Master thesis literature review data

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1 Introduction

This paper is an attachment to the master thesis by myself Borgen [8]. This paper presents the data from round 1 and 2 in the literature review, as presented in Chapter 3 of Borgen [8]. The tables used to present the data was defined in Chapter 3 of Borgen [8], but are presented here for redundancy in Table 1 and Table 2.

Quality Assessment Question	Score
Study ID	
Are the aims or research questions clearly stated?	
Is the research method, process or design clearly stated?	
Is the research method likely to have introduced significant bias?	
Are the data collection methods adequately described?	
Was the denominator (i.e. the population size), sample size, composition and coverage reported?	
How well have the detail, depth, and complexity (i.e. richness) of the data been conveyed?	
Are negative findings presented?	
Are important effects overlooked?	
How credible are the findings?	
If credible, are they important?	
How well has knowledge or understanding been extended by the research?	
How well is the scope for drawing wider inference explained?	
How well has the approach to, and formulation of, analysis been conveyed?	
How well was the diversity of perspective and context explored?	
How clear and coherent is the research?	
How clear are the assumptions/theoretical perspectives/values that have shaped the form and output of the evaluation?	
Do the researchers explain the consequences of any problems in relation to the validity/reliability of their measures?	

Table 1: Quality Assessment checklist, as presented in Borgen [8], that is slightly modified from the original from Borgen [7]

Data collection form Question	 Answer
Study ID	
Main categories	
Classification	
Metrics or measures	
Quality Assesment discussion	
Research question or issue	
Summary of paper	
Evaluation of paper	
Main findings	
Rapidchain specifics	
Rapidchain applications	
Future work	

Table 2: Data collection form, as presented in Borgen [8], that is slightly modified from the original from Borgen [7]

2 Round 1

Data collection form Title	 Accepted	 Notes	 Url
Blockchain for AI: Review and open research challenges	X	Application	`https://ieeexplore.ieee.org/iel7/6287639/6514899/08598784.pdf`
A survey on consensus mechanisms and mining strategy management in blockchain networks	X	No new information or discussion [has a comparison of sharding with scale out papers]	`https://ieeexplore.ieee.org/iel7/6287639/6514899/08629877.pdf`
SoK: Consensus in the age of blockchains	V	nan	`https://dl.acm.org/doi/pdf/10.1145/3318041.3355458`
Monoxide: Scale out blockchains with asynchronous consensus zones	V	improvment (not specific to rapidchain)	`https://www.usenix.org/system/files/nsdi19-wang-jiaping.pdf`

Towards scaling blockchain systems via sharding	V	Discussion, improvment (not specific to rapidchain), but uses TEE	https://dl.acm.org/doi/pdf/10.1145/3299869.3319889
Proof-of-Stake Sidechains.	X	Not related to rapidchain or any similar constructions	https://eprint.iacr.org/2018/1239.pdf
LightChain: A Lightweight Blockchain System for Industrial Internet of Things	X	Application	https://cse.buffalo.edu/~wenyaoxu/papers/journal/xu-tii2019.pdf
Polyshard: Coded sharding achieves linearly scaling efficiency and security simultaneously	V	An improvment to sharding?	https://arxiv.org/pdf/1809.10361
A game-theoretic analysis of shard-based permissionless blockchains	V	Game theory and incentive to similar pconstructions	https://ieeexplore.ieee.org/iel7/6287639/6514899/08558531.pdf
Flyclient: Super-Light Clients for Cryptocurrencies.	V	Minimizing the amount of data needed for verification. But no special relation to rapidchain other than the main author Zamani.	https://eprint.iacr.org/2019/226.pdf
Parallel Chains: Improving Throughput and Latency of Blockchain Protocols via Parallel Composition.	X	Not related to rapidchain	https://pdfs.semanticscholar.org/6116/a7c1c0820e357204e9277901c82bd38c35a5.pdf
OHIE: blockchain scaling made simple	X	Not related to comitte based constructions	https://arxiv.org/pdf/1811.12628
Fine-grained, secure and efficient data provenance on blockchain systems	X	Does not cite rapidchain	https://dl.acm.org/ft_gateway.cfm?id=3342042&type=pdf

BlockchainDB: a shared database on blockchains	V	Extra storage layer above blockchain, proposes sharding chains as backend. Could this construction allow more effecient transaction storage?	https://dl.acm.org/ft_gateway.cfm?id=3360366&type=pdf
Flash: efficient dynamic routing for offchain networks	X	Does not cite rapidchain	https://dl.acm.org/doi/pdf/10.1145/3359989.3365411
YODA: Enabling computationally intensive contracts on blockchains with Byzantine and Selfish nodes	X	Does not relate to comitee based constructions. But it's results are interesting	https://arxiv.org/pdf/1811.03265
Mystiko—Blockchain Meets Big Data	X	Not related	https://ieeexplore.ieee.org/iel7/8610059/8621858/08622341.pdf
Replay attacks and defenses against cross-shard consensus in sharded distributed ledgers	V	Attack vectors for comitee based sharding	https://arxiv.org/pdf/1901.11218
SoK: A Taxonomy for Layer-2 Scalability Related Protocols for Cryptocurrencies.	X	not related	https://www.researchgate.net/profile/Mario_Larangeira2/publication/332859444_SoK_A_Taxonomy_for_Layer-2_Scalability_Related_Protocols_for_Cryptocurrencies/links/5ccd585ea6fdccc9dd8b964e/SoK-A-Taxonomy-for-Layer-2-Scalabilit pdf

Velocity: Scalability improvements in block propagation through rateless erasure coding	V	May provide discussion or improvements on block gossiping. But did not discuss rapidchain at all in this context	https://ieeexplore.ieee.org/iel7/8744142/8751228/08751427.pdf
Lightchain: A dht-based blockchain for resource constrained environments	X	Not related and no relevant discussion	https://arxiv.org/pdf/1904.00375
A survey on consensus protocols in blockchain for iot networks	X	No relevant discussion	https://arxiv.org/pdf/1809.05613
Proof-of-stake sidechains	V	nan	https://ieeexplore.ieee.org/iel7/8826229/8835208/08835275.pdf
Agent-based simulations of blockchain protocols illustrated via kadena's chainweb	X	Not relevant	https://ieeexplore.ieee.org/iel7/8790672/8802376/08802494.pdf
Ostraka: Secure Blockchain scaling by node sharding	V	Relevant discussion of attack vectors	https://arxiv.org/pdf/1907.03331
A survey on efficient parallelization of blockchain-based smart contracts	X	No relevant discussion	https://arxiv.org/pdf/1904.00731
Committee selection is more similar than you think: Evidence from avalanche and stellar	V	Might provide some relevant discussion on comitte selection	https://arxiv.org/pdf/1904.09839
Sok: Sharding on blockchain	V	Might provide some relevant discussion on comitte based sharding	https://dl.acm.org/doi/pdf/10.1145/3318041.3355457
Robust and scalable consensus for sharded distributed ledgers	V	Maybe relevant discussion, and improvment on byzcoin which is in the same research line. From the author of omniledger	https://eprint.iacr.org/2019/676.pdf

A security reference architecture for blockchains	V	Security and attack vectors	https://ieeexplore.ieee.org/iel7/8938397/8946120/08946197.pdf
Anchoring the value of Cryptocurrency	X	economics	https://ieeexplore.ieee.org/iel7/9040368/9050160/09050264.pdf
SeF: A secure fountain architecture for slashing storage costs in blockchains	V	May provide discussion or improvements on block gossiping. But did not discuss rapidchain much in this context	https://arxiv.org/pdf/1906.12140
Segment blockchain: A size reduced storage mechanism for blockchain	X	Does not cite rapidchain.	https://ieeexplore.ieee.org/iel7/6287639/8948470/08957450.pdf
Don't Mine, Wait in Line: Fair and Efficient Blockchain Consensus with Robust Round Robin	V	A little bit of dicussion on rapidchain	https://arxiv.org/pdf/1804.07391
On the Security of Blockchain Consensus Protocols	V	Might provide some security discussion	https://link.springer.com/content/pdf/10.1007%2F978-3-030-05171-6_24.pdf
Cycledger: A scalable and secure parallel protocol for distributed ledger via sharding	V	A successor to rapidchain?	https://arxiv.org/pdf/2001.06778
Design and Implementation of a Scalable IoT-based Blockchain	V	A successor to rapidchain? Might provide some good comitte based sharding details	https://files.ifi.uzh.ch/CSG/staff/Rafati/Kursat-Aydinli-MA.pdf

A flexible n/2 adversary node resistant and halting recoverable blockchain sharding protocol	V	Might provide good discussion	https://onlinelibrary.wiley.com/doi/pdf/10.1002/cpe.5773
Sok: Communication across distributed ledgers	V	Discussion on cross-chain communication	http://www0.cs.ucl.ac.uk/staff/M.AlBassam/publications/crosschain.pdf
A methodology for a probabilistic security analysis of sharding-based blockchain protocols	V	security analysis	http://www.iro.umontreal.ca/~ahafid/docs/Hafid-blockchain.pdf
XBlock-EOS: Extracting and Exploring Blockchain Data From EOSIO	X	not relevant	https://arxiv.org/pdf/2003.11967
Microchain: A Hybrid Consensus Mechanism for Lightweight Distributed Ledger for IoT	X	not relevant	https://arxiv.org/pdf/1909.10948
The Security Reference Architecture for Blockchains: Towards a Standardized Model for Studying Vulnerabilities, Threats, and Defenses	V	security	https://arxiv.org/pdf/1910.09775
Scalable network-coded PBFT consensus algorithm	V	reducing communication burden	https://ieeexplore.ieee.org/iel7/8827389/8849208/08849573.pdf
Public blockchains scalability: An examination of sharding and segregated witness	X	not relevant	nan

Hyperservice: Interoperability and programmability across heterogeneous blockchains	X	Does not cite rapidchain	https://dl.acm.org/doi/pdf/10.1145/3319535.3355503
Divide and Scale: Formalization of Distributed Ledger Sharding Protocols	V	Formalization of rapidchain and detailed analysis?	https://arxiv.org/pdf/1910.10434
Solutions to scalability of blockchain: A survey	X	No relevant discussion	https://ieeexplore.ieee.org/iel7/6287639/8948470/08962150.pdf
Survey: Sharding in blockchains	V	Very relevant. (And also manalysis ethereum 2.0)	https://ieeexplore.ieee.org/iel7/6287639/8948470/08954616.pdf
Open infrastructure for edge: A distributed ledger outlook	X	not relevant	https://www.usenix.org/system/files/hotedge19-paper-zavodovski_0.pdf
How to Securely Prune Bitcoin's Blockchain	V	block pruning	https://arxiv.org/pdf/2004.06911
Replicated state machines without replicated execution	X	not relevant	https://eprint.iacr.org/2020/195.pdf
Evaluation and Improving Scalability of the BAZO Blockchain	X	not relevant	https://files.ifi.uzh.ch/CSG/staff/Rafati/Fabio-Maddaloni-BA.pdf
Utilizing Public Blockchains for the Sybil-Resistant Bootstrapping of Distributed Anonymity Services	X	not relevant	https://arxiv.org/pdf/2004.06386
Resilientdb: Global scale resilient blockchain fabric	X	Not relevant	https://arxiv.org/pdf/2002.00160

Managing QoS of Internet-of-Things Services Using Blockchain	X	Not relevant	https://ieeexplore.ieee.org/iel7/6570650/6780646/08741207.pdf
Platypus: Offchain Protocol Without Synchrony	X	Not relevant	https://ieeexplore.ieee.org/iel7/8930311/8935004/08935037.pdf
	X	Not in english	http://www.jcr.cacrnet.org.cn/CN/article/downloadArticleFile.do?attachType=PDF&id=343
Gas Consumption-Aware Dynamic Load Balancing in Ethereum Sharding Environments	V	An alternative way of assigning transactions? But does not discuss rapidchain at all	https://ieeexplore.ieee.org/iel7/8785421/8791939/08791945.pdf
Pledge: a private ledger based decentralized data sharing framework	X	Not relevant	https://ieeexplore.ieee.org/iel7/8728125/8732845/08732913.pdf
Proof-of-Execution: Reaching Consensus through Fault-Tolerant Speculation	X	No relevant discussion	https://arxiv.org/pdf/1911.00838
Flow: Separating Consensus and Compute	X	not a paper???	nan
SSHTDNS: A Secure, Scalable and High-Throughput Domain Name System via Blockchain Technique	X	Not relevant	https://scholar.google.com/scholar?output=instlink&q=info:9l1bEyD_hZoJ:scholar.google.com/&hl=en&as_sdt=1,5&sciodt=1,5&scillfp=15012720131320130813&oi=lle

Exploring heterogeneity in loosely consistent decentralized data replication	X	No relevant discussion	https://hal.inria.fr/tel-01964628/document
Blockchain business networks: Understanding the value proposal within centralized and decentralized governance structures	X	Not relevant	http://www.diva-portal.org/smash/get/diva2:1339471/FULLTEXT02
Serializability and Heterogeneous Trust from Two Phase Commit to Blockchains	X	No relevant discussion	https://ecommons.cornell.edu/bitstream/handle/1813/67616/Sheff_cornellgrad_0058F_11665.pdf?sequence=1
An Adaptive Modular-Based Compression Scheme for Address Data in the Blockchain System	X	No relevant discussion	https://link.springer.com/content/pdf/10.1007%2F978-981-15-2777-7_13.pdf
Eunomia: A Permissionless Parallel Chain Protocol Based on Logical Clock	X	No relevant discussion	https://arxiv.org/pdf/1908.07567
SoK: Layer-Two Blockchain Protocols	X	Not relevant	https://pure.tudelft.nl/portal/files/69224849/150.pdf
Technical Whitepaper	V	Migth provide relevant discussion	https://static2.coinpaprika.com/storage/cdn/whitepapers/10576969.pdf
Aplos: Smart Contracts Made Smart	X	Not relevant	https://link.springer.com/chapter/10.1007/978-981-15-2777-7_35

Secure Balance Planning of Off-blockchain Payment Channel Networks	X	Not relevant	https://www.u-aizu.ac.jp/~pengli/files/pcn_planning_infocom2020.pdf
Validating pairwise transactions on cryptocurrencies: a novel heuristics and network simulation	X	Not relevant	https://link.springer.com/article/10.1007/s42786-018-00003-5
An Approach of Secure Two-Way-Pegged Multi-sidechain	X	No relevant discussion	https://link.springer.com/chapter/10.1007/978-3-030-38961-1_47
Flash: E icient Dynamic Routing for O chain Networks	X	nan	http://www.cs.jhu.edu/~xinjin/files/CoNEXT19_Flash.pdf
XBlock-ETH: Extracting and Exploring Blockchain Data From Etherem	X	Not relevant	https://arxiv.org/pdf/1911.00169
Blockchain based Decentralized Applications: Technology Review and Development Guidelines	X	No relevant discussion	https://arxiv.org/pdf/2003.07131
Practicability of blockchain technology and scalable blockchain network: sharding	V	Optimized transaction routing/gossiping?	https://minds.wisconsin.edu/bitstream/handle/1793/79576/AbdoulYigoThesis.pdf?sequence=1&isAllowed=y
A Framework for Blockchain-Based Verification of Integrity and Authenticity	X	nan	https://link.springer.com/chapter/10.1007/978-3-030-33716-2_15
Apex: a High-Performance Hierarchical Distributed Ledger	X	No relevant discussion	https://ieeexplore.ieee.org/iel7/8924808/8939160/08939189.pdf

Core Concepts, Challenges, and Future Directions in Blockchain: A Centralized Tutorial	X	No relevant discussion	https://dl.acm.org/doi/pdf/10.1145/3366370
Gnocchi: Multiplexed Payment Channels for Cryptocurrencies	X	Not relevant	https://scholar.google.com/scholar?output=instlink&q=info:ZbHcPnTaVSIJ:scholar.google.com/&hl=en&as_sdt=1,5&sciodt=1,5&scillfp=4546932450360448581&oi=lle
Decentralized Authorization with Private Delegation	X	Not relevant	https://escholarship.org/uc/item/8r20m39b
Scaling Blockchain Databases through Parallel Resilient Consensus Paradigm	V	Maybe a better bft protocol?	https://arxiv.org/pdf/1911.00837
Consolidating Hash Power in Blockchain Shards with a Forest	X	Not relevant	https://link.springer.com/chapter/10.1007/978-3-030-42921-8_18
Efficient Transaction Processing in Byzantine Fault Tolerant Environments	X	Not a paper	https://jhellings.nl/files/htps2019_paper.pdf
Blockguard: Adaptive Blockchain Security	X	Not relevant	https://arxiv.org/pdf/1907.13232
PIRATE: A Blockchain-based Secure Framework of Distributed Machine Learning in 5G Networks	X	Not relevant	https://arxiv.org/pdf/1912.07860
Smart Contracts on the Move	X	Not relevant	https://arxiv.org/pdf/2004.05933

Decentralized Platform for Investments and Operation of Energy Communities	X	Not relevant	https://ieeexplore.ieee.org/iel7/8962268/8974850/08975165.pdf
Software-Defined Infrastructure for Decentralized Data Lifecycle Governance: Principled Design and Open Challenges	X	Not relevant	https://ieeexplore.ieee.org/iel7/8867821/8884790/08885317.pdf
Guaranteed-TX: The exploration of a guaranteed cross-shard transaction execution protocol for Ethereum 2.0.	X	Not relevant	http://essay.utwente.nl/79884/1/Wels_MA_EEMCS.pdf
Addressing Scalability and Storage issues in Block Chain using Sharding	X	No access to paper	nan
Reliable inter-blockchain communication framework for improving scalability	X	No access to paper (preprint)	https://www.researchgate.net/profile/Liu_Keyang/publication/334453300_Reliable_Inter-Blockchain_Protocol_for_improving_scalability/links/5d888025458515cbd1b3c4bb/Reliable-Inter-Blockchain-Protocol-fo pdf
Technical Report Fides: Managing Data on Untrusted Infrastructure	X	Not relevant	https://sites.cs.ucsb.edu/~sujaya_maiyya/assets/papers/Fides.pdf
A Blockchain Traceable Scheme with Oversight Function	X	Not relevant	https://eprint.iacr.org/2020/311.pdf

Local Bitcoin Network Simulator for Performance Evaluation using Lightweight Virtualization	X	Not relevant	https://arxiv.org/pdf/2002.01243
GARET: improving throughput using gas consumption-aware relocation in Ethereum sharding environments	V	An alternative way of assigning transactions?	https://link.springer.com/article/10.1007/s10586-020-03087-1
Effective scaling of blockchain beyond consensus innovations and Moore's law	X	No relevant discussion	https://arxiv.org/pdf/2001.01865
Beyond Replications in Blockchain	X	Not relevant	https://www.researchgate.net/profile/Shlomi_Dolev/publication/333813003_Beyond_Replications_in_Blockchain_OnOff-Blockchain_IDA_for_Storage_Efficiency_and_Confidentiality_Brief_Announcement/links/5dd2320c299bf1b74b4b3985/Beyond-Replications-in-Blockchain-On-pdf
On the Feasibility of Sybil Attacks in Shard-Based Permissionless Blockchains	V	security and attack vectors	https://arxiv.org/pdf/2002.06531

A Practical Dynamic Enhanced BFT Protocol	X	No relevant discussion	https://scholar.google.com/scholar?output=instlink&q=info:xWWIb0aIvVYJ:scholar.google.com/&hl=en&as_sdt=1,5&sciodt=1,5&scillfp=11267631656067756812&oi=lle
Sharding Is Scaling (Blockchain)	X	An unfinnished paper? What?	https://cdn.occloxium.com/g/seminar/55ea2bae/template_final.pdf
Enhancing Autonomy with Blockchain and Multi-Acess Edge Computing in Distributed Robotic Systems	X	Not relevant	https://tiers.utu.fi/static/papers/queralta2020enhancing.pdf
DiPETrans: A Framework for Distributed Parallel Execution of Transactions of Blocks in Blockchain	X	No relevant discussion	https://arxiv.org/pdf/1906.11721
Multi-Stage Proof-of-Work Blockchain.	X	No relevant discussion	https://pdfs.semanticscholar.org/f450/71da7486af515d4d1982cd20098b11fa9fd6.pdf
A Survey on Consensus Methods in Blockchain for Resource-constrained IoT Networks	X	No relevant discussion	https://www.techrxiv.org/articles/A_Survey_on_Consensus_Methods_in_Blockchain_for_Resource-constrained_IoT_Networks/12152142/files/22344654.pdf
A Generic Sharding Scheme for Blockchain Protocols	V	nan	https://arxiv.org/pdf/1909.01162

Lever: Breaking the Shackles of Scalable On-chain Validation	V	Takes inspiration from rapidchain	https://pdfs.semanticscholar.org/6fd1/705cf99c5d57bde230b3e9143c874e874d95.pdf
Thinkey: A Scalable Blockchain Architecture	X	Does not state correct information on rapidchain and does not offer a discussion or argument to their statements.	https://arxiv.org/pdf/1904.04560
Hybrid-BFT: Optimistically Responsive Synchronous Consensus with Optimal Latency or Resilience	X	No relevant discussion	https://eprint.iacr.org/2020/406.pdf
Flow: Separating Consensus and Compute	X	No relevant discussion	https://arxiv.org/pdf/1909.05821
Snappy: Fast On-chain Payments with Practical Collaterals	X	No relevant discussion	https://arxiv.org/pdf/2001.01278
Trust-Based Shard Distribution Scheme for Fault-Tolerant Shard Blockchain Networks	X	No relevant discussion	https://ieeexplore.ieee.org/iel7/6287639/8600701/08840847.pdf
A Node Rating Based Sharding Scheme for Blockchain	V	Node assigment based on speed	https://ieeexplore.ieee.org/iel7/8961328/8975714/08975842.pdf
Efficient Transaction Processing in Byzantine Fault Tolerant Environments	X	Just an abstract, full paper not available	https://gupta-suyash.github.io/hpts_abstract.pdf
Design and Optimization for Storage Mechanism of the Public Blockchain Based on Redundant Residual Number System	X	No relevant discussion and outside the field of sharding	https://ieeexplore.ieee.org/iel7/6287639/8600701/08767923.pdf

Fission: A Provably Fast, Scalable, and Secure Permissionless Blockchain	X	No relevant discussion	https://arxiv.org/pdf/1812.05032
Reliable Inter-Blockchain Protocol for improving scalability	X	Paper not available	nan
A State-aware Proof of Stake Consensus Protocol for Power System Resilience	X	No relevant discussion.	https://dl.acm.org/doi/pdf/10.1145/3307772.3330177
SkyEye: A Traceable Scheme for Blockchain	X	Not relevant	https://eprint.iacr.org/2020/034.pdf
A Fair Selection Protocol for Committee-based Permissionless Blockchains	V	relevant	https://www.sciencedirect.com/science/article/pii/S0167404820300055
Incentive Analysis of Bitcoin-NG, Revisited	X	No relevant discussion	https://arxiv.org/pdf/2001.05082
Boros: Secure Cross-Channel Transfers via Channel Hub	X	No relevant discussion	https://arxiv.org/pdf/1911.12929
Bootstrapping Consensus Without Trusted Setup: Fully Asynchronous Distributed Key Generation	V	Bootstrapping	https://eprint.iacr.org/2019/1015.pdf
SharPer: Sharding Permissioned Blockchains Over Network Clusters	V	Relevant discussion	https://arxiv.org/pdf/1910.00765
Scalable Blockchain Protocol Based on Proof of Stake and Sharding	X	No relevant discussion	nan
Charlotte: Composable Authenticated Distributed Data Structures, Technical Report	X	No relevant discussion	https://arxiv.org/pdf/1905.03888

Verifiable and Auditable Digital Interchange Framework	X	No relevant discussion	https://arxiv.org/pdf/2001.03717
Towards Private, Robust, and Verifiable Crowdsensing Systems via Public Blockchains	X	No relevant discussion	https://ieeexplore.ieee.org/iel7/8858/4358699/08839417.pdf
Multichain-MWPoW: A Adversary Power Resistant Blockchain Sharding Approach to a Decentralised Autonomous Organisation Architecture	V	Might provide some relevant discussion	https://arxiv.org/pdf/2004.04798
Contract-connection: An efficient communication protocol for Distributed Ledger Technology	X	No relevant discussion	https://ieeexplore.ieee.org/iel7/8955479/8958711/08958730.pdf
A Secure and Practical Blockchain Scheme for IoT	V	Compares it self with rapidchain	https://ieeexplore.ieee.org/iel7/8883860/8887294/08887375.pdf
An n/2 Byzantine node tolerate Blockchain Sharding approach	V	A successor?	https://arxiv.org/pdf/2001.05240
ShallowForest: Optimizing All-to-All Data Transmission in WANs	X	No relevant discussion	https://uwspace.uwaterloo.ca/bitstream/handle/10012/14690/Hao_Tan_Thesis.pdf?sequence=1&isAllowed=y
BAASH: Enabling Blockchain-as-a-Service on High-Performance Computing Systems	X	No relevant discussion	https://arxiv.org/pdf/2001.07022

Elastico as an ordering service in Hyperledger Fabric	X	No relevant discussion	https://security.cse.iitk.ac.in/sites/default/files/17111010.pdf
Load Balancing for Sharded Blockchains	V	load balancing	http://fc20.ifca.ai/wtsc/WTSC2020/WTSC20_paper_7.pdf
A Study on Security and Privacy related Issues in Blockchain Based Applications	X	No relevant discussion	https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=8991214
Progress on the Use of Sharding to Enhance Blockchain Scalability	V	very relevant. Compares elastico omniledger and rapidchain.	https://cdn.occloxium.com/g/seminar/3947cec6/paper.pdf
Blockchain System for 5G Network Sharing	X	No relevant discussion	https://i.cs.hku.hk/fyp/2019/fyp19037/assets/docs/proj_plan.pdf
On the information theory of clustering, registration, and blockchains	X	No relevant discussion	https://www.ideals.illinois.edu/bitstream/handle/2142/104833/RAMAN-DISSERTATION-2019.pdf?sequence=1&isAllowed=y
GARET: improving throughput using gas consumption-aware relocation in Ethereum sharding environments	X	nan	https://lass.sogang.ac.kr/pdf/2020/intl_jour/Cluster_Computing_2020_SWoo.pdf
Improving the Efficiency of Blockchain Applications with Smart Contract based Cyber-insurance	X	Not relevant	http://faculty.cs.njupt.edu.cn/~xujia/Paper/2020ICC.pdf
Scalable and Efficient Data Authentication for Decentralized Systems	X	Does not cite rapidchain, and no relevant discussion.	https://arxiv.org/pdf/1909.11590

Blockchain enabled Named Data Networking for Secure Vehicle-to-Everything Communications	X	No relevant discussion	https://ieeexplore.ieee.org/iel7/65/7593428/09023466.pdf
Permissioned Blockchain Through the Looking Glass: Architectural and Implementation Lessons Learned	X	Permissioned and No relevant discussion	https://arxiv.org/pdf/1911.09208
Fides: Managing Data on Untrusted Infrastructure	X	Not relevant	https://arxiv.org/pdf/2001.06933
Do you need a blockchain in construction? Use case categories and decision framework for DLT design options	X	Not relevant	https://www.sciencedirect.com/science/article/pii/S147403462030063X
Microchain: a Light Hierarchical Consensus Protocol for IoT System	X	No relevant discussion	https://arxiv.org/pdf/1912.10357
A Robust Throughput Scheme for Bitcoin Network without Block Reward	X	No relevant discussion	https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=8855462
New Mathematical Model to Analyze Security of Sharding-Based Blockchain Protocols	V	Analysis	https://ieeexplore.ieee.org/iel7/6287639/8600701/08936849.pdf
GCBlock: A Grouping and Coding Based Storage Scheme for Blockchain System	X	Not relevant	https://ieeexplore.ieee.org/iel7/6287639/8948470/09025067.pdf

Comparison Between Bitcoin and Quarkchain	X	Full paper not accessible	https://www.ingentaconnect.com/content/asp/jctn/2019/00000016/00000003/art00005
Projektbericht für die QS Qualität und Sicherheit GmbH, Bonn	X	Not in english	https://www.q-s.de/services/files/qs-wissenschaftsfonds/Forschungsbericht-Ermittlung-PotenzialC3%A4hlte-Distri.pdf

Table 3: Literature review round 1 results in Borgen [8]

3 Round 2

3.1 Accepted

Data collection form Question	 Answer
Study ID	2
Title of paper	A Game-Theoretic Analysis of Shard-Based Permissionless Blockchains
Main categories	Incentive mechanisms
Classification	model — game-theory — incentive mechanism
Metrics or measures	Byzantine adversary: arbitrarily malicious, rational: honest but selfish
Quality Assesment discussion	Great paper
Research question or issue	One significant research gap is a lack of understanding of thestrategic behavior of rational processors within committees.
Summary of paper	Creates a model of comitee-based sharding, presents a game-theory game on this model, and presents a novel incentive mechanism based on a coordinator.
Evaluation of paper	Great paper but must be adjusted for the threat model in rapidchain. Some assumptions make it hard to generalize.
Main findings	Model of comitte based sharding protocols
Rapidchain specifics	This paper uses a "final comitee" that recives many shards and combine them to one block. This is different from the design of rapidchain. Comments on the lack of clarity in Rapidchain (and others), therefore assume that a new epoch block cannot be appended if one shard fails.
Rapidchain applications	Incentive mechanism
Future work	

Table 4: Data collection form, as described in Borgen [8], for Manshaei et al. [27]

Quality assesment form Question	 Score
Is there any statistical methods applied and were they justified?	0
Are the aims or research questions clearly stated	10
Are important effects overlooked?	5
If credible, are they important?	10
Are negative findings presented?	7
Do the study measures allow the research questions to be answered?	10
Is the research method likely to have introduced significant bias?	8
How well was the diversity of perspective and context explored?	10
How clear are the assumptions/theoretical perspectives/values that have shaped the form and output of the evaluation?	10
How credible are the findings?	10
How clear and coherent is the research?	10
Do the researchers explain the consequences of any problems with the validity/reliability of their measures?	10
How clear are the links between data, interpretation and conclusions – i.e. how well can the route to any conclusions be seen?	9
Was the denominator (i.e. the population size), sample size, composition and coverage reported?	10
How well has knowledge or understanding been extended by the research?	10
Are the data collection methods adequately described?	9
How well does the evaluation address its original aims and purpose?	10
How well is the scope for drawing wider inference explained?	9
Are all study questions answered?	10
How well have detail, depth, and complexity (i.e. richness) of the data been conveyed?	10
Is the research method, process or design clearly stated?	10
How well has the approach to, and formulation of, analysis been conveyed?	10
Are the measures used in the study the most relevant ones for answering the research questions?	10

Table 5: Quality assesment form, as described in Borgen [8], for Manshaei et al. [27]

Data collection form Question	 Answer
Study ID	1
Title of paper	GARET: improving throughput using gas consumption-aware relocation in Ethereum sharding environments
Main categories	load balancing
Classification	
Metrics or measures	
Quality Assesment discussion	
Research question or issue	Load balancing in the Ethereum sharded enviroment
Summary of paper	See main findings
Evaluation of paper	Does not have a discussion on security
Main findings	Transaction load prediction algorithm (future gas usage based on past usage) — account relocation algorithm (priority queue based on previous algorithm) — 12 percent increase in throughput — 74 percent decrease in latency
Rapidchain specifics	
Rapidchain applications	Due to the different nature of transactions in Ethereums account model and Rapidchains UTXO model the results themselves doesn't mean anything, but the abstract concept of the main findings, as well ass a probabilatistic positive result of these mehods, may be applied to Rapidchain.
Future work	Overhead

Table 6: Data collection form, as described in Borgen [8], for Woo et al. [40]

Quality assesment form Question	 Score
Is there any statistical methods applied and were they justified?	10
Are the aims or research questions clearly stated	10
Are important effects overlooked?	-
If credible, are they important?	9
Are negative findings presented?	0
Do the study measures allow the research questions to be answered?	8
Is the research method likely to have introduced significant bias?	7
How well was the diversity of perspective and context explored?	7
How clear are the assumptions/theoretical perspectives/values that have shaped the form and output of the evaluation?	7
How credible are the findings?	6
How clear and coherent is the research?	10
Do the researchers explain the consequences of any problems with the validity/reliability of their measures?	3
How clear are the links between data, interpretation and conclusions – i.e. how well can the route to any conclusions be seen?	8
Was the denominator (i.e. the population size), sample size, composition and coverage reported?	10
How well has knowledge or understanding been extended by the research?	7
Are the data collection methods adequately described?	9
How well does the evaluation address its original aims and purpose?	10
How well is the scope for drawing wider inference explained?	10
Are all study questions answered?	9
How well have detail, depth, and complexity (i.e. richness) of the data been conveyed?	7
Is the research method, process or design clearly stated?	7
How well has the approach to, and formulation of, analysis been conveyed?	9
Are the measures used in the study the most relevant ones for answering the research questions?	8

Table 7: Quality assesment form, as described in Borgen [8], for Woo et al. [40]

Data collection form Question	 Answer
Study ID	9
Title of paper	Lever: Breaking the Shackles of Scalable On-chain Validation
Main categories	Incentive mechanism
Classification	
Metrics or measures	
Quality Assesment discussion	Low score due to very bad "clear and coherent" language. Non-scientific language and possible use of equivocation several places. This results in doubts about the credibility of the research as it's difficult to understand and judge details.
Research question or issue	-
Summary of paper	Incentive mechanism using staking. Rest of paper is not relevant.
Evaluation of paper	introduces some interseting concepts and results, but with doubting credibility.
Main findings	
Rapidchain specifics	
Rapidchain applications	
Future work	

Table 8: Data collection form, as described in Borgen [8], for Wang and Wu [38]

Quality assesment form Question	 Score
How clear are the assumptions/theoretical perspectives/values that have shaped the form and output of the evaluation?	-
Was the denominator (i.e. the population size), sample size, composition and coverage reported?	-
How well has knowledge or understanding been extended by the research?	7
Are the data collection methods adequately described?	-
Are the aims or research questions clearly stated	10
Are important effects overlooked?	5
How well is the scope for drawing wider inference explained?	5
How well has the approach to, and formulation of, analysis been conveyed?	2
Are negative findings presented?	-
If credible, are they important?	-
Is the research method likely to have introduced significant bias?	5
Is the research method, process or design clearly stated?	7
How well was the diversity of perspective and context explored?	6
How well have detail, depth, and complexity (i.e. richness) of the data been conveyed?	7
How clear and coherent is the research?	0
How credible are the findings?	5
Do the researchers explain the consequences of any problems with the validity/reliability of their measures?	-

Table 9: Quality assesment form, as described in Borgen [8], for Wang and Wu [38]

Data collection form Question	 Answer
Study ID	12
Title of paper	Ostraka: Secure Blockchain Scaling by Node Sharding
Main categories	Sharding — protocol
Classification	
Metrics or measures	
Quality Assesment discussion	
Research question or issue	-
Summary of paper	Introduces a new sharding protocol but the relevant part only discusses DoS.
Evaluation of paper	The relevant part is interesting, but lacks discussion and comprehensivness.
Main findings	
Rapidchain specifics	DoS — security
Rapidchain applications	
Future work	

Table 10: Data collection form, as described in Borgen [8], for Manuskin, Mirkin, and Eyal [28]

Quality assesment form Question	 Score
How clear are the assumptions/theoretical perspectives/values that have shaped the form and output of the evaluation?	-
Was the denominator (i.e. the population size), sample size, composition and coverage reported?	-
How well has knowledge or understanding been extended by the research?	3
Are the data collection methods adequately described?	0
Are the aims or research questions clearly stated	10
Are important effects overlooked?	2 — no mention of potenial incentive
How well is the scope for drawing wider inference explained?	-
How well has the approach to, and formulation of, analysis been conveyed?	-
Are negative findings presented?	-
If credible, are they important?	5
Is the research method likely to have introduced significant bias?	6
Is the research method, process or design clearly stated?	-
How well was the diversity of perspective and context explored?	-
How well have detail, depth, and complexity (i.e. richness) of the data been conveyed?	4
How clear and coherent is the research?	10
How credible are the findings?	10
Do the researchers explain the consequences of any problems with the validity/reliability of their measures?	-

Table 11: Quality assesment form, as described in Borgen [8], for Manuskin, Mirkin, and Eyal [28]

Data collection form Question	 Answer
Study ID	4
Title of paper	PolyShard: Coded Sharding Achieves Linearly Scaling Efficiency and Security Simultaneously
Main categories	coded sharding
Classification	
Metrics or measures	
Quality Assesment discussion	Researchers knowledge not applicable.
Research question or issue	
Summary of paper	Coded sharding takes several uncoded shards and mixes them with lagrange interpolation. Each shard then stores one of these coded shards, and computes on them. Replicates data and computational redudancy.
Evaluation of paper	Researchers knowledge not applicable.
Main findings	
Rapidchain specifics	
Rapidchain applications	
Future work	

Table 12: Data collection form, as described in Borgen [8], for Li et al. [24]

Quality assesment form Question	 Score
How clear are the assumptions/theoretical perspectives/values that have shaped the form and output of the evaluation?	-
Was the denominator (i.e. the population size), sample size, composition and coverage reported?	-
How well has knowledge or understanding been extended by the research?	-
Are the data collection methods adequately described?	-
Are the aims or research questions clearly stated	10
Are important effects overlooked?	-
How well is the scope for drawing wider inference explained?	-
How well has the approach to, and formulation of, analysis been conveyed?	-
Are negative findings presented?	-
If credible, are they important?	-
Is the research method likely to have introduced significant bias?	-
Is the research method, process or design clearly stated?	6
How well was the diversity of perspective and context explored?	-
How well have detail, depth, and complexity (i.e. richness) of the data been conveyed?	-
How clear and coherent is the research?	9
How credible are the findings?	5 — Incorrect statement that no other solution scale in security
Do the researchers explain the consequences of any problems with the validity/reliability of their measures?	-

Table 13: Quality assesment form, as described in Borgen [8], for Li et al. [24]

Data collection form Question	 Answer
Study ID	10
Title of paper	Progress on the Use of Sharding to Enhance Blockchain Scalability
Main categories	Survey
Classification	
Metrics or measures	
Quality Assesment discussion	Great paper, but doesn't really answer it's research question fully.
Research question or issue	"examine their resilience under as- pects of security in a classic manner, e.g. Sybil/Byzantine adversaries etc., as well as real-world scalability"
Summary of paper	Summary of comitee-based sharding. Components, and elastico, omniledger and Rapidchain. Discussion on how they compare.
Evaluation of paper	
Main findings	
Rapidchain specifics	Trade-off betwen high and low stake transactions
Rapidchain applications	
Future work	

Table 14: Data collection form, as described in Borgen [8], for Bartolomey [6]

Quality assesment form Question	 Score
How clear are the assumptions/theoretical perspectives/values that have shaped the form and output of the evaluation?	10
Was the denominator (i.e. the population size), sample size, composition and coverage reported?	-
How well has knowledge or understanding been extended by the research?	7
Are the data collection methods adequately described?	-
Are the aims or research questions clearly stated	10
Are important effects overlooked?	10
How well is the scope for drawing wider inference explained?	10
How well has the approach to, and formulation of, analysis been conveyed?	10
Are negative findings presented?	-
If credible, are they important?	10
Is the research method likely to have introduced significant bias?	5
Is the research method, process or design clearly stated?	5
How well was the diversity of perspective and context explored?	10
How well have detail, depth, and complexity (i.e. richness) of the data been conveyed?	9
How clear and coherent is the research?	10
How credible are the findings?	10
Do the researchers explain the consequences of any problems with the validity/reliability of their measures?	-

Table 15: Quality assesment form, as described in Borgen [8], for Bartolomey [6]

Data collection form Question	 Answer
Study ID	5
Title of paper	Scalable Network-Coded PBFT Consensus Algorithm
Main categories	Coding — network — data sharding
Classification	
Metrics or measures	
Quality Assesment discussion	Possible lack of own knowledge to judge the paper.
Research question or issue	network-coded Practical Byzantine Fault Tolerant (PBFT) consensus
Summary of paper	-
Evaluation of paper	Great paper, but possible use of equivocation because the lack of discussion and formal paper layout.
Main findings	
Rapidchain specifics	
Rapidchain applications	
Future work	

Table 16: Data collection form, as described in Borgen [8], for Choi et al. [12]

Quality assesment form Question	 Score
How clear are the assumptions/theoretical perspectives/values that have shaped the form and output of the evaluation?	4
Was the denominator (i.e. the population size), sample size, composition and coverage reported?	-
How well has knowledge or understanding been extended by the research?	8
Are the data collection methods adequately described?	-
Are the aims or research questions clearly stated	10
Are important effects overlooked?	-
How well is the scope for drawing wider inference explained?	7
How well has the approach to, and formulation of, analysis been conveyed?	8
Are negative findings presented?	-
If credible, are they important?	10
Is the research method likely to have introduced significant bias?	9
Is the research method, process or design clearly stated?	5
How well was the diversity of perspective and context explored?	6
How well have detail, depth, and complexity (i.e. richness) of the data been conveyed?	7
How clear and coherent is the research?	6
How credible are the findings?	8
Do the researchers explain the consequences of any problems with the validity/reliability of their measures?	3

Table 17: Quality assesment form, as described in Borgen [8], for Choi et al. [12]

Data collection form Question	 Answer
Study ID	8
Title of paper	Sok: Consensus in the age of blockchains
Main categories	Survey
Classification	
Metrics or measures	
Quality Assesment discussion	
Research question or issue	
Summary of paper	
Evaluation of paper	
Main findings	
Rapidchain specifics	
Rapidchain applications	
Future work	

Table 18: Data collection form, as described in Borgen [8], for Bano et al. [5]

Quality assesment form Question	Score
How clear are the assumptions/theoretical perspectives/values that have shaped the form and output of the evaluation?	
Was the denominator (i.e. the population size), sample size, composition and coverage reported?	
How well has knowledge or understanding been extended by the research?	
Are the data collection methods adequately described?	
Are the aims or research questions clearly stated	
Are important effects overlooked?	
How well is the scope for drawing wider inference explained?	
How well has the approach to, and formulation of, analysis been conveyed?	
Are negative findings presented?	
If credible, are they important?	
Is the research method likely to have introduced significant bias?	
Is the research method, process or design clearly stated?	
How well was the diversity of perspective and context explored?	
How well have detail, depth, and complexity (i.e. richness) of the data been conveyed?	
How clear and coherent is the research?	
How credible are the findings?	
Do the researchers explain the consequences of any problems with the validity/reliability of their measures?	

Table 19: Quality assesment form, as described in Borgen [8], for Bano et al. [5]

Data collection form Question	 Answer
Study ID	7
Title of paper	Sok: Sharding on blockchain
Main categories	Survey
Classification	
Metrics or measures	
Quality Assesment discussion	
Research question or issue	Systemazation of Knowledge on sharding
Summary of paper	-
Evaluation of paper	Great paper that compares several protocols.
Main findings	
Rapidchain specifics	
Rapidchain applications	
Future work	

Table 20: Data collection form, as described in Borgen [8], for Wang et al. [35]

Quality assesment form Question	 Score
How clear are the assumptions/theoretical perspectives/values that have shaped the form and output of the evaluation?	-
Was the denominator (i.e. the population size), sample size, composition and coverage reported?	-
How well has knowledge or understanding been extended by the research?	10
Are the data collection methods adequately described?	1
Are the aims or research questions clearly stated	10
Are important effects overlooked?	-
How well is the scope for drawing wider inference explained?	10
How well has the approach to, and formulation of, analysis been conveyed?	10
Are negative findings presented?	-
If credible, are they important?	10
Is the research method likely to have introduced significant bias?	5
Is the research method, process or design clearly stated?	7
How well was the diversity of perspective and context explored?	10
How well have detail, depth, and complexity (i.e. richness) of the data been conveyed?	10
How clear and coherent is the research?	10
How credible are the findings?	10
Do the researchers explain the consequences of any problems with the validity/reliability of their measures?	-

Table 21: Quality assesment form, as described in Borgen [8], for Wang et al. [35]

Data collection form Question	 Answer
Study ID	11
Title of paper	Towards scaling blockchain systems via sharding
Main categories	Sharding
Classification	
Metrics or measures	
Quality Assesment discussion	
Research question or issue	"Scal- ing blockchain systems under general workloads"
Summary of paper	
Evaluation of paper	Ok paper, but lacking security analysis, but that is not relevant for this lit rev anyways.
Main findings	
Rapidchain specifics	Isolation and atomicity of Rapidchain.
Rapidchain applications	
Future work	

Table 22: Data collection form, as described in Borgen [8], for Dang et al. [13]

Quality assesment form Question	 Score
How clear are the assumptions/theoretical perspectives/values that have shaped the form and output of the evaluation?	-
Was the denominator (i.e. the population size), sample size, composition and coverage reported?	-
How well has knowledge or understanding been extended by the research?	5
Are the data collection methods adequately described?	-
Are the aims or research questions clearly stated	10
Are important effects overlooked?	10
How well is the scope for drawing wider inference explained?	7
How well has the approach to, and formulation of, analysis been conveyed?	8
Are negative findings presented?	-
If credible, are they important?	10
Is the research method likely to have introduced significant bias?	4
Is the research method, process or design clearly stated?	8
How well was the diversity of perspective and context explored?	6
How well have detail, depth, and complexity (i.e. richness) of the data been conveyed?	7
How clear and coherent is the research?	10
How credible are the findings?	10
Do the researchers explain the consequences of any problems with the validity/reliability of their measures?	-

Table 23: Quality assesment form, as described in Borgen [8], for Dang et al. [13]

Data collection form Question	 Answer
Study ID	5
Title of paper	New mathematical model to analyze security of sharding-based blockchain protocols
Main categories	Security — failure probability
Classification	
Metrics or measures	
Quality Assesment discussion	Own knowledge not enough to properly validate results but seems exelent and well reasoned.
Research question or issue	"bound the failure probability for one committee and so for each epoch using probability bounds for sums of upper-bounded hypergeometric and binomial distributions." and "how to keep the failure probability, for a given sharding protocol, smaller than a predefined threshold?"
Summary of paper	Finds the best probability bound to estimate security, Hoeffding, that can be used to estimate paramters to be within a defined security treshold.
Evaluation of paper	Excelent paper!
Main findings	summary
Rapidchain specifics	Uses the model on rapidchain and its counterparts.
Rapidchain applications	Parameter picking
Future work	

Table 24: Data collection form, as described in Borgen [8], for Hafid, Hafid, and Samih [17]

Quality assesment form Question	 Score
How clear are the assumptions/theoretical perspectives/values that have shaped the form and output of the evaluation?	-
Was the denominator (i.e. the population size), sample size, composition and coverage reported?	10
How well has knowledge or understanding been extended by the research?	10
Are the data collection methods adequately described?	-
Are the aims or research questions clearly stated	10
Are important effects overlooked?	-
How well is the scope for drawing wider inference explained?	10
How well has the approach to, and formulation of, analysis been conveyed?	10
Are negative findings presented?	10
If credible, are they important?	10
Is the research method likely to have introduced significant bias?	9
Is the research method, process or design clearly stated?	10
How well was the diversity of perspective and context explored?	8
How well have detail, depth, and complexity (i.e. richness) of the data been conveyed?	9
How clear and coherent is the research?	10
How credible are the findings?	10
Do the researchers explain the consequences of any problems with the validity/reliability of their measures?	-

Table 25: Quality assesment form, as described in Borgen [8], for Hafid, Hafid, and Samih [17]

Data collection form Question	 Answer
Study ID	20
Title of paper	Robust and Scalable Consensus for Sharded Distributed Ledgers
Main categories	
Classification	
Metrics or measures	
Quality Assesment discussion	
Research question or issue	
Summary of paper	
Evaluation of paper	
Main findings	
Rapidchain specifics	
Rapidchain applications	
Future work	

Table 26: Data collection form, as described in Borgen [8], for Kokoris-kogias [22]

Quality assesment form Question	Score
How clear are the assumptions/theoretical perspectives/values that have shaped the form and output of the evaluation?	
Was the denominator (i.e. the population size), sample size, composition and coverage reported?	
How well has knowledge or understanding been extended by the research?	
Are the data collection methods adequately described?	
Are the aims or research questions clearly stated	
Are important effects overlooked?	
How well is the scope for drawing wider inference explained?	
How well has the approach to, and formulation of, analysis been conveyed?	
Are negative findings presented?	
If credible, are they important?	
Is the research method likely to have introduced significant bias?	
Is the research method, process or design clearly stated?	
How well was the diversity of perspective and context explored?	
How well have detail, depth, and complexity (i.e. richness) of the data been conveyed?	
How clear and coherent is the research?	
How credible are the findings?	
Do the researchers explain the consequences of any problems with the validity/reliability of their measures?	

Table 27: Quality assesment form, as described in Borgen [8], for Kokoris-kogias [22]

Data collection form Question	 Answer
Study ID	19
Title of paper	Divide and Scale: Formalization of Distributed Ledger Sharding Protocols
Main categories	
Classification	
Metrics or measures	
Quality Assesment discussion	
Research question or issue	
Summary of paper	
Evaluation of paper	
Main findings	
Rapidchain specifics	
Rapidchain applications	
Future work	

Table 28: Data collection form, as described in Borgen [8], for Avarikioti, Kokoris-Kogias, and Wattenhofer [3]

Quality assesment form Question	Score
How clear are the assumptions/theoretical perspectives/values that have shaped the form and output of the evaluation?	
Was the denominator (i.e. the population size), sample size, composition and coverage reported?	
How well has knowledge or understanding been extended by the research?	
Are the data collection methods adequately described?	
Are the aims or research questions clearly stated	
Are important effects overlooked?	
How well is the scope for drawing wider inference explained?	
How well has the approach to, and formulation of, analysis been conveyed?	
Are negative findings presented?	
If credible, are they important?	
Is the research method likely to have introduced significant bias?	
Is the research method, process or design clearly stated?	
How well was the diversity of perspective and context explored?	
How well have detail, depth, and complexity (i.e. richness) of the data been conveyed?	
How clear and coherent is the research?	
How credible are the findings?	
Do the researchers explain the consequences of any problems with the validity/reliability of their measures?	

Table 29: Quality assesment form, as described in Borgen [8], for Avarikioti, Kokoris-Kogias, and Wattenhofer [3]

Data collection form Question	 Answer
Study ID	13
Title of paper	Harmony
Main categories	Protocol
Classification	
Metrics or measures	
Quality Assesment discussion	
Research question or issue	
Summary of paper	
Evaluation of paper	Great paper, but since it is a white-paper, its results cannot be trusted.
Main findings	
Rapidchain specifics	Incentive mechanism — security — randomness — codes — voting power
Rapidchain applications	
Future work	

Table 30: Data collection form, as described in Borgen [8], for Team [34]

Quality assesment form Question	 Score
How clear are the assumptions/theoretical perspectives/values that have shaped the form and output of the evaluation?	9
Was the denominator (i.e. the population size), sample size, composition and coverage reported?	-
How well has knowledge or understanding been extended by the research?	9
Are the data collection methods adequately described?	-
Are the aims or research questions clearly stated	10
Are important effects overlooked?	8
How well is the scope for drawing wider inference explained?	-
How well has the approach to, and formulation of, analysis been conveyed?	-
Are negative findings presented?	10
If credible, are they important?	9
Is the research method likely to have introduced significant bias?	8
Is the research method, process or design clearly stated?	7
How well was the diversity of perspective and context explored?	-
How well have detail, depth, and complexity (i.e. richness) of the data been conveyed?	-
How clear and coherent is the research?	10
How credible are the findings?	5
Do the researchers explain the consequences of any problems with the validity/reliability of their measures?	10

Table 31: Quality assesment form, as described in Borgen [8], for Team [34]

Data collection form Question	 Answer
Study ID	6
Title of paper	The Security Reference Architecture for Blockchains: Towards a Standardized Model for Studying Vulnerabilities, Threats, and Defenses
Main categories	security
Classification	
Metrics or measures	
Quality Assesment discussion	
Research question or issue	Security framework to analyse blockchain security.
Summary of paper	List several attack vectors for several blockchain components.
Evaluation of paper	Ok paper, but I don't think the list of attack vectors is extensive enough.
Main findings	
Rapidchain specifics	
Rapidchain applications	
Future work	

Table 32: Data collection form, as described in Borgen [8], for Homoliak et al. [19]

Quality assesment form Question	 Score
How clear are the assumptions/theoretical perspectives/values that have shaped the form and output of the evaluation?	-
Was the denominator (i.e. the population size), sample size, composition and coverage reported?	-
How well has knowledge or understanding been extended by the research?	-
Are the data collection methods adequately described?	3
Are the aims or research questions clearly stated	10
Are important effects overlooked?	-
How well is the scope for drawing wider inference explained?	10
How well has the approach to, and formulation of, analysis been conveyed?	10
Are negative findings presented?	-
If credible, are they important?	10
Is the research method likely to have introduced significant bias?	5
Is the research method, process or design clearly stated?	8
How well was the diversity of perspective and context explored?	10
How well have detail, depth, and complexity (i.e. richness) of the data been conveyed?	7
How clear and coherent is the research?	10
How credible are the findings?	10
Do the researchers explain the consequences of any problems with the validity/reliability of their measures?	-

Table 33: Quality assesment form, as described in Borgen [8], for Homoliak et al. [19]

Data collection form Question	 Answer
Study ID	17
Title of paper	On the Feasibility of Sybil Attacks in Shard-Based Permissionless Blockchains
Main categories	Sybil resistance
Classification	
Metrics or measures	
Quality Assesment discussion	
Research question or issue	
Summary of paper	
Evaluation of paper	
Main findings	
Rapidchain specifics	
Rapidchain applications	Sybil resistance
Future work	

Table 34: Data collection form, as described in Borgen [8], for Rajab et al. [31]

Quality assesment form Question	 Score
How clear are the assumptions/theoretical perspectives/values that have shaped the form and output of the evaluation?	-
Was the denominator (i.e. the population size), sample size, composition and coverage reported?	-
How well has knowledge or understanding been extended by the research?	8
Are the data collection methods adequately described?	-
Are the aims or research questions clearly stated	10
Are important effects overlooked?	-
How well is the scope for drawing wider inference explained?	8
How well has the approach to, and formulation of, analysis been conveyed?	8
Are negative findings presented?	9
If credible, are they important?	6
Is the research method likely to have introduced significant bias?	5
Is the research method, process or design clearly stated?	8
How well was the diversity of perspective and context explored?	8
How well have detail, depth, and complexity (i.e. richness) of the data been conveyed?	8
How clear and coherent is the research?	10
How credible are the findings?	9
Do the researchers explain the consequences of any problems with the validity/reliability of their measures?	3

Table 35: Quality assesment form, as described in Borgen [8], for Rajab et al. [31]

Data collection form Question	 Answer
Study ID	3
Title of paper	on the Security of Blockchain Consensus Protocols
Main categories	Security
Classification	
Metrics or measures	
Quality Assesment discussion	This assemtent only rates the relevant parts. Ok paper.
Research question or issue	This paper summarizes the desired end properties of blockchain consensus protocols and sheds light on the critical role of theoretical analyses of their design
Summary of paper	Presents scalabality solutions based on byzantine agreement. States mostly only facts, but some small discussion.
Evaluation of paper	Ok survey paper, but lacking analysis and discussion.
Main findings	-
Rapidchain specifics	"The security of these designs depends directly on the size of the set of indentites established to run the BA protocol." ... "This sample size establishes limits on how often the identity establishment protocol can run, which is directly related to the constant c for which the fairness property holds" ... "Several works have improved the communication costs of BA agreement protocols, trading off the perfor- mance between the honest case and when the overlay P2P graphs have Byzan- tine adversaries
Rapidchain applications	
Future work	

Table 36: Data collection form, as described in Borgen [8], for B, B, and Rajan [4]

Quality assesment form Question	 Score
How clear are the assumptions/theoretical perspectives/values that have shaped the form and output of the evaluation?	-
Was the denominator (i.e. the population size), sample size, composition and coverage reported?	-
How well has knowledge or understanding been extended by the research?	5
Are the data collection methods adequately described?	0
Are the aims or research questions clearly stated	10
Are important effects overlooked?	-
How well is the scope for drawing wider inference explained?	10
How well has the approach to, and formulation of, analysis been conveyed?	10
Are negative findings presented?	-
If credible, are they important?	5
Is the research method likely to have introduced significant bias?	10
Is the research method, process or design clearly stated?	0
How well was the diversity of perspective and context explored?	8
How well have detail, depth, and complexity (i.e. richness) of the data been conveyed?	7
How clear and coherent is the research?	10
How credible are the findings?	10
Do the researchers explain the consequences of any problems with the validity/reliability of their measures?	-

Table 37: Quality assesment form, as described in Borgen [8], for B, B, and Rajan [4]

Data collection form Question	 Answer
Study ID	15
Title of paper	Bootstrapping Consensus Without Trusted Setup : Fully Asynchronous Distributed Key Generation
Main categories	Cryptography
Classification	
Metrics or measures	
Quality Assesment discussion	
Research question or issue	
Summary of paper	First fully asynchronous distributed key generation and high-treshold asynchronous verifiable secret sharing. Eventually efficient asynchronous binary agreement.
Evaluation of paper	
Main findings	
Rapidchain specifics	
Rapidchain applications	VSS
Future work	

Table 38: Data collection form, as described in Borgen [8], for Kokoris-kogias et al. [23]

Quality assesment form Question	 Score
How clear are the assumptions/theoretical perspectives/values that have shaped the form and output of the evaluation?	-
Was the denominator (i.e. the population size), sample size, composition and coverage reported?	-
How well has knowledge or understanding been extended by the research?	10
Are the data collection methods adequately described?	-
Are the aims or research questions clearly stated	9
Are important effects overlooked?	-
How well is the scope for drawing wider inference explained?	-
How well has the approach to, and formulation of, analysis been conveyed?	8
Are negative findings presented?	-
If credible, are they important?	10
Is the research method likely to have introduced significant bias?	6
Is the research method, process or design clearly stated?	7
How well was the diversity of perspective and context explored?	10
How well have detail, depth, and complexity (i.e. richness) of the data been conveyed?	-
How clear and coherent is the research?	7
How credible are the findings?	10
Do the researchers explain the consequences of any problems with the validity/reliability of their measures?	-

Table 39: Quality assesment form, as described in Borgen [8], for Kokoris-kogias et al. [23]

Data collection form Question	 Answer
Study ID	18
Title of paper	Survey: Sharding in Blockchains
Main categories	
Classification	
Metrics or measures	
Quality Assesment discussion	
Research question or issue	
Summary of paper	
Evaluation of paper	
Main findings	
Rapidchain specifics	
Rapidchain applications	
Future work	

Table 40: Data collection form, as described in Borgen [8], for Yu et al. [44]

Quality assesment form Question	Score
How clear are the assumptions/theoretical perspectives/values that have shaped the form and output of the evaluation?	
Was the denominator (i.e. the population size), sample size, composition and coverage reported?	
How well has knowledge or understanding been extended by the research?	
Are the data collection methods adequately described?	
Are the aims or research questions clearly stated	
Are important effects overlooked?	
How well is the scope for drawing wider inference explained?	
How well has the approach to, and formulation of, analysis been conveyed?	
Are negative findings presented?	
If credible, are they important?	
Is the research method likely to have introduced significant bias?	
Is the research method, process or design clearly stated?	
How well was the diversity of perspective and context explored?	
How well have detail, depth, and complexity (i.e. richness) of the data been conveyed?	
How clear and coherent is the research?	
How credible are the findings?	
Do the researchers explain the consequences of any problems with the validity/reliability of their measures?	

Table 41: Quality assesment form, as described in Borgen [8], for Yu et al. [44]

Data collection form Question	 Answer
Study ID	16
Title of paper	How to Securely Prune Bitcoin ' s Blockchain
Main categories	Checkpoint
Classification	
Metrics or measures	
Quality Assesment discussion	
Research question or issue	
Summary of paper	
Evaluation of paper	
Main findings	
Rapidchain specifics	
Rapidchain applications	Checkpoint
Future work	

Table 42: Data collection form, as described in Borgen [8], for Matzutt et al. [29]

Quality assesment form Question	 Score
How clear are the assumptions/theoretical perspectives/values that have shaped the form and output of the evaluation?	10
Was the denominator (i.e. the population size), sample size, composition and coverage reported?	10
How well has knowledge or understanding been extended by the research?	8
Are the data collection methods adequately described?	10
Are the aims or research questions clearly stated	10
Are important effects overlooked?	8
How well is the scope for drawing wider inference explained?	10
How well has the approach to, and formulation of, analysis been conveyed?	8
Are negative findings presented?	8
If credible, are they important?	10
Is the research method likely to have introduced significant bias?	8
Is the research method, process or design clearly stated?	10
How well was the diversity of perspective and context explored?	10
How well have detail, depth, and complexity (i.e. richness) of the data been conveyed?	10
How clear and coherent is the research?	10
How credible are the findings?	10
Do the researchers explain the consequences of any problems with the validity/reliability of their measures?	8

Table 43: Quality assesment form, as described in Borgen [8], for Matzutt et al. [29]

Data collection form Question	 Answer
Study ID	14
Title of paper	Velocity: Scalability Improvements in Block Propagation Through Rateless Erasure Coding
Main categories	EEC
Classification	
Metrics or measures	
Quality Assesment discussion	
Research question or issue	"1) Can we increase block size and transaction throughput while maintaining network behavior?2) Can a propagation method be chosen that improves resilience to communication disruption?3) Can the adversarially-resilient nature of existing ap- proaches be maintained under the revised scheme?4) Is a new propagation approach likely to be adopted by economically-rational actors"
Summary of paper	
Evaluation of paper	
Main findings	
Rapidchain specifics	EEC
Rapidchain applications	
Future work	

Table 44: Data collection form, as described in Borgen [8], for Chawla et al. [10]

Quality assesment form Question	 Score
How clear are the assumptions/theoretical perspectives/values that have shaped the form and output of the evaluation?	-
Was the denominator (i.e. the population size), sample size, composition and coverage reported?	-
How well has knowledge or understanding been extended by the research?	7
Are the data collection methods adequately described?	-
Are the aims or research questions clearly stated	10
Are important effects overlooked?	-
How well is the scope for drawing wider inference explained?	7
How well has the approach to, and formulation of, analysis been conveyed?	6
Are negative findings presented?	-
If credible, are they important?	-
Is the research method likely to have introduced significant bias?	5
Is the research method, process or design clearly stated?	10
How well was the diversity of perspective and context explored?	-
How well have detail, depth, and complexity (i.e. richness) of the data been conveyed?	-
How clear and coherent is the research?	10
How credible are the findings?	10
Do the researchers explain the consequences of any problems with the validity/reliability of their measures?	8

Table 45: Quality assesment form, as described in Borgen [8], for Chawla et al. [10]

3.2 Not accepted

Denial reason form Question	 Answer
Study ID	28
Reason	Not applicable to Rapidchain components, trivial or non-important results, and possible equivocation.

Table 46: Denial reason form for non accepted papers in round 2, as described in Borgen [8], for Liu et al. [26]

Denial reason form Question	 Answer
Study ID	25
Reason	Builds on previous rejected paper with id 26. Many of the ideas in this paper is just rebranded content from Rapidchain (or others).

Table 47: Denial reason form for non accepted papers in round 2, as described in Borgen [8], for Xu et al. [42]

Denial reason form Question	 Answer
Study ID	39
Reason	Generalizes sharding, and suggest that sharding schemes should follow this generalization instead of creating it from scratch to save time on correctness proof, but does not apply this generalization to Rapidchain. Generalization migth be good for new sharding designs, but applying this to Rapidchain won't increase value.

Table 48: Denial reason form for non accepted papers in round 2, as described in Borgen [8], for Fidelman [14]

Denial reason form Question	 Answer
Study ID	28
Reason	Duplicate

Table 49: Denial reason form for non accepted papers in round 2, as described in Borgen [8], for Hafid, Hafid, and Samih [16]

Denial reason form Question	 Answer
Study ID	40
Reason	The key idea behind a secure sharding strategy is to limit the abbility of a node to choose which committee it will belong to. The idea of sharding based on performance and latency is prone to attacks since nodes can emulate different speeds to trick the system.

Table 50: Denial reason form for non accepted papers in round 2, as described in Borgen [8], for Wang et al. [36]

Denial reason form Question	 Answer
Study ID	41
Reason	New nodes can only join the system at the start of a new epoch, same as in Rapidchain, contrary to their statements. Rapidchain works indipendantly of the underlying identity blockchain structure PoW/PoS, which makes their statement about Rapidchain invalid. Due to the fact that no PoW is required, an advesary could maybe pick their adress to target shards directly in a targeted attack. Shard reconfiguration scrambles all nodes similar to omniledger(?). Lacking security analysis of their proposed scheme.

Table 51: Denial reason form for non accepted papers in round 2, as described in Borgen [8], for Liu et al. [25]

Denial reason form Question	 Answer
Study ID	26
Reason	Severly lacking paper. Very short. Lacking analysis. Low score on the clear and coherrent criteria. Non-scientific normanclature. No clear explenation/argument of how n/2 tolerance is achived in the total setting, (yes each comitee/jury can have 1/2 adversaries, but what about the total resiliance?). I also cannot see how classes of paritipants is relevant, or how it has any meanigfull positive impact.

Table 52: Denial reason form for non accepted papers in round 2, as described in Borgen [8], for Xu and Huang [41]

Denial reason form Question	 Answer
Study ID	44
Reason	BlockchainDB is a layer on top of an existing blockchain. It cannot be used to improve the sharding enviroment of an UTXO system.

Table 53: Denial reason form for non accepted papers in round 2, as described in Borgen [8], for El-hindi [18]

Denial reason form Question	 Answer
Study ID	37
Reason	Federated, and not similar to Rapidchain.

Table 54: Denial reason form for non accepted papers in round 2, as described in Borgen [8], for Chitra and Chitra [11]

Denial reason form Question	 Answer
Study ID	30
Reason	Reputation based protocol. Small statements discussion on Rapidchain, but very lacking, no novel discussion, and some statements that may not be truthfull.

Table 55: Denial reason form for non accepted papers in round 2, as described in Borgen [8], for Zhang et al. [46]

Denial reason form Question	 Answer
Study ID	36
Reason	One validator per shard, where state is not further replicated, makes this not compatible with comittee based sharding.

Table 56: Denial reason form for non accepted papers in round 2, as described in Borgen [8], for Suzuki and Suda [33]

Denial reason form Question	 Answer
Study ID	43
Reason	Relies on Trusted Execution Enviroments, Selection bias only in PoS systems, and no meaningfull discussion on Rapidchain

Table 57: Denial reason form for non accepted papers in round 2, as described in Borgen [8], for Ahmed and Kostiainen [1]

Denial reason form Question	 Answer
Study ID	38
Reason	No apperent use to the rapidchain protocol itself. Only usefull for clients of a Rapidchain implementation, but that is outside the scope of this literature review.

Table 58: Denial reason form for non accepted papers in round 2, as described in Borgen [8], for Bünz et al. [9]

Denial reason form Question	 Answer
Study ID	45
Reason	Preliminary version of

Table 59: Denial reason form for non accepted papers in round 2, as described in Borgen [8], for Kim et al. [21]

Denial reason form Question	 Answer
Study ID	27
Reason	Ethereum 2.0 accounts can choose to change shards, while this is not a option in Rapidchain. This paper focuses on that aspect and the results is therefore not relevant for the rapidchain protocol.

Table 60: Denial reason form for non accepted papers in round 2, as described in Borgen [8], for Okanami [30]

Denial reason form Question	 Answer
Study ID	42
Reason	No novel contributions related to comitee based sharding. The concept of sharding based on locality is suceptable for targeted attacks on a single shard.

Table 61: Denial reason form for non accepted papers in round 2, as described in Borgen [8], for Wang and Wang [37]

Denial reason form Question	 Answer
Study ID	24
Reason	Builds on previous rejected papers with id 26 and id 25.

Table 62: Denial reason form for non accepted papers in round 2, as described in Borgen [8], for Xu et al. [43]

Denial reason form Question	 Answer
Study ID	33
Reason	Different sharding paradigm. Concept where a transaction with each validation grows it's proof.

Table 63: Denial reason form for non accepted papers in round 2, as described in Borgen [8], for Wilsdon [39]

Denial reason form Question	 Answer
Study ID	30
Reason	Incompatible protocols. Focused on atomic cross-chain protocol which Rapidchain does not have. Replay attacks can anyways be partly avoided using nonces in messages.

Table 64: Denial reason form for non accepted papers in round 2, as described in Borgen [8], for Sonnino et al. [32]

Denial reason form Question	 Answer
Study ID	34
Reason	The abstract concept of this paper is to run any underlying primary backup bft protocol in pararellel. However this would increase communication cost significantly in the Rapidchain case. The paper does not discuss this BFT protocol in context of Rapidchain. The bft protocol in Rapidchain is specifically designed with the sharded enviroment in mind, so such a multi bft paradigm migth not be usefull, for example due to cross shard transactions.

Table 65: Denial reason form for non accepted papers in round 2, as described in Borgen [8], for Gupta, Hellings, and Sadoghi [15]

Denial reason form Question	 Answer
Study ID	35
Reason	No relevant discussion on Rapidchain. Works similarly to the Rapidchain reed solomon erasure codes, but because of structural differences in Rapidchain the proposed codes would not be immidiatly applicable. States that these codes is only used for archival/full nodes, which rapidchain do not need. The authors do however state that these codes are more computationally efficient. But the computational complexity of these codes is not relevant to the total complexity of the protocol.

Table 66: Denial reason form for non accepted papers in round 2, as described in Borgen [8], for Kadhe, Chung, and Ramchandran [20]

Denial reason form Question	 Answer
Study ID	32
Reason	Wrong statements, too strong assumptions, sharding based on geography (succeptible to targeted atttacks), and no reconfiguration

Table 67: Denial reason form for non accepted papers in round 2, as described in Borgen [8], for Amiri, Agrawal, and Abbadi [2]

Denial reason form Question	 Answer
Study ID	31
Reason	This is about two different ledgers, not running the same protocol.

Table 68: Denial reason form for non accepted papers in round 2, as described in Borgen [8], for Zamyatin et al. [45]

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