G. O.	2016	Enhancing Business Process Performance Analysis through Coverage-Based Monitoring	10th International Conference on the Quality of Information and Communications Technology (QUATIC) 2016
Paper 31	Johannsen, Florian, and Hans-Georg Fill.	2017	Meta Modeling for Business Process Improvement	Business & Information Systems Engineering
Paper 32	Sánchez-González, L., García, F., Ruiz, F., & Piattini, M.	2017	A case study about the improvement of business process models driven by indicators	Software & Systems Modeling
Paper 33	Cho, M., Song, M., Comuzzi, M., & Yoo, S.	2017	Evaluating the effect of best practices for business process redesign: An evidence-based approach based on process mining techniques	Decision Support Systems
Paper 34	Khan, M. A. A., Butt, J., Mebrahtu, H., Shirvani, H., & Alam, M. N.	2018	Data-driven process reengineering and optimization using a simulation and verification technique	Designs
Paper 35	AbdEllatif, Mahmoud, Marwa Salah Farhan, and Naglaa Saeed Shehata	2018	Overcoming business process reengineering obstacles using ontology-based knowledge map methodology	Future Computing and Informatics Journal
Paper 36	Khan, M. A. A., Butt, J., Mebrahtu, H., Shirvani, H., Sanaei, A., & Alam, M. N.	2019	Integration of Data-Driven Process Re-Engineering and Process Interdependence for Manufacturing Optimization Supported by Smart Structured Data	Designs
Paper 37	Tsakalidis, G., Vergidis, K., Kougka, G., & Gounaris, A.	2019	Eligibility of BPMN models for business process redesign	Information
Paper 38	PaulHarmon	2019	Chapter 13: A comprehensive redesign methodology	Business Process Change (4th Edition)

Paper 39	Cherni, Jihen, Ricardo Martinho, and Sonia Ayachi Ghannouchi.	2019	Towards Improving Business Processes based on preconfigured KPI target values, Process Mining and Redesign Patterns	Procedia Computer Science
Paper 40	Pérez-Castillo, Ricardo, María Fernández-Ropero, and Mario Piattini.	2019	Business process model refactoring applying IBUPROFEN. An industrial evaluation	Journal of Systems and Software
Paper 41	Suresh, M., V. Vaishnavi, and Rajesh D. Pai.	2020	[HTML] Leanness evaluation in health-care organizations using fuzzy logic approach	International Journal of Organizational Analysis
Paper 42	Mukherjee, K. K., Reka, L., Mullahi, R., Jani, K., & Taraj, J.	2021	Public services: a standard process model following a structured process redesign	Business Process Management Journal
Paper 43	Nafchi, S. R., Saeedi, F., & Fathi, M. R.	2021	Developing a model to assess the organisational readiness for business process reengineering implementation (case study: a manufacturing firm)	International Journal of Process Management and Benchmarking
Paper 44	Tsakalidis, George, and Kostas Vergidis	2021	A Roadmap to Critical Redesign Choices That Increase the Robustness of Business Process Redesign Initiatives	Journal of Open Innovation: Technology, Market, and Complexity

Section 2. Demographic Statistics

Beyond the objective of this SLR this section provides some basic demographic statistics on this research. As shown in Figure S1 there has been a fluctuation in the number of publications related to such methodologies between 2000 and 2021. An increase of interest on the research topic can be observed after 2012.

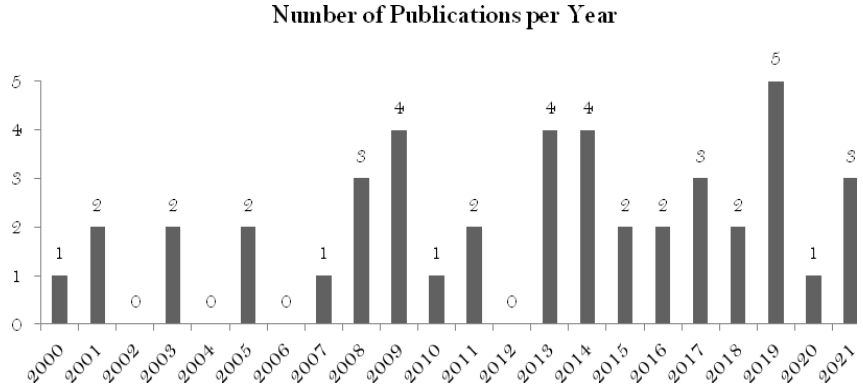

Figure S1. Publication's year Overview.

Main authors in the research area of business process redesign methodologies according to this SLR are shown in Figure A2.

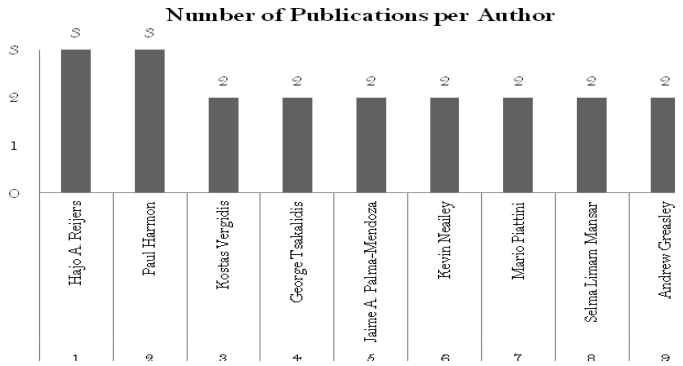

Figure S2. Authors Overview.

If we focus on publication type (Figure S3), we can see that 32 out of 44 (73%) of the papers were published in Journals, 7 (16%) in Conference / Symposium / Workshop Proceedings and 5 out of the 44 (11%) were included in books or book chapters.

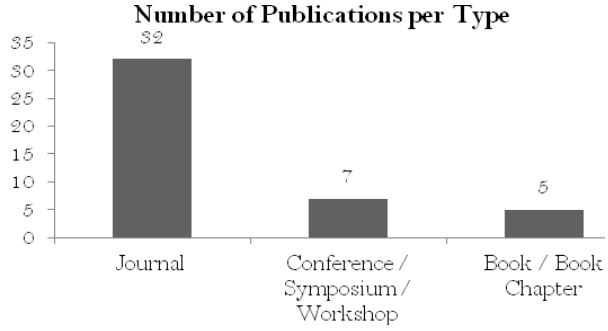

Figure S3. Publications Type Overview.

Table S2 shows the publication outlets with the largest number of papers related to the redesign methodologies with prior assessment. The first is the Business Process Management Journal (Emerald Publishing) with 12 published papers in the defined period.

Table S2. Publications overview.

Source	Source Type	Count
Business Process Management Journal	Journal	5
Business Process Change	Book / Book Chapter	4
International Journal of Information Management	Journal	3
Decision Support Systems	Journal	2
Software & Systems Modeling	Journal	2
Designs	Journal	2
Winter Simulation Conference (WSC)	Conference / Symposium / Workshop	2

In figure S4 the authors present the number of publications for each type of change. The most papers refer to business process improvement (19) and the least ones to business process refactoring (1). In many cases, the 3 disciplines (improvement, redesign and reengineering) are used interchangeably to refer to the same applied business process change initiative.

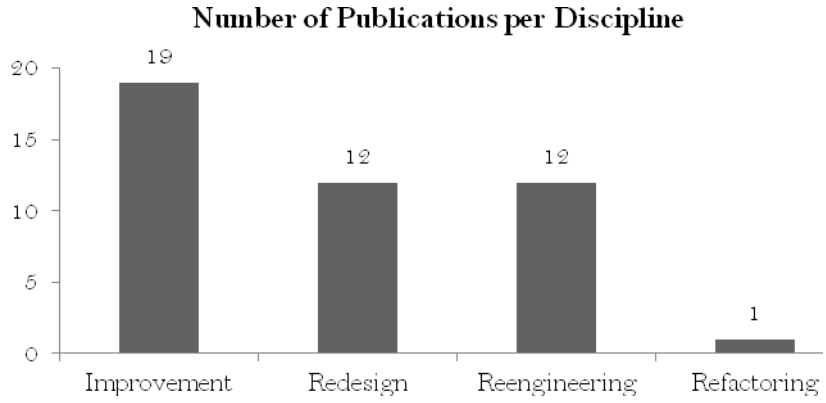

Figure S4. Type of Change Overview.

Section 3. Detailed results of data extraction

In this section, the author provides detailed results of the extracted data. Table S3 presents the artefacts (frameworks or methodologies) introduced in the 44 selected papers, the papers each one appears in (either intact or as an extension of the initially introduced one) and the type of change it pertains to. Each artefact is numbered using the notation AS (Assessment) MD (Methodology) and a number assigned in descending chronological order, while its title or a short description is also provided. In total, 32 artefacts were introduced in the data set of 44 papers.

Table S3. Artefacts resulting from the SLR.

No	Framework / Methodology title or short description	Papers	Type
AS MD 1	REBUS	paper 1	Reengineering
AS MD 2	Adaptation of The TotalPlant (TM) paradigm to business processes	paper 2	Reengineering
AS MD 3	Performance measurement system for Continuous (Kaizen) and Radical improvement	paper 3	Improvement
AS MD 4	A business-process reengineering approach based on simulation	paper 4	Reengineering
AS MD 5	Systematic optimized design methodology of business process	paper 5	Reengineering
AS MD 6	Business process improvement using Workflow management systems	paper 6	Improvement
AS MD 7	BPR Framework	paper 7	Redesign
AS MD 8	BPTrends Process Redesign methodology	papers 8,26,38	Redesign
AS MD 9	The business process modelling, simulation and	paper 9	Reengineering

	reengineering (BPMSR) lifecycle		
AS MD 10	Process Improvement Methodology by enabling Simulation – Simulation	paper 10	Improvement
AS MD 11	Assessment model of process improvement	paper 11	Improvement
AS MD 12	Framework of continuous improvement	paper 13	Continuous Improvement
AS MD 13	A multicriteria method using Analytic Hierarchy Process (AHP)	paper 15	Redesign
AS MD 14	Conceptual model of process evaluation	paper 16	Improvement
AS MD 15	Framework for assessing readiness in BPR implementation.	paper 17	Reengineering
AS MD 16	Methodology based on time-driven activity-based costing (TDABC)	paper 19	Improvement
AS MD 17	BPR Framework	paper 21	Reengineering
AS MD 18	BPR project development and implementation view	paper 22	Reengineering
AS MD 19	The BPI Roadmap	papers 24,31	Improvement
AS MD 20	Business process redesign methodology to support e-business adoption/use for supply chain improvement	papers 25, 28	Redesign
AS MD 21	A framework including lean, simulation and optimization	paper 27	Improvement (Lean)
AS MD 22	Extended conceptual framework for the assessment of process improvement patterns	paper 29	Improvement
AS MD 23	BPMIMA framework	paper 32	Improvement
AS MD 24	Business Process Assessment Framework	paper 33	Redesign
AS MD 25	Proposed PROM (Process Reengineering Ontology Map) methodology	paper 35	Reengineering
AS MD 26	Khan-Hassan-Butt (KHB) methodology	paper 36	Reengineering
AS MD 27	Eligibility Assessment Mechanism	paper 37	Redesign
AS MD 28	The KPI4BPI approach	paper 39	Improvement
AS MD 29	IBUPROFEN (Improvement and BUsiness Process Refactoring OF Embedded Noise)	paper 40	Refactoring
AS MD 30	Framework for continuous measurement of leanness	paper 41	Improvement (Lean)
AS MD 31	Process redesign framework	paper 42	Redesign
AS MD 32	The BP-RCA Framework	paper 44	Redesign

Section 4. Analysis of Artefacts

This section presents the phases or stages of the assessment artefacts and important information related to the assessment type and generalizability aspects of each artefact.

Table S4. Phases / Stages of each Artefact.

No	AS MD Phases / Stages
AS MD 1	Human factors, Business process simulation, Cases of BPR success and failure, The role of information technology in BPR, Knowledge management and BPR.
AS MD 2	The paradigm is based on four principles of success ± process mapping, failsafing, teamwork, and communication.
AS MD 3	Application of historical performance measurement (Economy, Efficiency, Effectiveness) or new approaches (Activity-based costing, Balanced scorecard) for designing a performance measurement system and applying continuous or radical improvement.
AS MD 4	Build and communicate process map, measure and analyse process performance, develop future process design, enable and implement future designs.
AS MD 5	BPR is decomposed into business reengineering (BR) and process reengineering (PR), corresponding to business strategy formation and business process planning and control in integrated business process management.
AS MD 6	Six research steps for the measurement of real data and simulation, before and after WfM implementation: 0, 1a, 2a, 3, 2b, and 1b.
AS MD 7	Customers, Products, Business Process Operation and Behavioural Views, Organization - Structure - Population, Information and Technology.
AS MD 8	Process level Steps: Understand project, Analyze business processes, Redesign business process, Implement redesigned process, Roll-out redesigned process.
AS MD 9	sub-phases: Changes needed, Defining modelling objectives, Defining modelling boundaries, Data collection and analysis, Business process model development, Business process simulation, Model testing, Model experimentation, Output analysis, Business process change recommendation, Reengineering and improvement, New process performance analysis.
AS MD 10	Assess 'As-Is': Build and Communicate Process Map, Measure and Analyse Process Performance. Build 'To-Be' Develop Future Process Design, Enable and Implement Future Process Design.
AS MD 11	Four analyzed factors: cycle time, process bottleneck, cycle, cost, and resource utilization.
AS MD 12	Layers: information acquisition layer, performance evaluation layer, structural defects identification layer and improved model generation layer.
AS MD 13	Four AHP phases: Phase 1- Building a hierarchical process for the decision problem, Phases 2 and 3 - Pair-wise comparison of each built hierarchical level's elements and Relative weight appraisal between the elements of each two adjacent levels which develops priorities for the alternatives, and Phase 4 - Relative weights aggregation of the different hierarchical levels to provide alternatives' classification of the decision.
AS MD 14	Dimensions of a process: Process Dimensions (Activity, Information Flows, Resources), Performance Measures (e.g., cost, efficiency, time etc.) and Non-Value Added Activities (NVA) Risk Factors (Organizational and Technological).
AS MD 15	The methodology is based on the effect and role of 21 desired organizational capabilities (DOCs) in aspects of BPR.
AS MD 16	The computer-based assessment program, named the Pre-Operative Triage Tool (POTT), was merged with TDABC methodology to demonstrate cost savings.
AS MD 17	Steps: Develop the Business Vision and Business Objective, Identify the Processes to Be Redesigned, Understand and Measure the Existing Processes, Identify the IT levers, Design and Build a prototype of the new processes, Continuous Improvement.
AS MD 18	It considers BPR success factors and encompasses five distinct general phases: Project inception, Processes definition/analysis, Processes change/redesign, Project benefits assessment.

AS MD 19	Phases: Define, Measure, Analyse, Improve and Control.
AS MD 20	Stages: 1. top management commitment and vision, 2. business understanding, 3. identification of relevant supply chain processes and selection of target for re-design, 4. definition of objectives for improvement, 5. understanding the process AS IS, 6. design of process TO BE, 7. implementation of changes, 8. evaluation of changes.
AS MD 21	The simulation can support Lean through the steps: 1) Educational purpose, 2) Facilitation purpose and 3) Evaluation purpose by Evaluating the current state, Evaluating a future state/target condition and Evaluating the implementation.
AS MD 22	Beyond the concepts of process improvement patterns (PIPs) and business processes or application scenarios, the authors introduce organizational objectives, process improvement objectives, and process improvement measures
AS MD 23	The activities that make up the BPMIMA process are: (a) Measurement, (b) Evaluation, (c) Redesign.
AS MD 24	The methodology includes two sets of indicators: (i) one to identify and clearly demonstrate the implementation of the best practice, i.e., Best Practice Implementation indicators (BPIs), and (ii) one to assess process improvements yielded by its application, i.e., Process Performance Indicators (PPIs).
AS MD 25	Steps: preparing for BPR, building ontology, identifying and prioritizing processes, Create the knowledge map, Analyze the maps, modify the business processes and evaluate the results, Update the ontology.
AS MD 26	The KHB methodology is a data-driven process re-engineering (DDPR) and verification technique based on: Process Mapping and Identification, Gathering Quantifiable and Quality Data, Model Verification Technique, Cause and Effect Algorithm and Cause and Effect Relationship (CER) between Functions.
AS MD 27	The mechanism focuses on the input model type, the features of the model that allow optimization (i.e., resequencing capability), the structuredness of the model and the model complexity.
AS MD 28	Four phases: (Re) Design, Configuration, Enactment and Evaluation. The KPI4BPI approach adds for each phase the activities and techniques used to improve business processes based on Key Performance Indicators (KPIs) target values, Process Mining (PM) and redesign patterns.
AS MD 29	IBUPROFEN assesses the Quality (Understandability and Modifiability) of BPMN models and applies a subset of refactoring operators to optimize them.
AS MD 30	For hospital measuring leanness situations, a set of fuzzy numbers for approximating linguistic variable values is adopted. By using the fuzzy numbers, the leanness measure index is calculated.
AS MD 31	The PRF was deployed through the steps: (1) Use activity sequence through stages to build a standard set of activities and design the flow connecting them to depict any envisioned service process, (2) conceive a standard set of roles from functional roles for activities determined in the first step, (3) identify groups of activities from the activities determined in the first step that can be conceived as a “module”, (4) identify all activity parameters to be captured in the SPM, (5) Use easy-to-understand process representation techniques to depict SPM.
AS MD 32	Framework Components: Redesign Technique, Performance Criteria, Redesign Heuristics, BP Complexity. Framework Phases: Selection, Representation, Assessment.

Table S5. Generalizability aspects of each Artefact.

No	1. Can the artefact be applied to all BPs?	2. Does the artefact support different BPC methods?	3. Does the artefact support different process model notations?	4. Does the artefact support the selection of different objectives?	5. Does the artefact support different redesign heuristics?
AS MD 1	X	X			
AS MD 2					
AS MD 3	X	X		X	
AS MD 4	X				
AS MD 5	X				
AS MD 6	X			X	
AS MD 7	X			X	X
AS MD 8	X				
AS MD 9	X	X	X	X	
AS MD 10	X				
AS MD 11	X			X	
AS MD 12	X			X	
AS MD 13	X			X	X
AS MD 14	X			X	
AS MD 15	X				
AS MD 16				X	
AS MD 17	X	X	X	X	
AS MD 18	X			X	
AS MD 19	X				
AS MD 20				X	
AS MD 21	X			X	
AS MD 22	X			X	X
AS MD 23	X				X
AS MD 24	X			X	X
AS MD 25	X				
AS MD 26	X				
AS MD 27	X				
AS MD 28	X				
AS MD 29	X				
AS MD 30					
AS MD 31	X				X
AS MD 32	X	X	X	X	X