UNIVERSITÄT DUISBURG ESSEN

Open-Minded

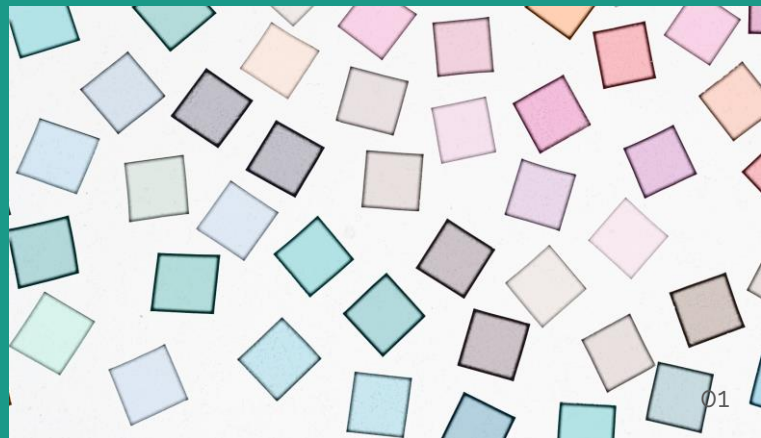
Selecting Appropriate Process Models for IT Projects: Towards a Tool-Supported Decision Approach

by Michael Harr & Sarah Seufert

Research Paper

WI 2023 Conference in Paderborn – 21.09.2023

Agenda



Navigating Complex & Changing Environments

- Digitization leading to IT projects becoming increasingly complex
- Research and Practice acknowledge the need for systematic process models
- Process models are "axiomatically appropriate" (Fitzgerald, 1998, p. 317)
- Established and widespread use in practice

Most IT Projects Fail

Only

15 %

of software projects are delivered as planned

Average IT project overruns the budget by

27 %

1/6 IT projects overruns the budget by

200 %

and the timeframe by

70 %

Sources: PricewaterhouseCoopers (2014), The Standish Group (2015)

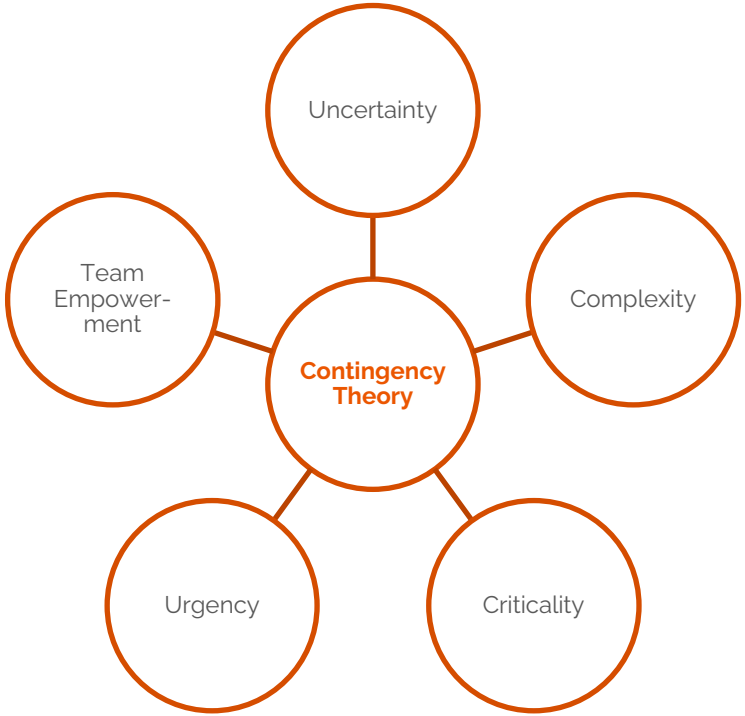
Lost in Translation Gap

- Advice of consultants, seeking to sell their own approaches
- Compliance with certificates
- Retention of the status quo
- Theoretical approaches without practical implementation

RQ: How can the decision-making capabilities of organizations be enhanced for the selection and evaluation of process models for IT projects?

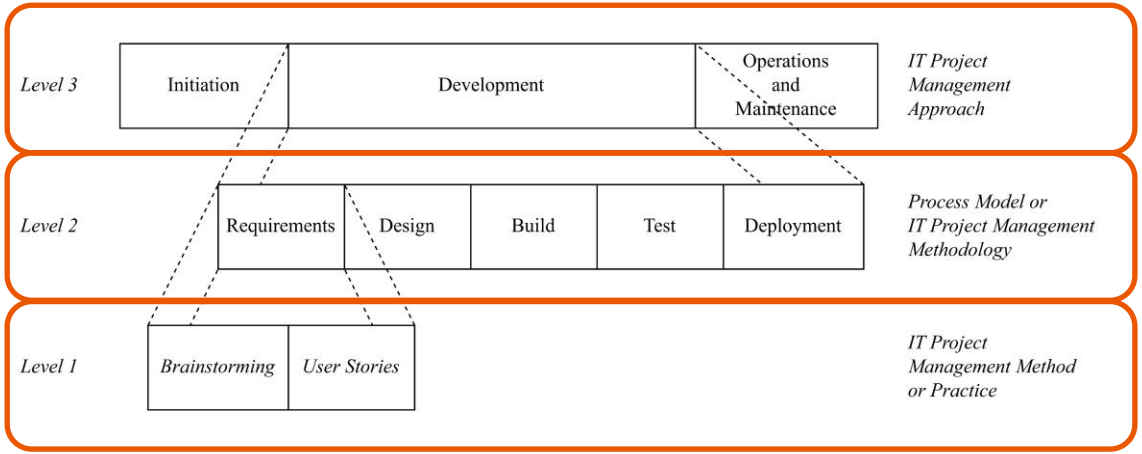
Contingency Theory

- Survival and effectiveness are tied to organization's alignment with specific contexts
- IT projects are contingent upon their type and specific characteristics



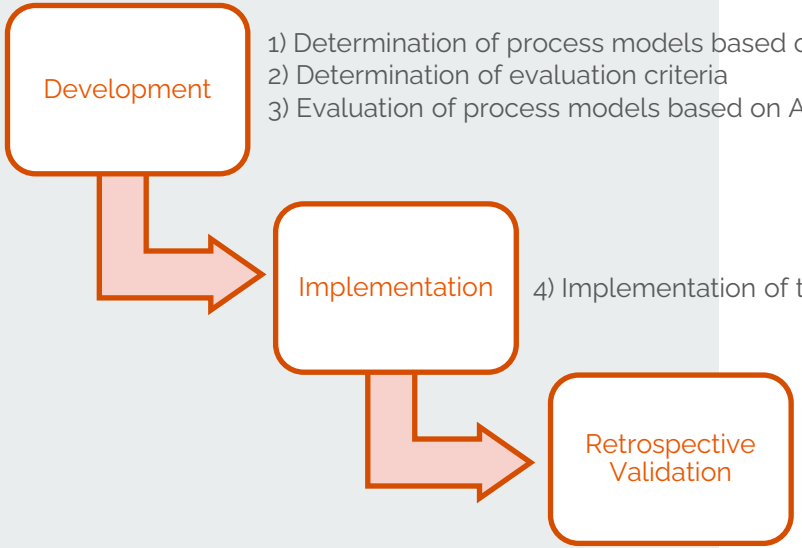
Sources: Howell et al. (2010), Drazin & de Ven (1985)

Delimitation of Ambiguous Terms



Sources: Alexander & Davis (1991)

Method



1) Determination of process models based on a systematic literature review
2) Determination of evaluation criteria
3) Evaluation of process models based on Albers (2021)

4) Implementation of the decision model in the self-enforcing network (SEN)

5) Retrospective validation based on an online survey with experts
6) Comparison to Albers' (2021) proposed decision model

Decision Field

Our model includes

17

process models as alternatives in the decision field.

- 6 traditional
- 9 agile
- 2 hybrid

Our model includes

81

process model characteristics from five contingency dimensions ordered in four topics.

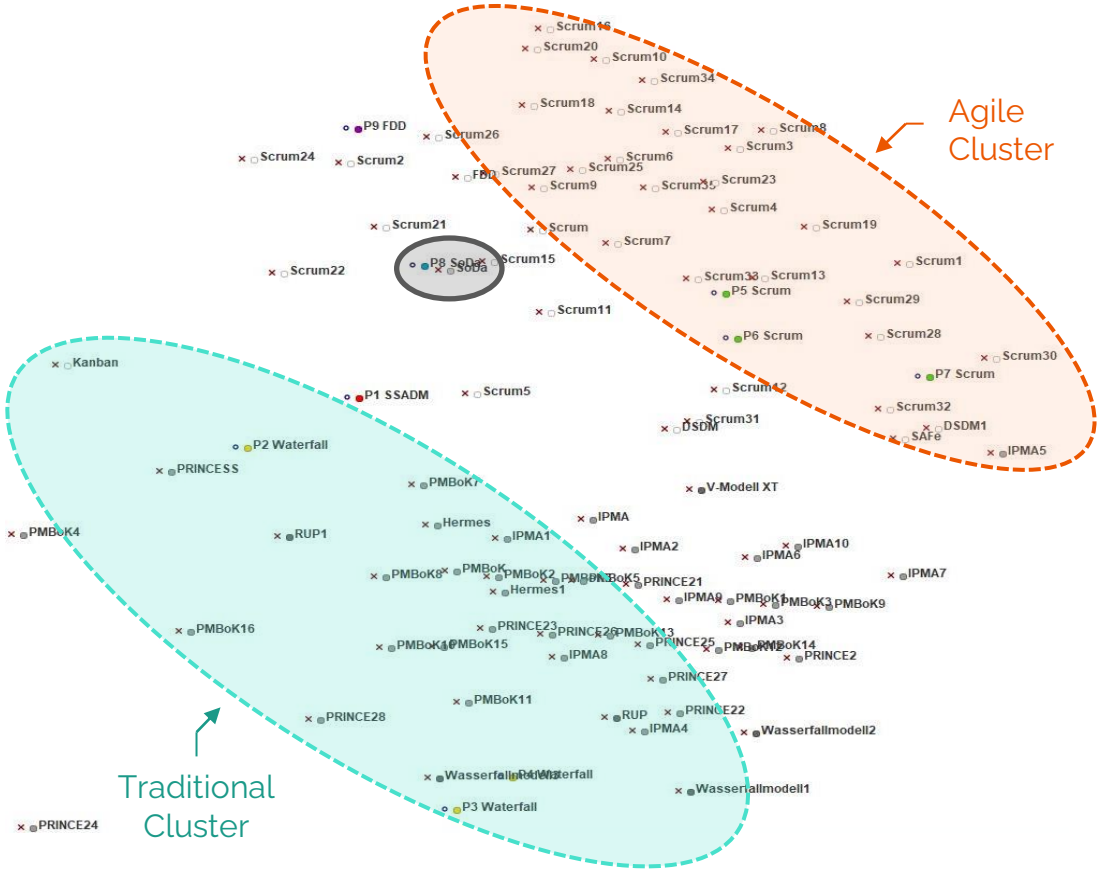
- 15 project-specific
- 37 project management-specific
- 17 project team-specific
- 12 organizational

Sources: Albers (2021)

Implement ation

Criteria c_n	*Attribute name*	cvf_a	*Author(s)*
c_6	Novelty / Market uncertainty	2.0	(Ratbe *et al.*, 1999;
c_{13}	(IT project) complexity	2.0	Ahimbisibwe *et al.*,
c_{15}	(IT product) complexity	2.0	2017; Butler *et al.*,
c_{39}	Requirements volatility	2.0	2020; Ciric *et al.*, 2022)
c_{38}	Time of requirements elicitation	1.5	(Beck *et al.*, 2001;
c_{44}	Stakeholder integration	1.5	Fowler & Highsmith,
c_{59}	Team's hierarchical task organi-zation	1.5	2001)
c_{61}	Team communication culture	1.5	
c_{62}	Reflection on collaboration	1.5	
c_{64}	Willingsness to learn and change	1.5	
c_{67}	Trust within the team	1.5	

Validation

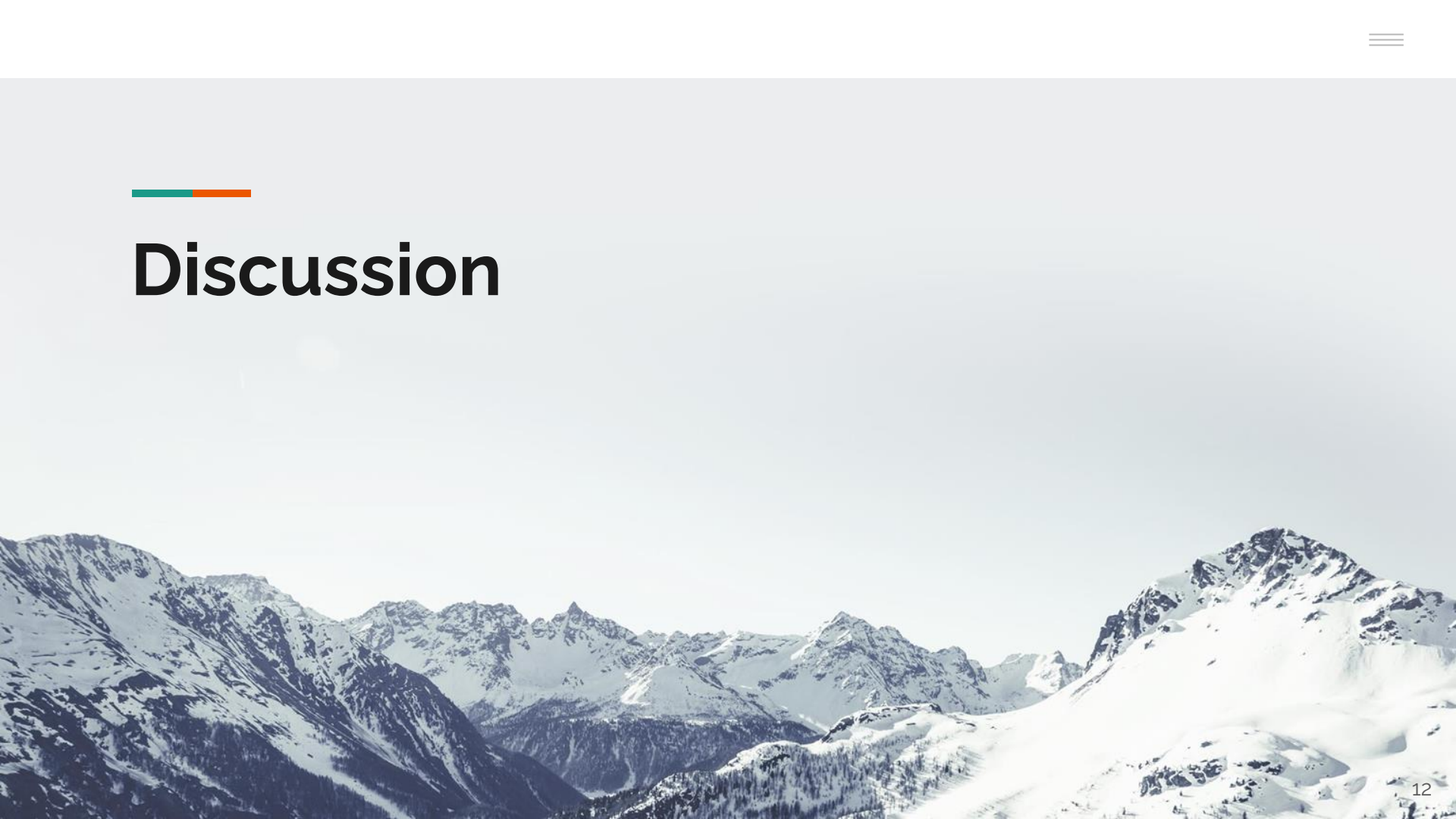

Agile Cluster
Traditional Cluster
Scrum16
Scrum20
Scrum10
Scrum34
Scrum18
Scrum14
P9 FDD
Scrum26
Scrum17
Scrum8
Scrum3
Scrum24
Scrum2
Scrum6
FDD
Scrum27
Scrum25
Scrum9
Scrum35
Scrum23
Scrum4
Scrum21
Scrum
Scrum19
Scrum7
P8 SoDa
Scrum15
Scrum1
Scrum22
Scrum33
Scrum13
P5 Scrum
Scrum29
Scrum11
P6 Scrum
Scrum28
Scrum30
P7 Scrum
Kanban
P1 SSADM
Scrum5
Scrum42
Scrum32
Scrum31
DSDM
DSDM1
SAFe
IPMA5
P2 Waterfall
PRINCESS
PMBoK7
V-Modell XT
IPMA
PMBoK4
RUP1
Hermes
IPMA1
IPMA2
IPMA10
IPMA6
PMBoK8
PMBoK
PMBoK2
PMBoK5
PRINCE21
IPMA7
Hermes1
IPMA9
PMBoK1
PMBoK3
PMBoK9
IPMA3
PMBoK16
PRINCE23
PRINCE26
PMBoK13
PMBoK15
PRINCE25
PMBoK14
IPMA8
PRINCE2
PRINCE27
PMBoK11
PRINCE28
RUP
PRINCE22
IPMA4
Wasserfallmodell2
Wasserfallmodell1
P3 Waterfall
PRINCE24

Conclusion & Limitations

- Self-reported, subjective online questionnaire
- Limited sample size (9 IT projects)
- Assumption that successful IT projects also adopted appropriate process models

- AI- and ML-based weighted decision model based on previous work by Albers (2021)
- Easy applicability for organizations
- We add to the ongoing discourse on situational method engineering and contingency theory
- Address the dynamic nature of process models, adapting to volatile contextual factors

Discussion



Literature

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- **Fitzgerald, B**. (1998), 'An empirical investigation into the adoption of systems development methodologies', Information & Management, 34(6), pp. 317–328.
- **Fowler, M. & Highsmith, J.** (2001), 'The Agile Manifesto', Software Development, 9, pp. 28–32.
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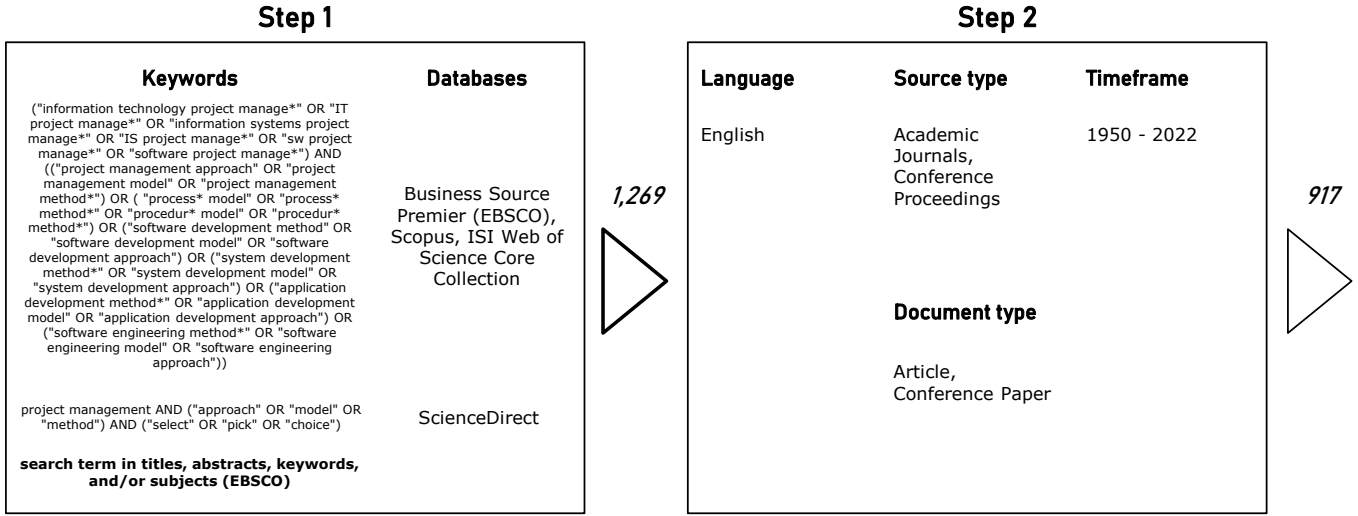
- **PricewaterhouseCoopers** (2014), Project Management: Improving performance, reducing risk. https://www.pwc.com/jg/en/publications/ned-presentation-project-management.pdf. Accessed: 05/01/2023.
- **Ratbe, D., King, W.R. & Kim, Y.G**. (1999), 'The fit between project characteristics and application development methodologies: A contingency approach', Journal of Computer Information Systems, 40(2), pp. 26–33.
- **The Standish Group** (2010), Chaos Report. Boston.

Appendix

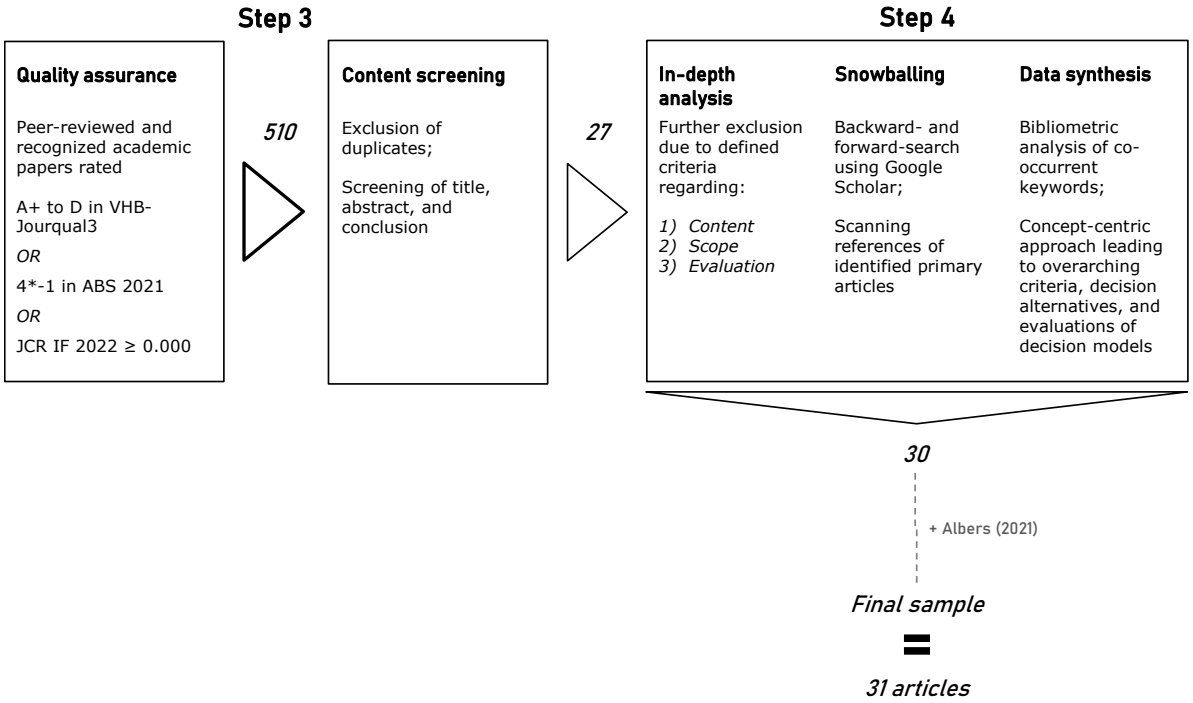
SLR – Pilot Search

Main Term	Synonyms/Homonyms	Exemplary Author(s)
IT Project Management	Information Systems Project Management OR IS Project Management	(Mahaney and Lederer 2003, 2010; Mastrogiacomo et al. 2014; Botchkarev and Finnigan 2015)
	Software Project Management OR SW Project Management	(Boehm and Ross 1989; Jurison 1999; Azenha et al. 2021; Saleem et al. 2021)
Model	Methodology	(Wells 2012; Babenko et al. 2019; Jayakody and Wijayanayake 2021)
	Method	(Cervone 2011; Tripp et al. 2016; Cooper and Sommer 2018; Tripp and Armstrong 2018)
	Approach	(Lee and Xia 2010; Gemino et al. 2021; Ciric et al. 2022)
Process Model	Procedural Model OR Procedure Model	(Fettke et al. 2002; Bauer et al. 2019; El Mariouli and Laassiri 2019; Thesing et al. 2021)
	Software Development Model OR Software Development Method OR Software Development Approach OR Software Development Methodology	(Selby et al. 1987; Moløkken-Østvold and Jørgensen 2005; Brhel et al. 2015; Bilgaiyan et al. 2016; Vijayasarathy and Butler 2016; Bakhtouchi and Rahmouni 2018)
	Systems Development Model OR Systems Development Method OR Systems Development Approach OR Systems Development Methodology	(Fitzgerald 1996, 1997, 1998; Iivari and Huisman 2007; Karlsson and Pär 2009; Baghizadeh et al. 2020; Lagstedt et al. 2022)
	Software Engineering Model OR Software Engineering Method OR Software Engineering Approach OR Software Engineering Methodology	(Mohammed et al. 2010; Gu and Lago 2011; Bavota et al. 2012; Fitsilis and Lekatos 2017)
	Project Management Model OR Project Management Method OR Project Management Approach OR Project Management Methodology	(Mohan and Ahlemann 2010; Wells 2012; Gonzalez 2014; Joslin and Müller 2015; Markopoulos 2020; Ciric et al. 2022)

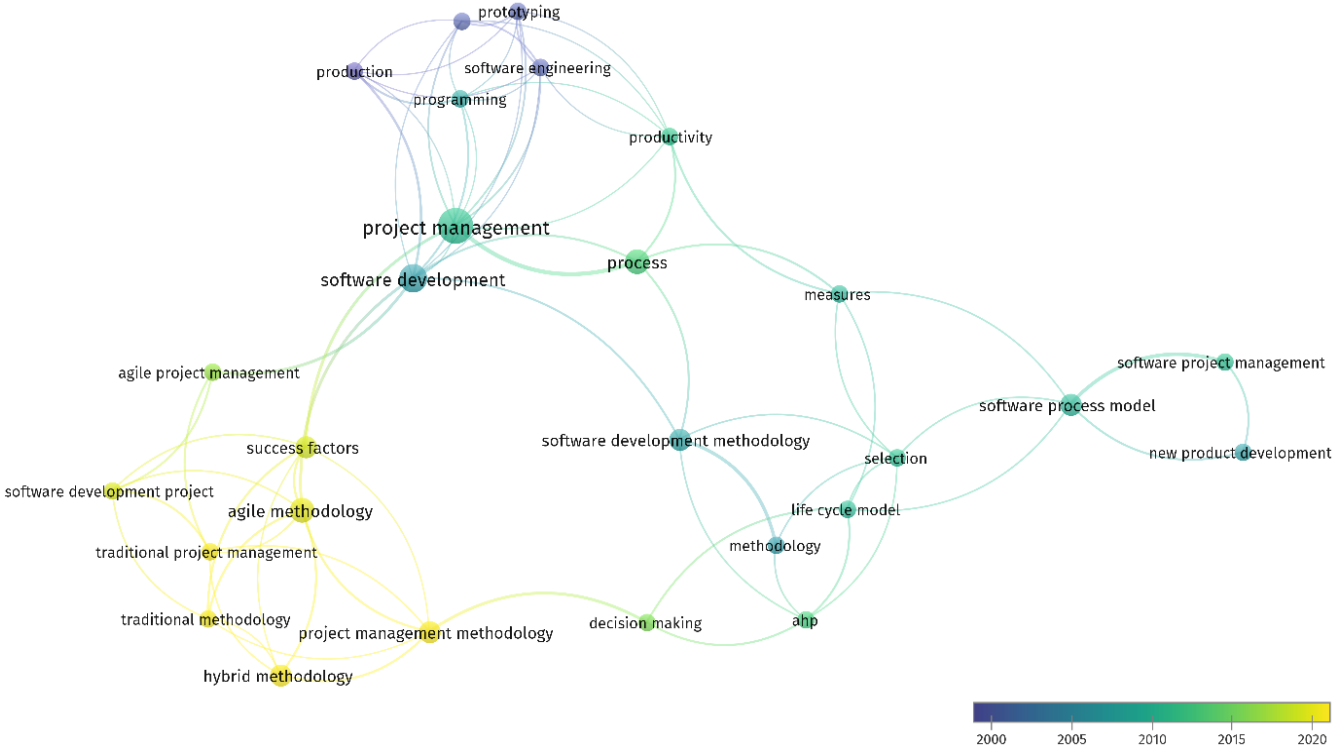
SLR (1)


Step 1
Keywords
("information technology project manage*" OR "IT project manage*" OR "information systems project manage*" OR "IS project manage*" OR "sw project manage*" OR "software project manage*") AND (("project management approach" OR "project management model" OR "project management method*") OR ("process* model" OR "process* method*" OR "procedur* model" OR "procedur* method*") OR ("software development method" OR "software development model" OR "software development approach") OR ("system development method*" OR "system development model" OR "system development approach") OR ("application development method*" OR "application development model" OR "application development approach") OR ("software engineering method*" OR "software engineering model" OR "software engineering approach"))
project management AND ("approach" OR "model" OR "method") AND ("select" OR "pick" OR "choice")
search term in titles, abstracts, keywords, and/or subjects (EBSCO)
Databases
Business Source Premier (EBSCO), Scopus, ISI Web of Science Core Collection
ScienceDirect
1,269
Step 2
Language
English
Source type
Academic Journals, Conference Proceedings
Timeframe
1950 - 2022
Document type
Article, Conference Paper
917

SLR (2)


Step 3
Step 4
Quality assurance
Peer-reviewed and recognized academic papers rated
A+ to D in VHB-Jourqual3
OR
4*-1 in ABS 2021
OR
JCR IF 2022 ≥ 0.000
510
Content screening
Exclusion of duplicates;
Screening of title, abstract, and conclusion
27
In-depth analysis
Further exclusion due to defined criteria regarding:
1) Content
2) Scope
3) Evaluation
Snowballing
Backward- and forward-search using Google Scholar;
Scanning references of identified primary articles
Data synthesis
Bibliometric analysis of co-occurrent keywords;
Concept-centric approach leading to overarching criteria, decision alternatives, and evaluations of decision models
30
+ Albers (2021)
Final sample
=
31 articles

SLR Results VOSv



SLR Results Decision Models (lvl. 3)

Hierarchy	Approach	T	H	A
Level 3: *IT project management approach*	**T**	(Turner and Cochrane 1993; Payne and Turner 1999)		
	H			
	A	(Little 2005; Shenhar and Dvir 2007b; Howell et al. 2010; Špundak 2012; Kuchta and Skowron 2016; Ahimbisibwe et al. 2017; Kokkeler 2018; Butler et al. 2020)		(Austin and Devin 2009; Young et al. 2016)
	All approaches (T, H, A)	(Wysocki 2019; Azenha et al. 2021; Ciric et al. 2022; Lagstedt et al. 2022)		

SLR Results Decision Models (lvl. 2)

Hierar-chy	Process Models	T	H	A
Level 2: *Process models*	**T**	(Song et al. 2016)		
	H	(Carvalho et al. 2011)		
	A	(Davis et al. 1988; Alexander and Davis 1991; Ratbe et al. 1999; Charvat 2003; Kettunen and Laanti 2005; Jain and Chandrasekaran 2009; Hicdurmaz 2012; Moyo et al. 2013; Dawson and Dawson 2014)		
	All pro-cess models (T, H, A)	(Albers 2021)		

Decision Field – Process Models

Traditional approach		Hybrid approach		Agile approach	
pm_1	Build & Fix	pm_{16}	AUP	pm_7	Crystal
pm_2	RUP	pm_{17}	SoDa	pm_8	DSDM
pm_3	Spiral model			pm_9	FDD
pm_4	SSADM			pm_{10}	TDD
pm_5	V-Model XT			pm_{11}	Kanban
pm_6	Waterfall model			pm_{12}	OEP
				pm_{13}	SAFe
				pm_{14}	Scrum
				pm_{15}	ScrumBan

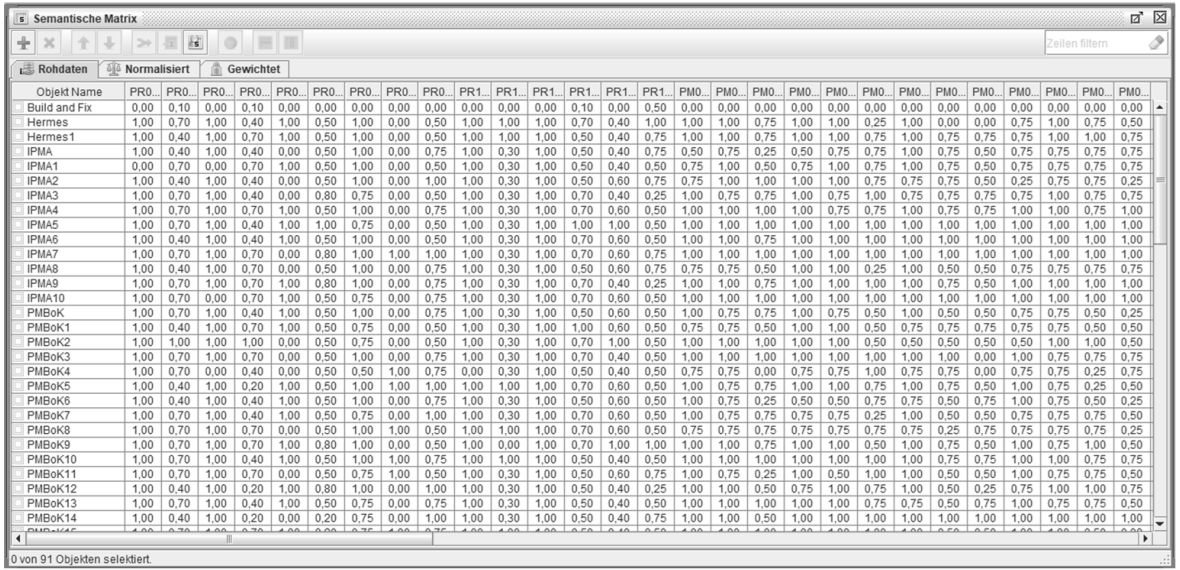
Standards and frameworks used in the decision model but not in the conducted survey

pm_{18}	*HERMES*
pm_{19}	*PMBoK*
pm_{20}	*Prince 2*
pm_{21}	*PRINCESS*
pm_{22}	*IPMA*

Decision Field – Criteria

IT project criteria		IT project management criteria		IT project team criteria		Organizational criteria	
c_1	Time limitation	c_{16}	Total PP coverage	c_{53}	Team location	c_{70}	Organizational hierarchies
c_2	Timeframe	c_{17}	Coverage PP initiation	c_{54}	Virtual teams	c_{71}	Unplanned additional work
c_3	Budget profile	c_{18}	Coverage PP setting up project infrastructure	c_{55}	Team diversity	c_{72}	Management style organization
c_4	Budget size	c_{19}	Coverage PP planning	c_{56}	Team size	c_{73}	Qualification programs incentives
c_5	Uniqueness	c_{20}	Coverage PP closing	c_{57}	Team's process model experience	c_{74}	Monetary incentives
c_6	Novelty / Market uncertainty	c_{21}	Coverage PP planning instruments	c_{58}	Certifications	c_{75}	Company-wide default process model
c_7	Goal uncertainty	c_{22}	CS risk management	c_{59}	Team's hierarchical task organization	c_{76}	CS metrics CPI
c_8	Monetary benefit	c_{23}	CS incident management	c_{60}	Team's task allocation type	c_{77}	CS metrics CMMI
c_9	Demarcation project organization	c_{24}	CS error management	c_{61}	Team communication culture	c_{78}	CS metrics automotive SPICE (or MAN.3)

Implementation – Raw Data


Semantische Matrix

Zeilen filtern

Rohdaten | Normalisiert | Gewichtet

Objekt Name	PR0...	PR0...	PR0...	PR0...	PR0...	PR0...	PR0...	PR0...	PR0...	PR1...	PR1...	PR1...	PR1...	PR1...	PR1...	PM0...	PM0...	PM0...	PM0...	PM0...	PM0...	PM0...	PM0...	PM0...	PM0...	PM0...	PM0...	PM0...
Build and Fix	0,00	0,10	0,00	0,10	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,10	0,00	0,50	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Hermes	1,00	0,70	1,00	0,40	1,00	0,50	1,00	0,00	0,50	1,00	1,00	1,00	0,70	0,40	1,00	1,00	1,00	0,75	1,00	1,00	0,25	1,00	0,00	0,00	0,75	1,00	0,75	0,50
Hermes1	1,00	0,40	1,00	0,70	1,00	0,50	1,00	0,00	0,50	1,00	1,00	1,00	0,50	0,40	0,75	1,00	1,00	0,75	1,00	1,00	0,75	1,00	0,75	0,75	0,75	1,00	1,00	0,75
IPMA	1,00	0,40	1,00	0,40	0,00	0,50	1,00	0,00	0,75	1,00	0,30	1,00	0,50	0,40	0,75	0,50	0,75	0,25	0,50	0,75	0,75	1,00	0,75	0,50	0,75	0,75	0,75	0,75
IPMA1	0,00	0,70	0,00	0,70	1,00	0,50	1,00	0,00	0,50	1,00	0,30	1,00	0,50	0,40	0,50	0,75	1,00	0,50	0,75	1,00	0,75	1,00	0,75	0,50	0,75	0,75	0,75	0,75
IPMA2	1,00	0,40	1,00	0,40	0,00	0,50	1,00	0,00	1,00	1,00	0,30	1,00	0,50	0,60	0,75	0,75	1,00	1,00	1,00	1,00	0,75	0,75	0,75	0,50	0,25	0,75	0,75	0,25
IPMA3	1,00	0,70	1,00	0,40	0,00	0,80	0,75	0,00	0,50	1,00	0,30	1,00	0,70	0,40	0,25	1,00	0,75	0,75	1,00	0,75	1,00	0,75	0,75	0,75	0,75	1,00	0,75	0,75
IPMA4	1,00	0,70	1,00	0,70	1,00	0,50	1,00	0,00	0,75	1,00	0,30	1,00	0,70	0,60	0,50	1,00	1,00	1,00	1,00	0,75	0,75	1,00	0,75	0,75	1,00	1,00	0,75	1,00
IPMA5	1,00	0,70	1,00	0,40	1,00	1,00	0,75	0,00	0,50	1,00	0,30	1,00	1,00	1,00	0,50	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
IPMA6	1,00	0,40	1,00	0,40	1,00	0,50	1,00	0,00	0,50	1,00	0,30	1,00	0,70	0,60	0,50	1,00	1,00	0,75	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
IPMA7	1,00	0,70	1,00	0,70	0,00	0,80	1,00	1,00	1,00	1,00	0,30	1,00	0,70	0,60	0,75	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
IPMA8	1,00	0,40	1,00	0,70	0,00	0,50	1,00	0,00	0,75	1,00	0,30	1,00	0,50	0,60	0,75	0,75	0,75	0,50	1,00	1,00	0,25	1,00	0,50	0,50	0,75	0,75	0,75	0,75
IPMA9	1,00	0,70	1,00	0,70	1,00	0,80	1,00	0,00	0,75	1,00	0,30	1,00	0,70	0,40	0,25	1,00	1,00	0,75	1,00	1,00	1,00	1,00	0,75	0,50	1,00	1,00	1,00	1,00
IPMA10	1,00	0,70	0,00	0,70	1,00	0,50	0,75	0,00	0,75	1,00	0,30	1,00	0,70	0,60	0,50	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
PMBoK	1,00	0,70	1,00	0,40	1,00	0,50	1,00	0,00	0,75	1,00	0,30	1,00	0,50	0,60	0,50	1,00	0,75	0,75	1,00	0,75	0,50	1,00	0,50	0,50	0,75	0,75	0,50	0,25
PMBoK1	1,00	0,40	1,00	0,70	1,00	0,50	0,75	0,00	0,50	1,00	0,30	1,00	1,00	0,60	0,50	0,75	0,75	0,50	1,00	1,00	0,50	0,75	0,75	0,75	0,75	0,75	0,50	0,50
PMBoK2	1,00	1,00	1,00	1,00	0,00	0,50	0,75	0,00	0,50	1,00	0,30	1,00	0,70	1,00	0,50	1,00	1,00	1,00	1,00	1,00	0,50	0,50	0,50	0,50	0,50	1,00	1,00	0,50
PMBoK3	1,00	0,70	1,00	0,70	0,00	0,50	1,00	0,00	0,75	1,00	0,30	1,00	0,70	0,40	0,50	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	0,00	1,00	0,75	0,75	0,75
PMBoK4	1,00	0,70	0,00	0,40	0,00	0,50	0,50	1,00	0,75	0,00	0,30	1,00	0,50	0,40	0,50	0,75	0,75	0,00	0,75	0,75	1,00	0,75	0,75	0,00	0,75	0,75	0,25	0,75
PMBoK5	1,00	0,40	1,00	0,20	1,00	0,50	1,00	1,00	1,00	1,00	1,00	1,00	0,70	0,60	0,50	1,00	0,75	0,75	1,00	1,00	0,75	1,00	0,75	0,50	1,00	0,75	0,25	0,50
PMBoK6	1,00	0,40	1,00	0,40	1,00	0,50	1,00	0,00	0,75	1,00	0,30	1,00	0,50	0,60	0,50	1,00	0,75	0,25	0,50	0,50	0,75	0,75	0,50	0,75	1,00	0,75	0,50	0,25
PMBoK7	1,00	0,70	1,00	0,40	1,00	0,50	0,75	0,00	1,00	1,00	0,30	1,00	0,70	0,60	0,50	1,00	0,75	0,75	0,75	0,75	0,25	1,00	0,50	0,50	0,75	0,75	0,75	0,50
PMBoK8	1,00	0,70	1,00	0,70	0,00	0,50	1,00	1,00	0,50	1,00	1,00	1,00	0,70	0,60	0,50	0,75	0,75	0,75	0,75	0,75	0,75	0,25	0,75	0,75	0,75	0,75	0,75	0,25
PMBoK9	1,00	0,70	1,00	0,70	1,00	0,80	1,00	0,00	0,50	1,00	0,00	1,00	0,70	1,00	1,00	1,00	1,00	0,75	1,00	1,00	0,50	1,00	0,75	0,50	1,00	0,75	1,00	0,50
PMBoK10	1,00	0,70	1,00	0,40	1,00	0,50	1,00	1,00	0,75	1,00	1,00	1,00	0,50	0,40	0,50	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	0,75	0,75	1,00	1,00	0,75	0,75
PMBoK11	1,00	0,70	1,00	0,70	0,00	0,50	0,75	1,00	0,50	1,00	0,30	1,00	0,50	0,60	0,75	1,00	0,75	0,25	1,00	0,50	1,00	1,00	0,50	0,50	1,00	0,75	0,75	0,50
PMBoK12	1,00	0,40	1,00	0,20	1,00	0,80	1,00	0,00	1,00	1,00	0,30	1,00	0,50	0,40	0,25	1,00	1,00	0,50	0,75	1,00	0,75	1,00	0,50	0,25	0,75	1,00	1,00	0,75
PMBoK13	1,00	0,70	1,00	0,40	1,00	0,50	0,75	0,00	0,75	1,00	0,30	1,00	0,50	0,40	0,50	1,00	1,00	1,00	1,00	1,00	0,75	0,75	0,50	0,75	1,00	0,75	0,75	0,50
PMBoK14	1,00	0,40	1,00	0,20	0,00	0,20	0,75	0,00	1,00	1,00	0,30	1,00	0,50	0,40	0,75	1,00	1,00	0,50	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00

0 von 91 Objekten selektiert.