Digital Transformation of Education Credential Processes and Life Cycles

A Structured Overview on Main Challenges and Research Questions

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About me

- Diploma in Physics at University of Regensburg, Germany

- Dr. europeus by University of Granada, Spain

- Experience in biomedical data analytics, high order statistics

- Main interests:
  - Distributed systems and networks (blockchain, etc)
  - Open science and Open Data
  - Biomedical data analytics

- See my VIVO page:
  https://vivo.tib.eu/fis/display/n0000-0002-9878-1698

Our Research groups

Scientific Data Management

- Knowledge graphs
- Domain specific ontologies
- Integration of data sources
- Federated query engines
- Tools like SDM-RDFizer, Falcon
- … and much more

Open Science Lab

- Linked Open Data & research information
- Open Education
- Open Research Data
- Open Science communication
- Self Sovereign Identity & Distributed Identifiers
- … and much more

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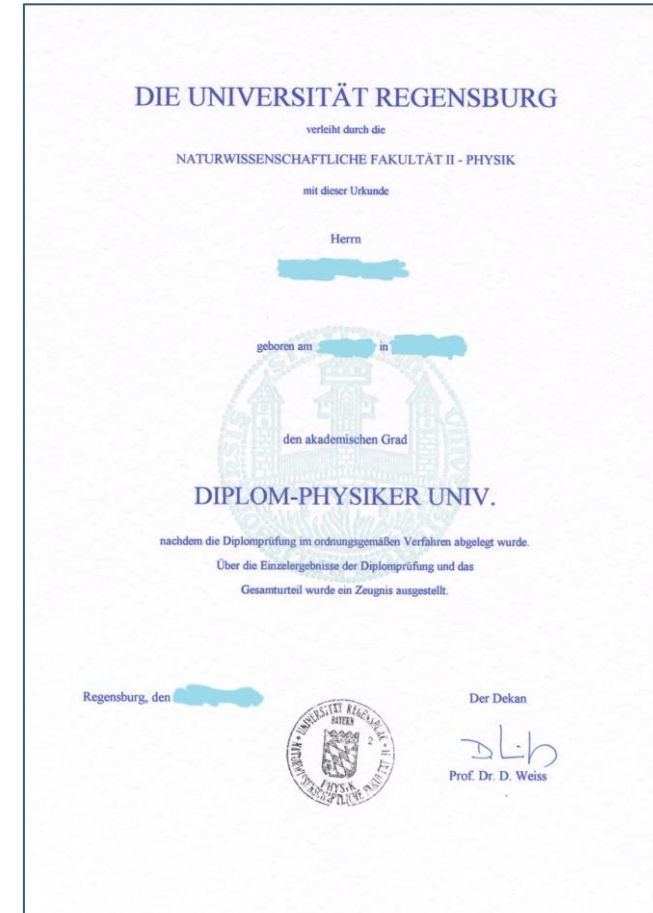
5. **Outlook**

Motivation

Motivation

Education credentials rule our lives:

- School

- University

- Jobs

- Life long learning

Still mostly in paper, but digital formats are coming.

DIE UNIVERSITÄT REGENSBURG
verleiht durch die
NATURWISSENSCHAFTLICHE FAKULTÄT II - PHYSIK
mit dieser Urkunde
Herrn

geboren am   in

den akademischen Grad

DIPLOM-PHYSIKER UNIV.

nachdem die Diplomprüfung im ordnungsgemäßen Verfahren abgelegt wurde.
Über die Einzelergebnisse der Diplomprüfung und das
Gesamturteil wurde ein Zeugnis ausgestellt.

Regensburg, den   Der Dekan

Prof. Dr. D. Weiss

Question

How can we evaluate credential management solutions for the transformation from paper to digital?
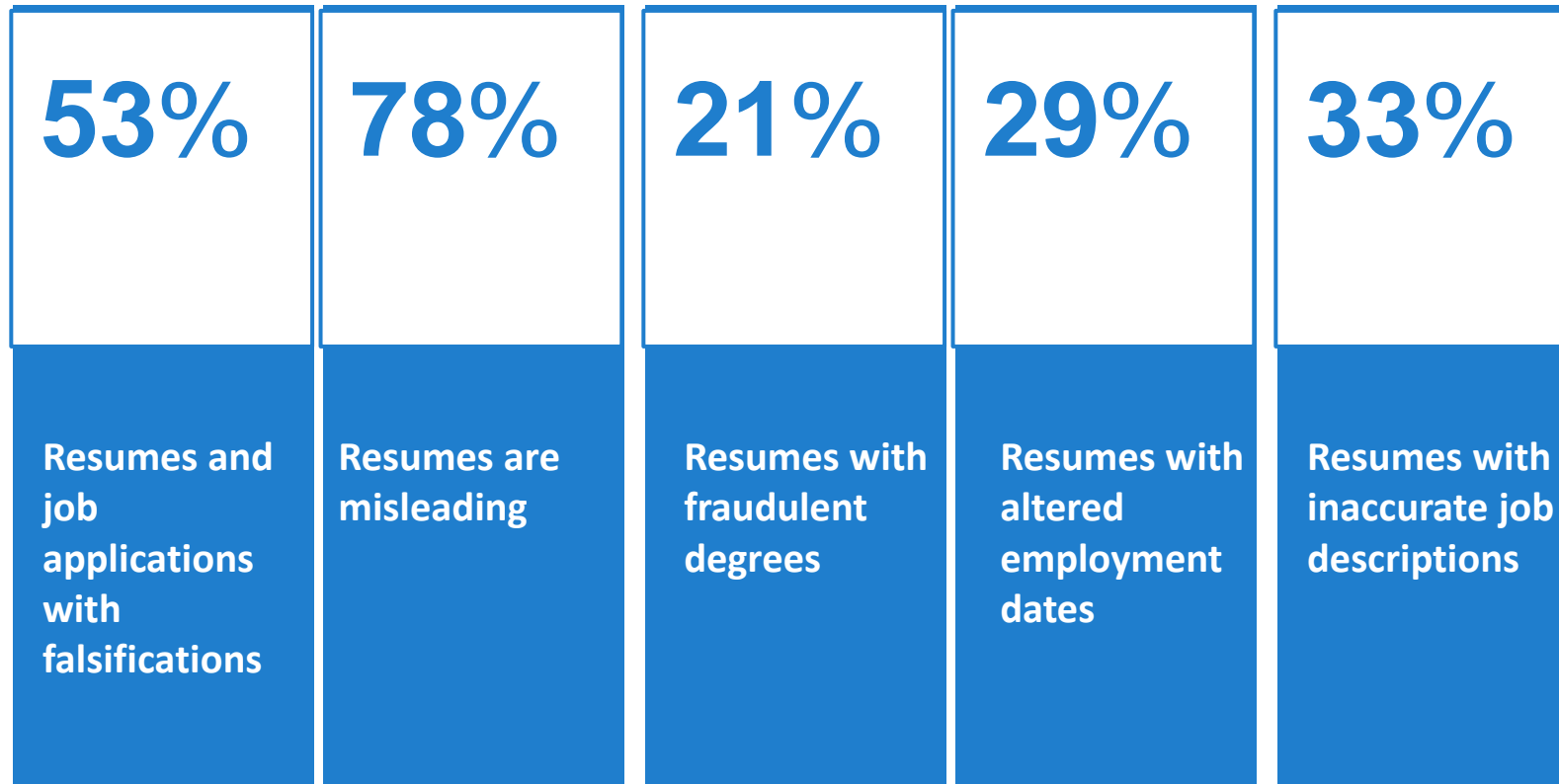
Answer

…We look at the challenges:

- In analogue world
- In analogue to digital transformation
- In digital world

Challenges of paper-based credentials

Fraud and Verification

53%	**78%**	**21%**	**29%**	**33%**
Resumes and job applications with falsifications	Resumes are misleading	Resumes with fraudulent degrees	Resumes with altered employment dates	Resumes with inaccurate job descriptions

According to a survey by **CareerBuilder.com** (one of the largest online job finder sites)

"Fifty-eight Percent of Employers Have Caught a Lie on a Resume, According to a New CareerBuilder Survey", August 7, 2014, https://www.careerbuilder.com/share/aboutus/pressreleasesdetail.aspx?sd=8%2F7%2F2014&id=pr837&ed=12%2F31% 2F2014

Dependency on Issuer

- Cost of anti-counter feign measures

- Trust based on big institutions

- Manual verification required for peer 2 peer certificates (e.g. letters of reference)

Image by Bruno /Germany from Pixabay
https://pixabay.com/photos/seal-sealed-write-communicate-3237984/

Handling

- Easy with few credentials
- High effort with many (e.g. job application process at HR)

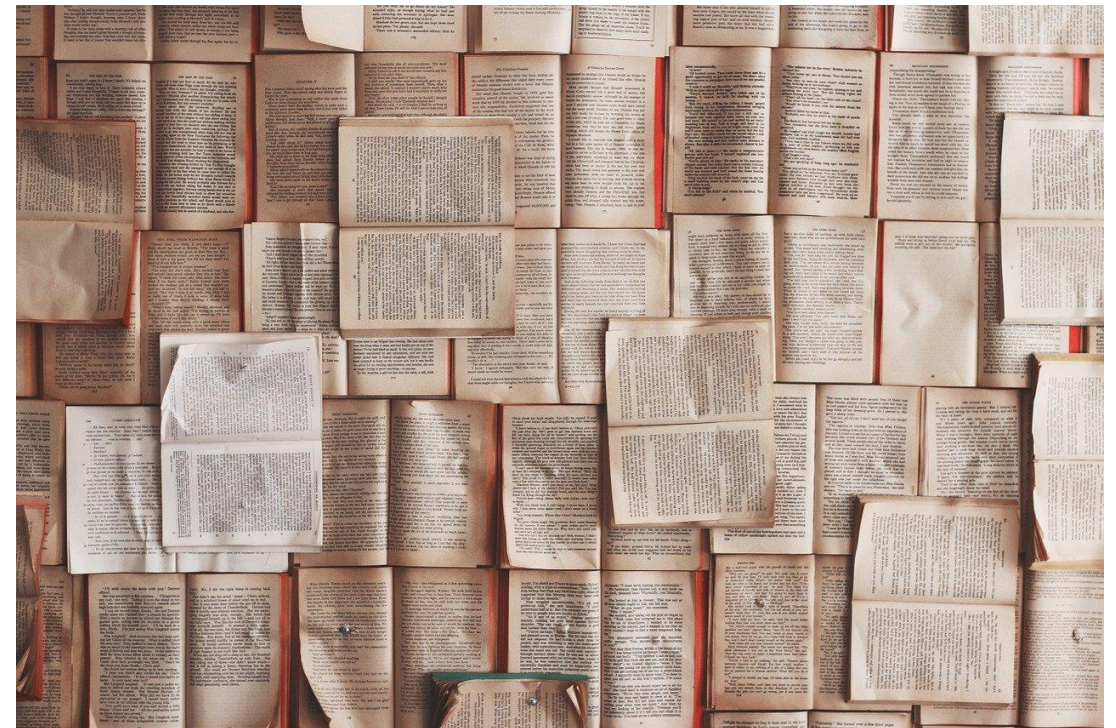Image by Free-Photos from Pixabay
https://pixabay.com/photos/books-pages-story-stories-notes-1245690/

Data Security

- Paper sensitive to fire, humidity, vermin

- Perfect duplication impossible

- Good knowledge of preservation in archives

Image by Michal Jarmoluk from Pixabay.
https://pixabay.com/photos/old-books-book-old-library-436498/

Challenges of transition from analogue to digital credentials

Digitisation

- Should retain all important information

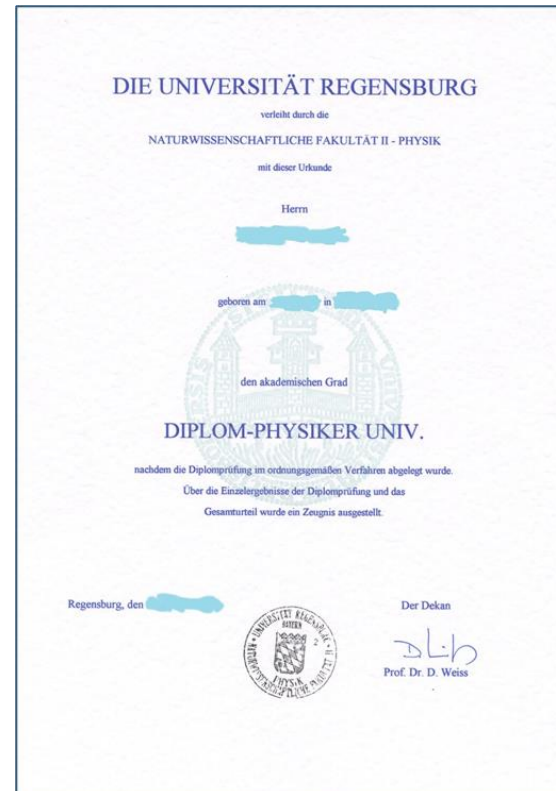- Structured data needed

- Simple scans not enough

```
{
  "@context": "https://w3id.org/openbadges/v2",
  "id": "https://example.org/assertions/123",
  "type": "Assertion",
  "recipient": {
    "type": "email",
    "identity": "alice@example.org"
  },
  "issuedOn": "2016-12-31T23:59:59+00:00",
  "verification": {
    "type": "hosted"
  },
  "badge": {
    "type": "BadgeClass",
    "id": "https://example.org/badges/5",
    "name": "3-D Printmaster",
    "description": "This badge is awarded for passing the 3-D printing knowledge and safety test.",
    "image": "https://example.org/badges/5/image",
    "criteria": {
      "narrative": "Students are tested on knowledge and safety, both through a paper test and a supervised
    },
    "issuer": {
      "id": "https://example.org/issuer",
      "type": "Profile",
      "name": "Example Maker Society",
      "url": "https://example.org",
      "email": "contact@example.org",
      "verification": {
        "allowedOrigins": "example.org"
      }
    }
  }
}
```

Workflows

Needs to handle:

- Paper based credentials
- Digital credentials

```
{
  "@context": "https://w3id.org/openbadges/v2",
  "id": "https://example.org/assertions/123",
  "type": "Assertion",
  "recipient": {
    "type": "email",
    "identity": "alice@example.org"
  },
  "issuedOn": "2016-12-31T23:59:59+00:00",
  "verification": {
    "type": "hosted"
  },
  "badge": {
    "type": "BadgeClass",
    "id": "https://example.org/badges/5",
    "name": "3-D Printmaster",
    "description": "This badge is awarded for passing the 3-D printing knowledge and safety test.",
    "image": "https://example.org/badges/5/image",
    "criteria": {
      "narrative": "Students are tested on knowledge and safety, both through a paper test and a supervised p
    },
    "issuer": {
      "id": "https://example.org/issuer",
      "type": "Profile",
      "name": "Example Maker Society",
      "url": "https://example.org",
      "email": "contact@example.org",
      "verification": {
        "allowedOrigins": "example.org"
      }
    }
  }
}
```

Challenges of digital credentials

Private data protection

Person rights from GDPR:

- Information about data processing

- Access to personal data

- Correct and delete wrong data

- Erase old/unlawful data

- Data portability

- Human decision making

4.5.2016   EN   Official Journal of the European Union   L 119/1

REGULATION (EU) 2016/679 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

of 27 April 2016

on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation)

(Text with EEA relevance)

THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION,

Having regard to the Treaty on the Functioning of the European Union, and in particular Article 16 thereof,

Having regard to the proposal from the European Commission,

After transmission of the draft legislative act to the national parliaments,

Having regard to the opinion of the European Economic and Social Committee [1],

Having regard to the opinion of the Committee of the Regions [2],

Acting in accordance with the ordinary legislative procedure [3],

Whereas:

(1) The protection of natural persons in relation to the processing of personal data is a fundamental right. Article 8(1) of the Charter of Fundamental Rights of the European Union (the 'Charter') and Article 16(1) of the Treaty on the Functioning of the European Union (TFEU) provide that everyone has the right to the protection of personal data concerning him or her.

(2) The principles of, and rules on the protection of natural persons with regard to the processing of their personal data should, whatever their nationality or residence, respect their fundamental rights and freedoms, in particular their right to the protection of personal data. This Regulation is intended to contribute to the accomplishment of an area of freedom, security and justice and of an economic union, to economic and social progress, to the strengthening and the convergence of the economies within the internal market, and to the well-being of natural persons.

Data Security

- Lots Of Copies Keep Stuff Save
- Physical storage degrades over time
- Frequent re-copying
- Open formats necessary

Data Management

- Digital data needs to be rendered

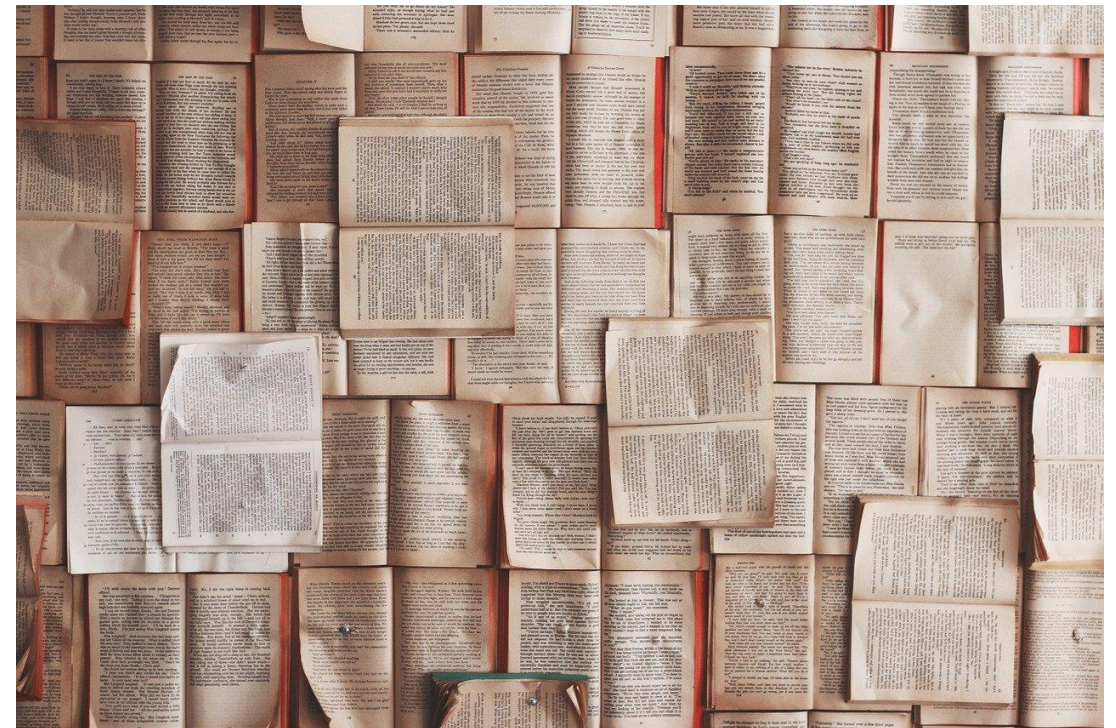- Where is the data

- How can I handle the data?

Image by Free-Photos from Pixabay
https://pixabay.com/photos/books-pages-story-stories-notes-1245690/

Data Sovereignty

- Who has power over credential?
- Paper: physical ownership
- Digital: ?

The world's most valuable resource is no longer oil, but data

The data economy demands a new approach to antitrust rules

The Economist, 6. Mai 2017
https://www.economist.com/leaders/2017/05/06/the-worlds-most-valuable-resource-is-no-longer-oil-but-data

Evaluation Framework

Method

- Questionnaire
- Cover all challenges
- Qualitative questions on each challenge
- Quantitative questions on specific characteristics of solution

Example: Data Security

Question	QUnit
How is the credential stored in the system?	qualitative
Is the credential data format public and open?	yes/no
How many independent copies of the credential are stored in the system at any time?	number
How is the credential secured against accidental loss or data change?	qualitative
How is the credential secured against unauthorised, but intentional, loss or change of data?	qualitative

See for complete framework:
https://www.thinkmind.org/index.php?view=article&articleid=elml_2020_4_30_58006

Use Case

QualiChain Pilots

- Cross-University Degree Equivalence Verification
- Smart Curriculum Design
- Staffing the Public Sector
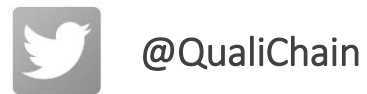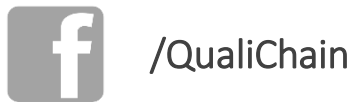- Provision of HR Consulting & Competency Management Services

Outlook

- Evaluation will start in 2021

- Extended framework submitted to the International Journal On Advances in Intelligent Systems

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European Commission