

Master's Thesis

Peer Review Verification with Verifiable Credentials and Zero-Knowledge Proofs

Kaan Uzdogan

Supervisors: Prof. Jens Großklags, Prof. Ali Sunyaev

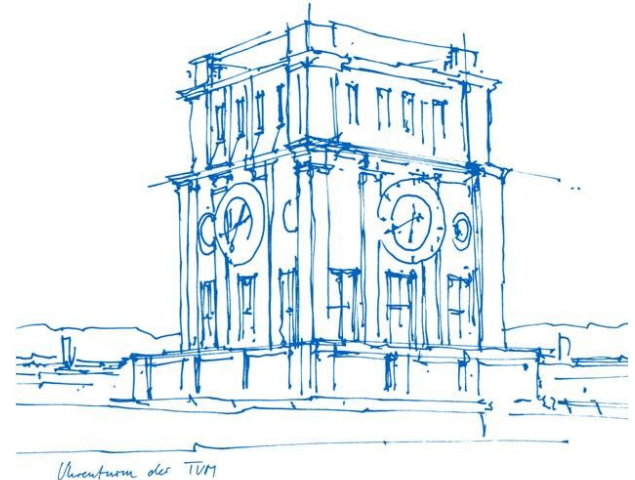
Advisors: Dr. Benjamin Sturm, Tibor Posa

Technische Universität München

Fakultät für Informatik

Lehrstuhl für Cyber Trust

1 February 2022



Problem Statement

- Peer review is essential for scientific publishing.
- Despite the importance many problems of peer review: bias, inconsistency, long publishing times, finding reviewers, review quality...
- Some of the problems due to the current incentives in academia to **publish more and review less.**
- Why?
 - Academic tenure, reputation etc. depend on publication based metrics
 - Scholars have limited time and reviews take time

Problem Statement

Closedness of Reviews Prevents Their Acknowledgement

- Nature of the reviews: mostly blinded and not published
- Unlike manuscripts, reviews are not publicly accessible, thus not possible to attribute.
- Even if a review is said to be done, it is **not possible to verify**.

Problem Statement

- Review showcase platforms tackling the problem of acknowledgement.
- Build a “peer review CV”. Forward the review email to them.
- Problems from an **open science perspective**:
 - Transparency: How are these reviews verified?
 - Access to data: API not providing much, scraping prohibited
 - Can be put behind a paywall, data access can be restricted
 - World's peer review data effectively owned by a single for profit entity
- Due to them being **trusted third-parties**



Research Question

How can closed peer reviews be verified without trusted third-parties?

Research Problem

- Research mostly focused on incentivization of peer reviews
 - Reward/punishment
 - Reputation tokens
 - Bounties
- Existing works assume an open peer review system and don't consider how to collect and verify peer review data.
- No research focusing to circumvent the third-parties in peer review verification

Goal

Design a system that will enable the verification of closed peer reviews without a trusted third-party

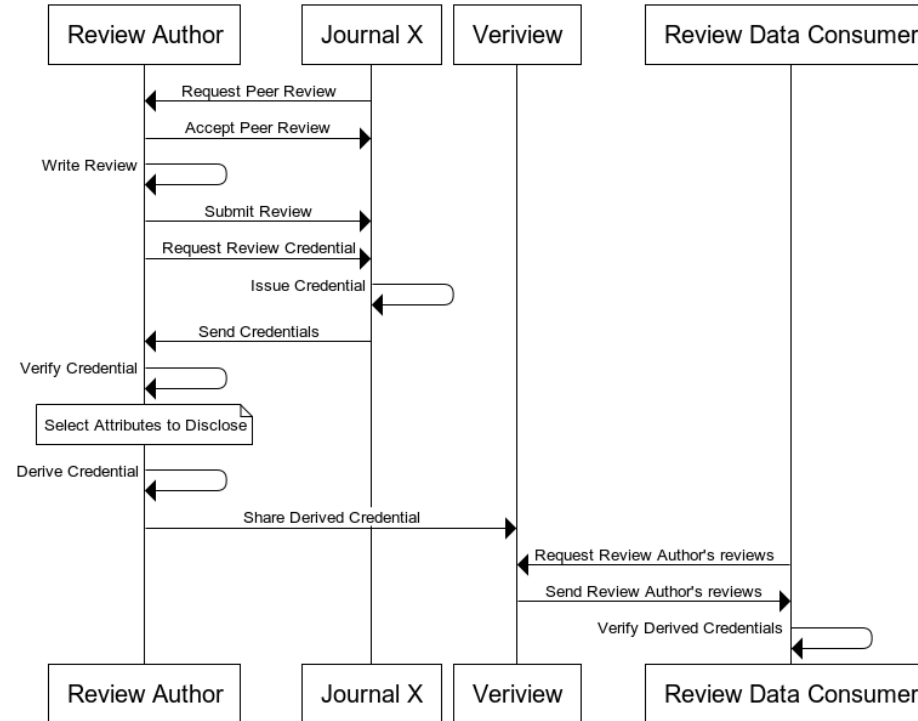
Design

Requirements based on problems stated:

- RQ1: Verifiability: Checking review authenticity
- RQ2: Transparency: How the verification is done
- RQ3: Open Data: Data stored = data public
- RQ4: Open Standards: Avoid lock-in, provide composability
- RQ5: Direct Trust: Avoid intermediaries
- RQ6: Selective Disclosure: Different data for different contexts, exclude identifying data in closed reviews.
- RQ7: Compatibility: Allow different review practices and different data schemas

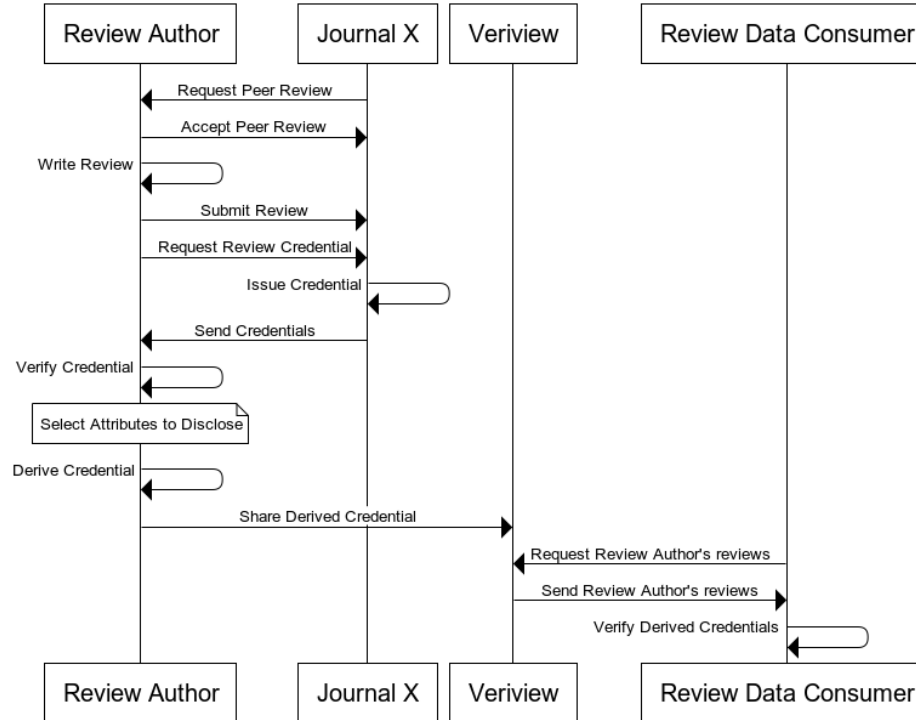
Design

Peer Review Credential Issuance & Sharing



Design

Peer Review Credential Issuance & Sharing



zk-proofs →

Leave out identifying information e.g. title of the manuscript

The Credential Document

- Based on W3C's Verifiable Credentials (VC) specification v1.0.
- Follows the JSON-LD (Linked Data) with Linked Proofs
 - Semantic Web
 - Vocabularies/Ontologies
- BBS+ signatures with BLS12-381 curve
 - Verification
 - Selective disclosure and zero-knowledge proofs

Example Credential Document

```

1  {
2    "@context": [
3      "https://www.w3.org/2018/credentials/v1",
4      "https://raw.githubusercontent.com/kuzdogan/
5        peer-review-verifiable-credentials-thesis/main/code/PeerReview.json",
6      "https://w3id.org/security/bbs/v1"
7    ],
8    "type": [
9      "PeerReviewCredential",
10     "VerifiableCredential"
11   ],
12   "id": "https://journalx.com/reviews/60afb3a10c601a002c8a43fe/credential",
13   "description": "A Verifiable Credential representing a peer review that is done for
14     a scholarly article.",
15   "name": "Peer Review Credential version 0.1",
16   "issuanceDate": "2021-05-27T15:33:28.743Z",
17   "issuer": "did:web:journalx.com",
18   "credentialSubject": { ...
41 },
42   "proof": {
43     "type": "BbsBlsSignature2020",
44     "created": "2021-05-27T15:33:28Z",
45     "nonce": "PvEw7iQVMcSiXrzQFg2+Y44aD4I0W0wKJyVWeUPtL1oGoY37ukNP81VipI18N1LoIAY=",
46     "proofPurpose": "assertionMethod",
47     "proofValue": "r1jtn/bxSof/
48       0U0Alnro1bm217GIhENTezDWMKxubTQvybwSD62LoEkQfFD4PkhSHjSv
49       888GciT5vpG5TareYENbLXa4W91/S2CTVwvwlYgt/moCC8/
50       0C63wG2hskjQi0JcZ3wZ4Bki8gZ2vVPkvQ==",
51     "verificationMethod": "did:web:journalx.com#credentialsKey"
52   }
53 }

```

Base Verifiable Credentials context

```

1  {
2    "@context": [
3      "https://www.w3.org/2018/credentials/v1",
4      "https://raw.githubusercontent.com/kuzdogan/
5      peer-review-verifiable-credentials-thesis/main/code/PeerReview.json",
6      "https://w3id.org/security/bbs/v1"
7    ],
8    "type": [
9      "PeerReviewCredential",
10     "VerifiableCredential"
11   ],
12   "id": "https://journalx.com/reviews/60afb3a10c601a002c8a43fe/credential",
13   "description": "A Verifiable Credential representing a peer review that is done for
14     a scholarly article.",
15   "name": "Peer Review Credential version 0.1",
16   "issuanceDate": "2021-05-27T15:33:28.743Z",
17   "issuer": "did:web:journalx.com",
18   "credentialSubject": { ...
41 },
42   "proof": {
43     "type": "BbsBlsSignature2020",
44     "created": "2021-05-27T15:33:28Z",
45     "nonce": "PvEw7iQVMcSiXrzQFg2+Y44aD4I0W0wKJyVWeUPtL1oGoY37ukNP81VipIL8N1LoIAY=",
46     "proofPurpose": "assertionMethod",
47     "proofValue": "r1jtn/bxSof/
48     0U0Alnro1bm217GIhENTezDWMKxubTQvybwSD62LoEkQfFD4PkhSHjSv
49     888GciT5vpG5TareYENbLXa4W91/S2CTVwvwlYgt/moCC8/
50     0C63wG2hskjQi0JcZ3wZ4Bki8gZ2vVPKvQ==",
51     "verificationMethod": "did:web:journalx.com#credentialsKey"
52   }
53 }

```

Linked Data
signature
definition

```

1  {
2    "@context": [
3      "https://www.w3.org/2018/credentials/v1",
4      "https://raw.githubusercontent.com/kuzdogan/
5      peer-review-verifiable-credentials-thesis/main/code/PeerReview.json",
6      "https://w3id.org/security/bbs/v1"
7    ],
8    "type": [
9      "PeerReviewCredential",
10     "VerifiableCredential"
11   ],
12   "id": "https://journalx.com/reviews/60afb3a10c601a002c8a43fe/credential",
13   "description": "A Verifiable Credential representing a peer review that is done for
14     a scholarly article.",
15   "name": "Peer Review Credential version 0.1",
16   "issuanceDate": "2021-05-27T15:33:28.743Z",
17   "issuer": "did:web:journalx.com",
18   "credentialSubject": { ...
19     ...
20   }
21 }
22
23 {
24   "proof": {
25     "type": "BbsBlsSignature2020",
26     "created": "2021-05-27T15:33:28Z",
27     "nonce": "PvEw7iQVMcSiXrzQFg2+Y44aD4I0W0wKJyVWeUPtL1oGoY37ukNP81VipI18N1LoIAY=",
28     "proofPurpose": "assertionMethod",
29     "proofValue": "r1jtn/bxSof/
30       0U0Alnro1bm217GIhENTezDWMKxubTQvybwSD62LoEkQfFD4PkhSHjSv
31       888GciT5vpG5TareYENbLXa4W91/S2CTVwvwlYgt/moCC8/
32       0C63wG2hskjQi0JcZ3wZ4Bki8gZ2vVPKvQ==",
33     "verificationMethod": "did:web:journalx.com#credentialsKey"
34   }
35 }

```

Linked Data
signature

Expand



```

1  {
2    "@context": [
3      "https://www.w3.org/2018/credentials/v1",
4      "https://raw.githubusercontent.com/kuzdogan/
      peer-review-verifiable-credentials-thesis/main/code/PeerReview.json",
5      "https://w3id.org/security/bbs/v1"
6    ],
7    "type": [
8      "PeerReviewCredential",
9      "VerifiableCredential"
10   ],
11   "id": "https://journalx.com/reviews/60afb3a10c601a002c8a43fe/credential",
12   "description": "A Verifiable Credential representing a peer review that is done for
      a scholarly article.",
13   "name": "Peer Review Credential version 0.1",
14   "issuanceDate": "2021-05-27T15:33:28.743Z",
15   "issuer": "did:web:journalx.com",
16   "credentialSubject": { ...
41 },
42   "proof": {
43     "type": "BbsBlsSignature2020",
44     "created": "2021-05-27T15:33:28Z",
45     "nonce": "PvEw7iQVMcSiXrzQFg2+Y44aD4I0W0wKJyVWeUPtL1oGoY37ukNP81VipI18N1LoIAY=",
46     "proofPurpose": "assertionMethod",
47     "proofValue": "r1jtn/bxSof/
      0U0Alnro1bm217GIhENTezDWMKxubTQvybwSD62LoEkQfFD4PkhSHJjSv
      888GciT5vpG5TareYENbLXa4W91/S2CTVwvwlYgt/moCC8/
      0C63wG2hskjQi0JcZ3wZ4Bki8gZ2vVPkvQ==",
48     "verificationMethod": "did:web:journalx.com#credentialsKey"
49   }
50 }

```

```

16  ··"credentialSubject":·{
17  ··  ··"id":·"https://journalx.com/reviews/60afb3a10c601a002c8a43fe",
18  ··  ··"type":·"PeerReview",
19  ··  ··"competingInterestStatement":·"",
20  ··  ··"reviewDate":·"2021-05-27T14:58:41.746Z",
21  ··  ··"title":·"Review:·Australian·state·influenza·notifications·and·school·holidays·in·Australia",
22  ··  ··"content":·"Summary:·Australia's·influenza·season·does·not·typically·display·a·clear·pattern·of·activity·over·time.·The·observed·and·predicted·plots·in·Appendix·3·appear·to·show·3·different·periods,·but·it·is·unclear·what·change·is·reported·in·Table·1.",
23  ··  ··"recommendation":·"Accept",
24  ··  ··"journal":·{
25  ··    ··"id":·"https://journalx.com/",
26  ··    ··"issn":·"2046-1402",
27  ··    ··"name":·"International·Journal·of·X"
28  ··  },
29  ··  ··"manuscript":·{
30  ··    ··"id":·"https://doi.org/10.1000/182",
31  ··    ··"title":·"Australian·state·influenza·notifications·and·school·holidays·in·Australia",
32  ··    ··"abstract":·"Background:·The·impact·of·school·holidays·on·influenza·activity·in·Australia.·In·2019,·these·results·have·important·public·health·implications.·Extension·of·holiday·periods·could·be·an·emergency·option·for·state·governments.",
33  ··  },
34  ··  ··"author":·{
35  ··    ··"id":·"did:key:z6MkpTHR8VNsBxYAAWHut2Geadd9jSwuBV8xRoAnwWsdvktH",
36  ··    ··"type":·"PeerReviewAuthor",
37  ··    ··"email":·"john@uni-example.edu",
38  ··    ··"familyName":·"Doe",
39  ··    ··"givenName":·"John"
40  ··  }
41  ··},
42  ··"proof":·{

```


Defined peer review credential context

```

1  {
2    "@context": [
3      "https://www.w3.org/2018/credentials/v1",
4      "https://raw.githubusercontent.com/kuzdogan/
5      peer-review-verifiable-credentials-thesis/main/code/PeerReview.json",
6      "https://w3id.org/security/bbs/v1"
7    ],
8    "type": [
9      "PeerReviewCredential",
10     "VerifiableCredential"
11   ],
12   "id": "https://journalx.com/reviews/60afb3a10c601a002c8a43fe/credential",
13   "description": "A Verifiable Credential representing a peer review that is done for
14     a scholarly article.",
15   "name": "Peer Review Credential version 0.1",
16   "issuanceDate": "2021-05-27T15:33:28.743Z",
17   "issuer": "did:web:journalx.com",
18   "credentialSubject": { ...
41 },
42   "proof": {
43     "type": "BbsBlsSignature2020",
44     "created": "2021-05-27T15:33:28Z",
45     "nonce": "PvEw7iQVMcSiXrzQFg2+Y44aD4I0W0wKJyVWeUPtL1oGoY37ukNP81VipIL8N1LoIAY=",
46     "proofPurpose": "assertionMethod",
47     "proofValue": "r1jtn/bxSof/
48     0U0Alnro1bm217GIhENTezDWMKxubTQvybwSD62LoEkQfFD4PkhSHJjSv
49     888GciT5vpG5TareYENbLXa4W91/S2CTVwvwlYgt/moCC8/
50     0C63wG2hskjQi0JcZ3wZ4Bki8gZ2vVPKvQ==",
51     "verificationMethod": "did:web:journalx.com#credentialsKey"
52   }
53 }

```

Decentralized Identifiers (DIDs)

- Used for the verification of the document
- Distributed ledger based:
 - Highly available
 - Tamperproof
 - e.g. `did:sov:mnjkl98uipsndg2hdjdjuf7`
 - Requires binding `did:sov:mnjkl98uipsndg2hdjdjuf7` with the real world identity
- Non-distributed ledger based:
 - `did:web:journalx.com` stored under `https://<HOST-NAME>/.well-known/did.json`
 - Requires server to be online
 - Can be changed without noticing
 - Uses the domain name and the TLS identity of journal website.

Example DID document

```
1 {
2   "@context": [ "https://www.w3.org/ns/did/v1", "https://w3id.org/security/bbs/v1" ],
3   "id": "did:web:journalx.herokuapp.com",
4   "assertionMethod": [
5     {
6       "id": "did:web:journalx.herokuapp.com#credentialsKey",
7       "type": "BbsBlsSignature2020",
8       "controller": "did:web:journalx.herokuapp.com",
9       "publicKeyBase58": "23V58StUorHjCjukwEfuyvSMDAisf5sgxKvBCAyt3jQTD5zVCw57hao·
10        qotHxbqQQZ5WmruofpXUfSNDEVv9gfHE7sFD4fULfhESpJC2FyH2·CNaga1Tuzr6VpMcAfUvo3BYGA"
11     }
12   ]
13 }
```

Public key used for verifying
BbsBlsSignature2020
signatures

Selectively Disclosed Credential

```

16  .."credentialSubject":{
17  ..  .."id":"https://journalx.com/reviews/60afb3a10c601a002c8a43fe",
18  ..  .."type":"PeerReview",
19  ..  .."author":{
20  ..    .."id":"did:key:z6MkpTHR8VNsBxYAAWHut2Geadd9jSwuBV8xRoAnwWsdvktH",
21  ..    .."type":"PeerReviewAuthor",
22  ..    .."email":"john@uni-example.edu",
23  ..    .."familyName":"Doe",
24  ..    .."givenName":"John"
25  ..  },
26  ..  .."journal":{
27  ..    .."id":"https://journalx.com/",
28  ..    .."issn":"2046-1402",
29  ..    .."name":"International Journal of X"
30  ..  }
31  },
32  .."proof":{
33  ..  .."type":"BbsBlsSignatureProof2020",
34  ..  .."created":"2021-07-05T12:55:25Z",
35  ..  .."nonce":"1kQgiD0XEyLc9qr3UX83C1mFip6jIQzCch0+j0iSUsKs32N8Ewokaxgtggd7zMWiDks=",
36  ..  .."proofPurpose":"assertionMethod",
37  ..  .."proofValue":"ABwHD/4/h4RPDqsdnm7LiAxQ7joN8tYJJp+pUwIFRjSUwuDwLNH3f53ZC
    ..    ..+yD7V62KAlvxskPhmSLIGB42pEnNwWUULlrTFxC...37t6cRsCjePM39bj+ddfkELtV+s04uvVTv/aHbWIu
    ..    ..K0kmG/4Xx2g0ZgdZtk7tq4Ux4P49eUZSAw93CHY6/
    ..    ..IgjncIg3aLV5j8rxKxDp1782dHCUaFPt2anY3YVodjKQez6rdu9phbSdxebqFq9",
38  ..  .."verificationMethod":"did:web:journalx.com#credentialsKey"
39  ..}
40 }

```

← "manuscript" excluded

```

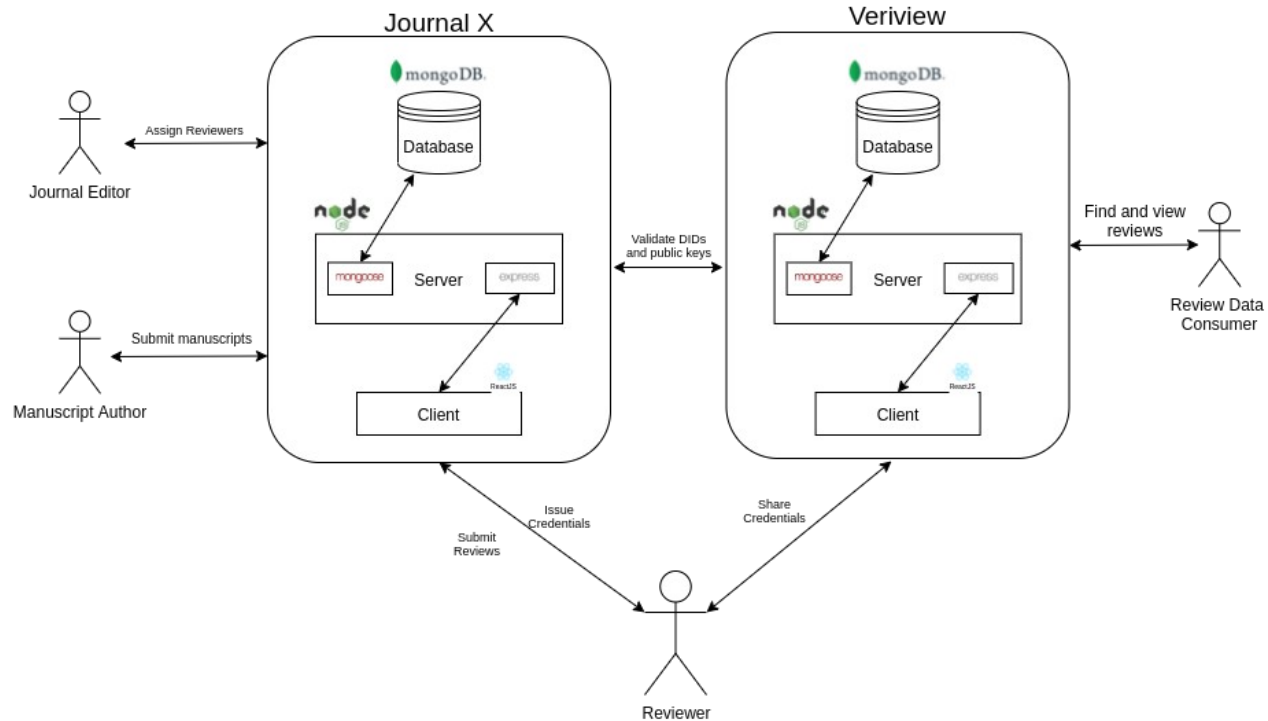
16  .."credentialSubject":{
17  ..  .."id": "https://journalx.com/reviews/60afb3a10c601a002c8a43fe",
18  ..  .."type": "PeerReview",
19  ..  .."author":{
20  ..    .."id": "did:key:z6MkpTHR8VNsBxYAAWHut2Geadd9jSwuBV8xRoAnwWsdvktH",
21  ..    .."type": "PeerReviewAuthor",
22  ..    .."email": "john@uni-example.edu",
23  ..    .."familyName": "Doe",
24  ..    .."givenName": "John"
25  ..  },
26  ..  .."journal":{
27  ..    .."id": "https://journalx.com/",
28  ..    .."issn": "2046-1402",
29  ..    .."name": "International Journal of X"
30  ..  },
31  },
32  .."proof":{
33  ..  .."type": "BbsBlsSignatureProof2020",
34  ..  .."created": "2021-07-05T12:55:25Z",
35  ..  .."nonce": "1kQgiD0XEyLc9qr3UX83C1mFip6jIQzCch0+j0iSuSks32N8Ewokaxgtggd7zMWiDks=",
36  ..  .."proofPurpose": "assertionMethod",
37  ..  .."proofValue": "ABwHD/4/h4RPDqsdnm7LiAxQ7joN8tYJJp+pUwiFRjSUwuDwLNH3f53ZC
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K0kmG/4Xx2g0ZgdZtk7tq4Ux4P49eUZSAw93CHY6/
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38  ..  .."verificationMethod": "did:web:journalx.com#credentialsKey"
39  ..}
40 }

```

Not BbsBlsSignature2020 but
BbsBlsSignature**Proof**2020

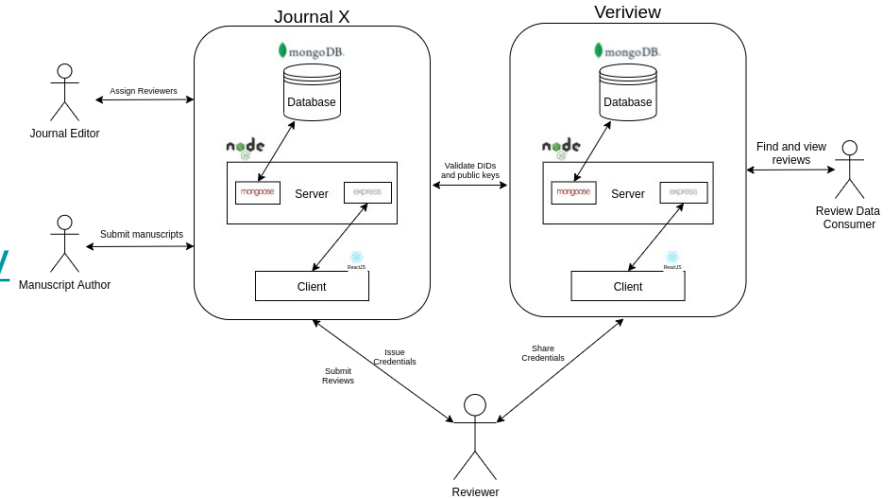
zk-proof

Prototype



Prototype

- A working prototype is built to demonstrate the feasibility of the designed system
- Code and instructions: <https://github.com/kuzdogan/peer-review-verifiable-credentials-thesis>
- Deployed to
 - <https://journalx.herokuapp.com/>
 - <https://veriview.herokuapp.com/>



Journal X



Mehmet Yilmaz
mehmet@test.com
60b0a8af1137b0002cddde26f
Author

[Home](#)[Manuscripts](#)[Reviews](#)[Log Out](#)

REVIEWS/60CF80351E54C9002CCAB41F

Review: Australian state influenza notifications and school holiday closures in 2019[Issue Credential](#)**Reviewer**

Mehmet Yilmaz

Manuscript

Australian state influenza notifications and school holiday closures in 2019

Content

Seasonal Influenza Surveillance deploying epidemiological and virological data on patients with influenza virus infection is a global task performed in coordination with WHO requirements. These include sentinel surveillance and hospital surveillance for severe cases of laboratory confirmed influenza. Even though influenza has been studied in depth, there are still some issues that need to be addressed, at least to encourage increase in vaccine uptake and recommendations. There are several issues that are not clear and being this a point observation of just one season, inference is not sound enough to ascertain as evidence. Comparison with previous seasons would be desirable. Comments: One highly contrasted issue is the amplification that children trigger as to transmission of infection to their siblings and household members from the school setting. And this might be prevented by vaccination. (Basta et al. 2009)¹. So this is not new but it might be relevant for Australia to implement preventive measures, if so this should be stated. During epidemic periods transmission is high and the number of syndromic cases make laboratory confirmation out of range of health systems. Is this so in Australia? As stated in data sources only laboratory confirmed cases are taken into account for reporting: States and territories differ in how they collect and report data on flu cases. New South Wales⁷ and Queensland⁸ report the number of samples that test positive for Influenza A and B (lab-confirmed); Australian Capital Territory⁹ reports the number of influenza (lab) notifications to the state; and Western Australia¹⁰, Victoria¹¹ and South Australia¹² report the number of lab-confirmed influenza cases (strains unspecified). What is the difference between the three (besides type identification)? Positive for Influenza A and B

Reviewers can issue verifiable credentials for the reviews done

VERIVIEW

 PROFILE

 REVIEWS

 PUBLIC PROFILE

Log Out

Peer Review Credential

 Verified

Please select the attributes below you would like to share publicly on your profile

Credential

Credential ID

<https://journalx.herokuapp.com/reviews/60b0aa071137b0002cdde275/credential>

Name

Peer Review Credential version 0.1

Description

A Verifiable Credential representing a peer review that is done for a scholarly article.

Issuer

did:web:journalx.herokuapp.com

Issuance Date

19 June 2021

Review Author

Author ID

<https://journalx.herokuapp.com/reviewers/60b0a8af1137b0002cdde26f>

Given Name

Mehmet

Family Name

Yilmaz

Email

mehmet@test.com

Institution

Bogazici University

Review

Review ID

<https://journalx.herokuapp.com/users/60b0aa071137b0002cdde275>

Type

PeerReview

☒ **Title**

Review: Using agricultural metadata: a novel investigation of trends in sowing date in on-farm research trials using the Online Farm Trials database

☐ **Content**

This study aims to explore the possibility of using and analyzing metadata in order to tackle overarching agricultural challenges like yield prediction. By applying statistical methods for a specific question, the value of metadata is presented. Different literature has been studied and categorized as part of the introduction. However, the interrelation between these data categories and FAIR could be more clear in the introduction part. Also, the objective could be stated more clearly. Further...

Selecting attributes to disclose on Veriview prototype

VERVIEW

PROFILE

REVIEWS

PUBLIC PROFILE

Log Out

Selectively Disclosed Peer Review Credential

SHOW CODE

DOWNLOAD CREDENTIAL

SUBMIT

Credential**Credential ID**<https://journalx.herokuapp.com/reviews/60b0aa071137b0002cdde275/credential>**Name**

Peer Review Credential version 0.1

Description

A Verifiable Credential representing a peer review that is done for a scholarly article.

Issuer

did:web:journalx.herokuapp.com

Issuance Date

19 June 2021

Review Author**Author ID**<https://journalx.herokuapp.com/reviewers/60b0a8af1137b0002cdde26f>**Given Name**

Mehmet

Family Name

mehmet@test.com

Email

mehmet@test.com

Institution

Bogazici University

Review**Review ID**<https://journalx.herokuapp.com/users/60b0aa071137b0002cdde275>**Type**

PeerReview

Journal**ID**<https://journalx.herokuapp.com/>

Evaluation

Fulfilling self imposed requirements:

- RQ1: Verifiability
- RQ2: Transparency
- RQ3: Open Data
- RQ4: Open Standards
- RQ5: Direct Trust
- RQ6: Selective Disclosure
- RQ7: Compatibility

60 min interviews with 5 different researchers with peer review experience

- Personal connections and contacting Publons users directly.
- Finding out their perspectives on peer review
- Their insights into showcase platforms
- Introduce conceptual design
- User test prototype
- Solicited review on the system

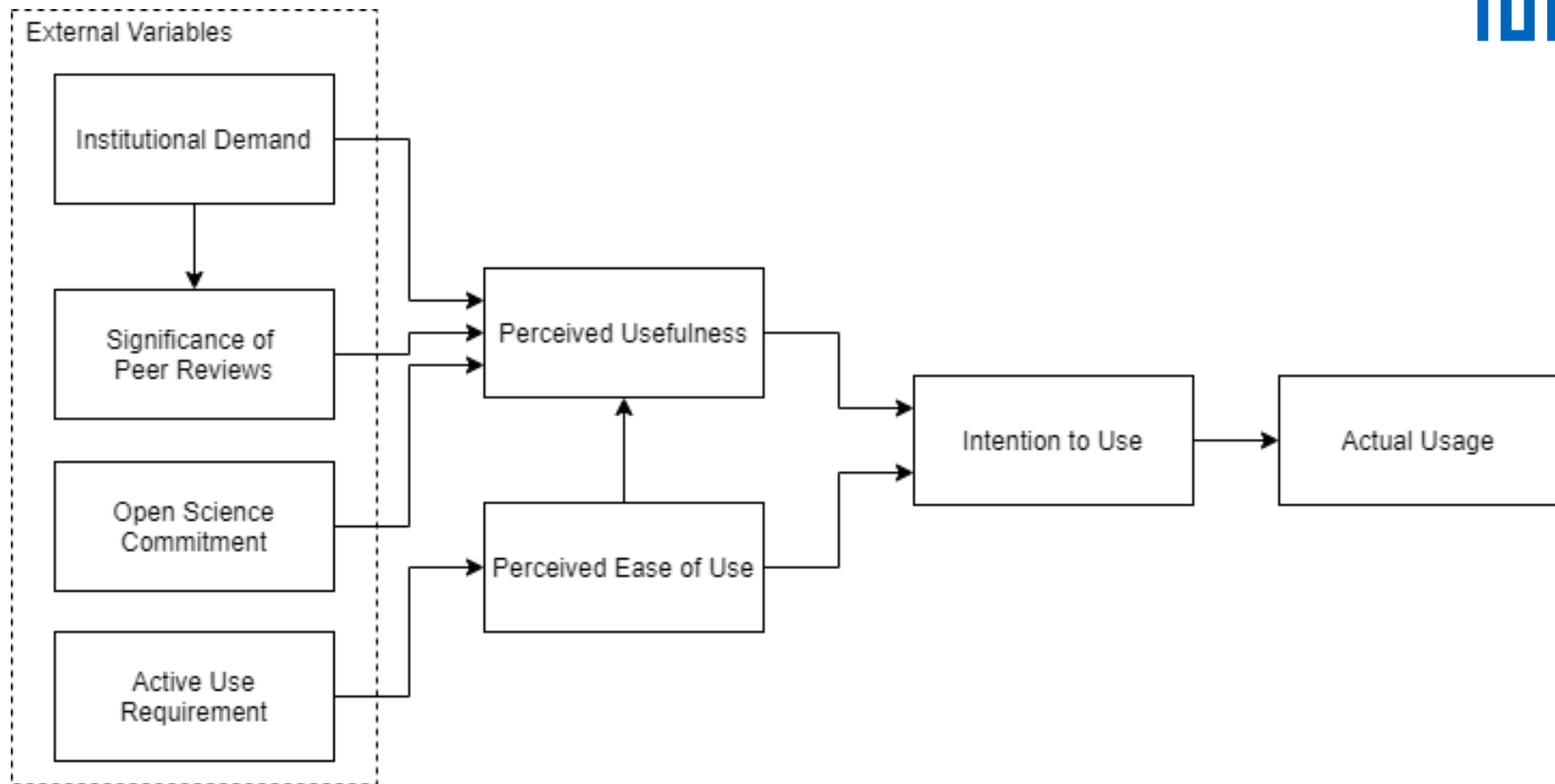
Evaluation

Interview Findings:

- **Too much user involvement:** download-upload and manage credentials
Should be automated as possible.
- **Worth the effort?** Some researchers don't seem to attribute much importance to reviews. For them the system would not provide much value.
- **Need to verify reviews?** Is peer review verification really a necessity? There is not much incentive to lie on reviews
 - Needs validation but there are already widely used platforms so this is also a validation.
- **Open science aspect:** Mostly yes, existing platforms can be a concern in terms of open science

Acceptance Model

- A model for the adoption of the proposed system
- Based on the Technology Acceptance Model (TAM) by Davis, Bagozzi, & Warshaw, 1989
 - Usage of a system depends on the **perceived usefulness** and **perceived ease of use** of the system
- Variables influencing perceived usefulness and perceived ease of use were extracted from interviews.



Discussion and Conclusion

- The dilemma of peer review: Transparency & accountability vs. need for anonymity
- The designed system does not solve the dilemma but attempts to bring two ends closer by leveraging emerging standards and cryptography.
- Learnings from scientific publishing: adherence to open science principles

Shortcomings:

- Journals need to issue credentials
- Consensus on peer review vocabularies
- Peer review habits difficult to change
- Cold start problem
- Inherits the UX problems of Self-Sovereign Identity and Verifiable Credential systems.
 - Credential and key management
- Who will run the system?

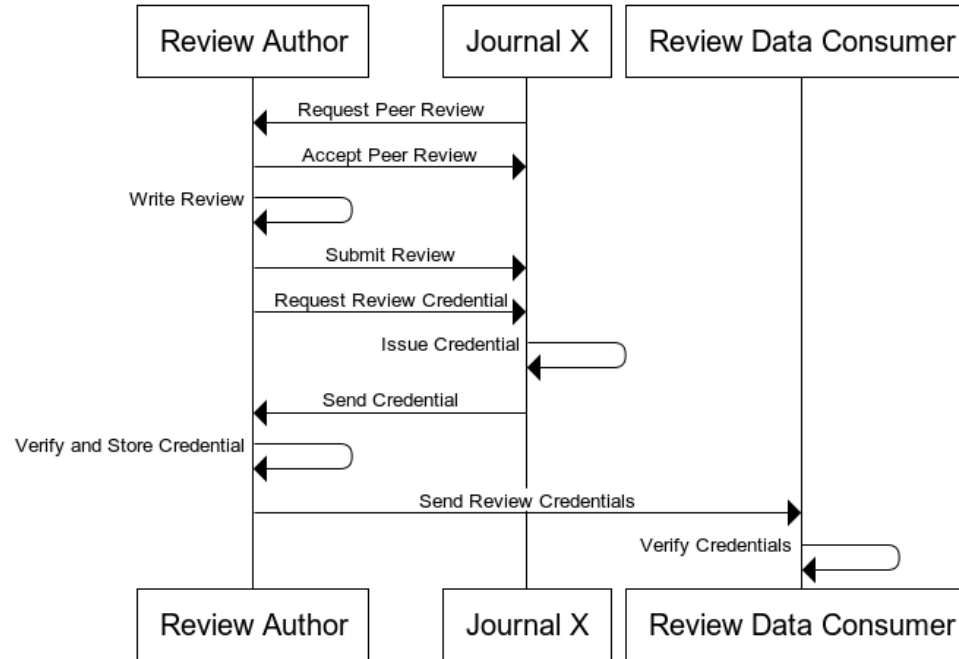
- Wider fundamental problems:
 - What is a good review?
 - How can it be measured?
 - How should it be incentivized or should it be?

- As with anything involving humans, peer review is not perfect either. But it can only improve by research and experimentation.

Thank you for your attention
Questions?

Additional Resources

Peer Review Credential Exchange in Private Setting



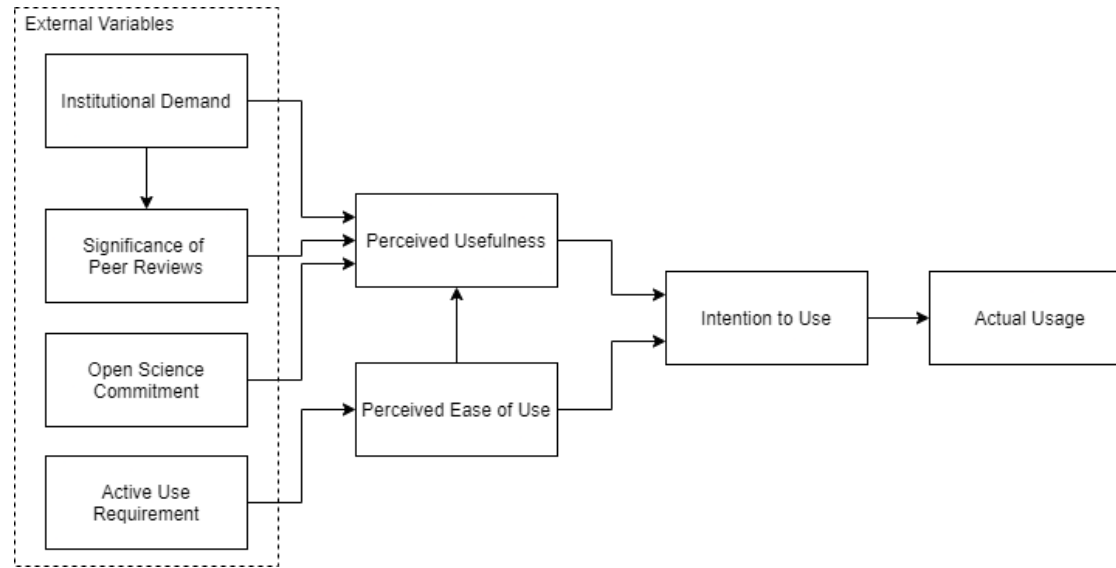
- In a private setting there's no need for attribute selection and the Veriview platform.

```

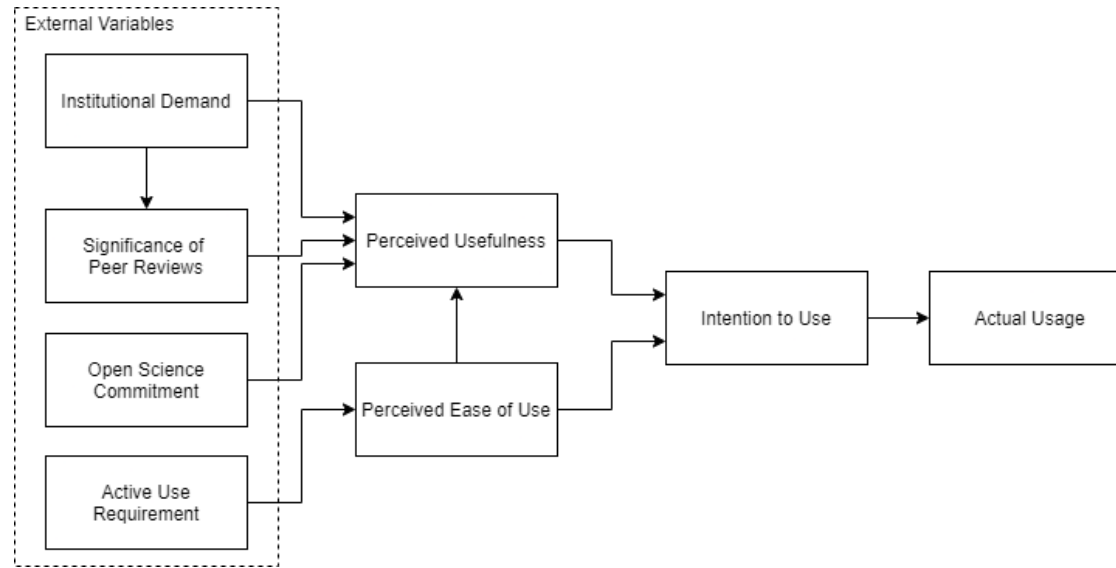
1  {
2    "@context": {
3      "@version": "1.1",
4      "schema": "http://schema.org/",
5      "PeerReviewCredential": {
6        "@id": "https://raw.githubusercontent.com/kuzdogan/peer-review-verifiable-credentials-thesis/main/code/PeerReview.json#PeerReviewCredential",
7        "@context": {
8          "@version": "1.1",
9          "id": "@id",
10         "type": "@type",
11         "description": "schema:description",
12         "name": "schema:name"
13       },
14     },
15     "PeerReview": {
16       "@id": "https://raw.githubusercontent.com/kuzdogan/peer-review-verifiable-credentials-thesis/main/code/PeerReview.json#PeerReview",
17       "@context": {
18         "@version": "1.1",
19         "id": "@id",
20         "type": "@type",
21         "title": "schema:headline",
22         "content": "schema:text",
23         "reviewDate": "schema:dateCreated",
24         "competingInterestStatement": "schema:Text",
25         "recommendation": "schema:Recommendation",
26         "journal": {
27           "@id": "https://raw.githubusercontent.com/kuzdogan/peer-review-verifiable-credentials-thesis/main/code/PeerReview.json#journal",
28           "@context": {
29             "@version": "1.1",
30             "id": "@id",
31             "type": "@type",
32             "name": "schema:name",
33             "issn": "schema:issn"
34           },
35         },

```

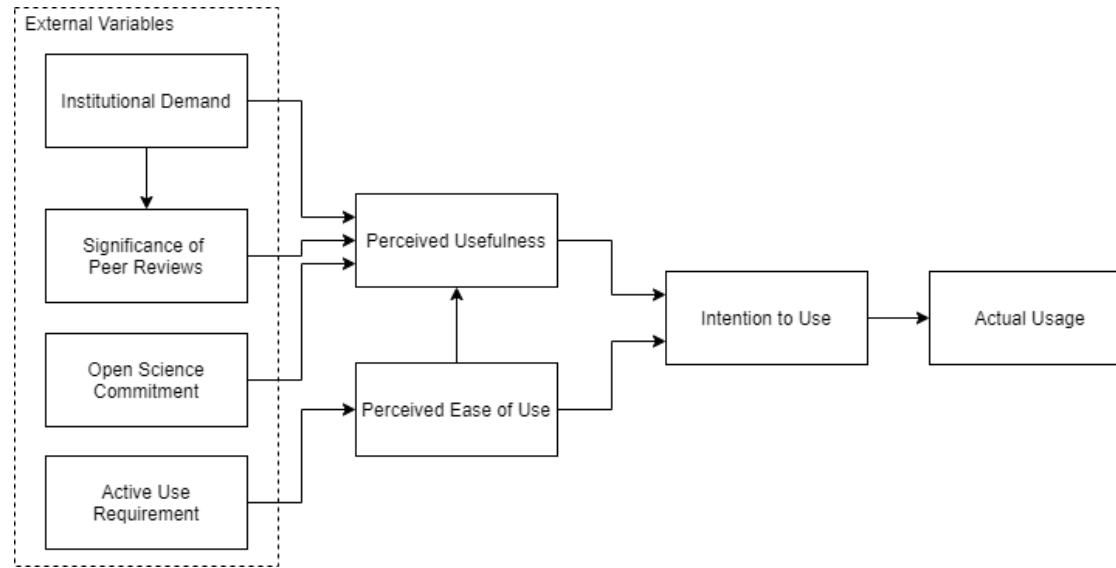
Defined peer review context



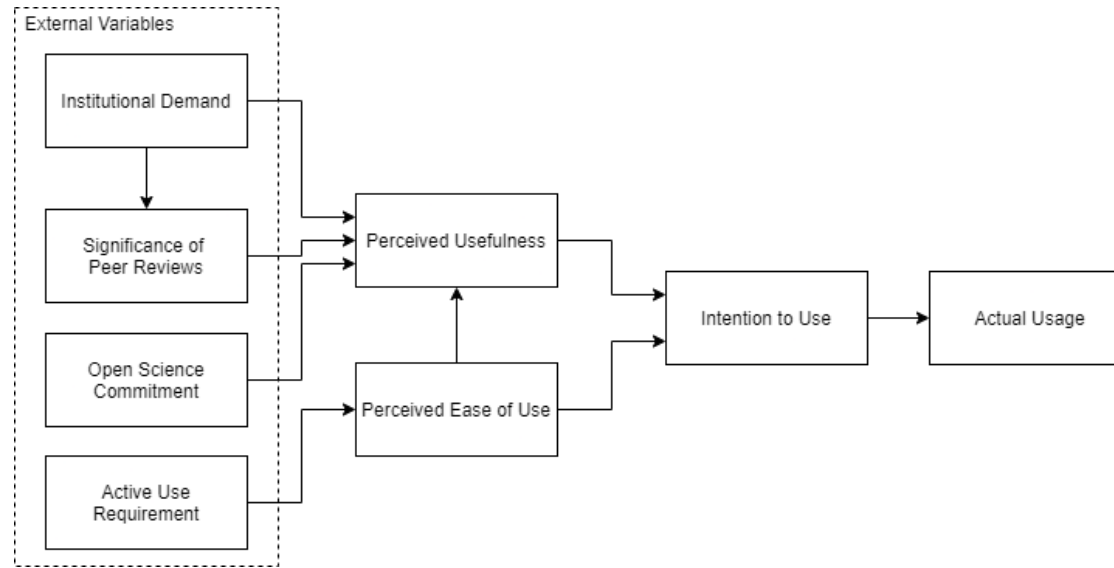
- Institutional Demand: Peer reviews are not an important part of the resume as it is not considered by institutions.
- Higher institutional demand will have a positive impact on the perceived usefulness of the system



- Significance of Reviews: Value given by researchers, recognition from institutions, perception of the broader scientific community
- Higher significance of reviews will have a positive impact on the perceived usefulness
- Chicken and egg problem here: Showcasing platforms not used because peer review is not recognized, and peer review is not recognized because peer review can't be "showcased".
- Room for positive feedback: more visibility → more recognition → more showcasing → more visibility



- Open Science Commitment of a researcher has a positive impact on the perceived usefulness.



- Active Use: As researchers don't spend much time on peer review, more active use would influence the ease of use negatively.
 - This variable is the only variable of the designed system. The rest are outside the system design.