

A Standardized Digital Maturity Index (DMI) and the Application to Higher Education

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Motivation

- Doing the right things – doing things right
- Measuring is key to the successful change
- Guiding the Digital Transformation (Dx) requires continuous monitoring
- How to measure the maturity of a changing organization

What's wrong about the „state of the art“

- Digital Maturity by Capability Maturity Model Integration (CMMI)
 - no indication what to do next
 - no relative weight on how to improve
- EDUCAUSE Self-Assessment
 - no comparison between HEIs
 - requires major effort, when done for multiple area
- Four stage model by HIS HE
 - coarse and unspecific
 - oriented towards transport media (paper vs. database)

How to develop a new Digital Maturity Index (DMI)?

- Collect requirements
- Generic idea and robust mathematical model
- Design data acquisition
- Collect data
- Find relative weights of items
- Validate results with additional data

What would we expect of an DMI?

- General features
 - Simple: Clear and concise coverage of the relevant scope.
 - Generic: Measurable items while maintaining a level of abstraction.
 - Flexible: Adaptable to specific sectors through the choice of parameters.
 - Robustness: Missing items or values should not result in major changes.
- Requirements as digital index
 - Relevant: Mixture of Dx-related items.
 - Objective: Derived from facts rather than judgements.
 - Unspecific: Independent of specific technologies
- Requirements to an index suitable for measuring maturity
 - How, not what: Measure how things are done
 - Applicable: To any process or capability in institutions.

Technological qualities of digital processes

- **Reliability:** The ability to ensure the reliability and availability of systems and applications and minimise downtime and disruptions.
- **Usability:** The ability to design systems and applications that are user-friendly and intuitive, and meet user needs and expectations.
- **Flexibility:** The ability to adapt systems and applications to changing business requirements and processes.
- **Standardisation:** The extent to which digital processes are standardised and documented to ensure consistency in execution.
- **Security:** The ability to ensure the security and privacy of data and systems, and protect against cybersecurity threats.
- **Scalability:** The ability to scale systems and applications up or down to meet changing business needs and demands.
- **Integration:** The ability to integrate different systems, applications, and data sources to streamline operations and improve data management.
- **Continuous Improvement:** The level of commitment to continually improving digital processes to optimise performance and meet changing business needs.
- **Performance:** The ability to optimise system and application performance to ensure they meet performance requirements and deliver a seamless user experience.
- **Automation:** The ability to automate tasks and processes to increase efficiency and productivity. Requirements to an index suitable for measuring maturity

Selected items in questionnaire

- **Paper***: The use of printed paper as a data carrier is necessary for the processes.
- **Help***: Professional information and help are available online and can be found through search engines.
- **Exceptions**: It is always possible to intervene in the process to take circumstances into account.
- **Online forms***: Can be digitally processed by users after downloading (e.g., using embedded full text, XML and signatures).
- **Roles and rights**: Responsibilities are mapped digitally.
- **No media discontinuity***: The process is entirely electronic.
- **Persistent data**: Existing data (e.g., from forms and databases) can be reused by users.
- **Data quality**: Data is enhanced and checked for plausibility as it is entered and processed.
- **Interfaces**: Data is linked to other processes via standardised interfaces.
- **Parallel processing**: In some cases, the processing of a case is carried out by several people in parallel.
- **Sampling**: Processing is largely automated, with manual random checks only carried out on a case-by-case basis.

X

- Time scale: Current status (now), intended development during next 5 years (5y), long term perspective (long term), and item is not a goal

DMI calculation

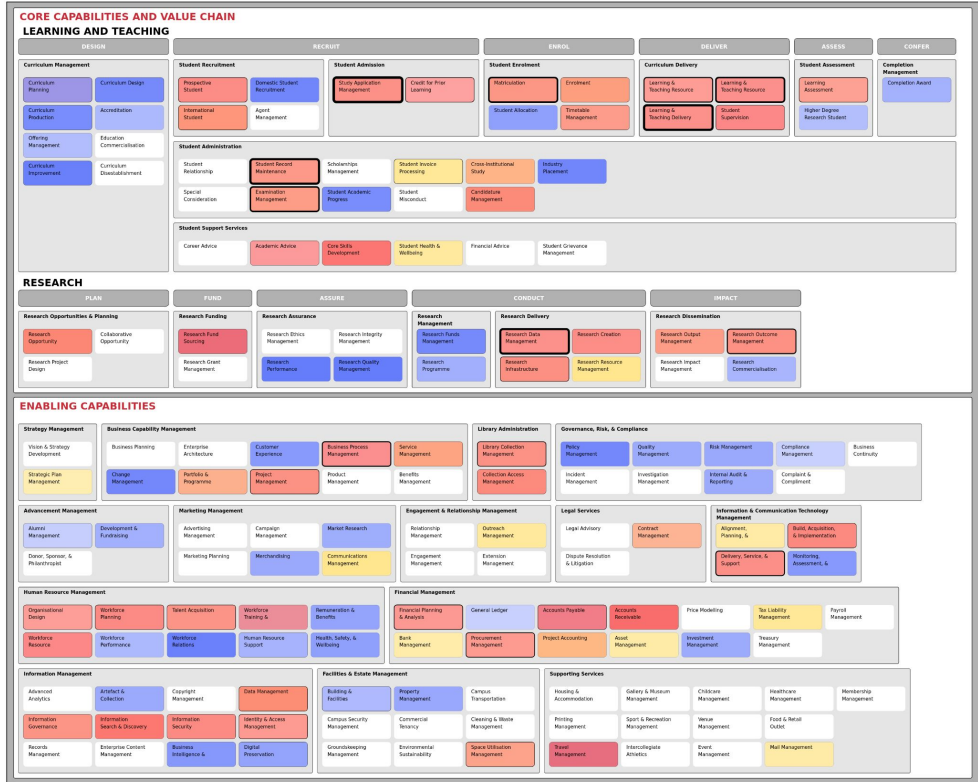
DMI = (sum{n=1;n≤MaxSelection} of biggest n item weights at point in time) / MaxSelection

- Assessment of 11 items across 3 time scales (now, 5y, long-term)
- Weight optimisation to range of 10-100 by Monte Carlo Simulation
- Stable and robust results for 9 to 11 items (MaxSelection)
- High correlation with overall Digital judgement (data from survey)

Max Selection	Cluster	Reversal Error	Distance Measure	Average Weight	V589	V590	V591	V592	V593	V594	V595	V596	V597	V600	V601
2	0	62	41	51.5	27	35	56	86	19	45	75	95	65	50	14
3	2	58	136	46.6	16	31	47	94	24	46	70	82	58	35	10
4	1	49	66	47.6	10	23	43	94	39	51	73	81	62	32	16
5	2	41	258	50.5	12	27	38	96	45	89	60	81	62	29	17
6	1	32	174	61.0	12	38	46	90	78	83	65	98	85	51	25
7	1	24	276	64.4	12	48	56	92	77	82	68	100	87	60	26
8	2	21	398	64.2	10	42	74	84	79	79	72	98	90	57	21
9	2	17	599	65.4	12	42	57	73	72	81	80	99	88	66	49
10	2	17	561	64.4	11	40	58	71	73	79	78	98	86	64	50
11	2	17	593	64.5	11	41	58	71	73	79	78	98	87	64	49
Stats	Cluster	Reversal Error	Distance Measure	Average Weight	Paper	Help	Online forms	No media discontinuity	Per-sistent data	Inter-faces	Data quality	Sam-pling	Parallel proces-sing	Roles and rights	Except-ions
Mean	2	34	310	58	13	37	53	85	58	71	72	93	77	51	28
StdDev	0.7	16.7	204.7	7.5	4.8	7.3	9.7	9.5	22.5	16.1	6.0	7.7	12.6	13.3	14.9
Min	0	17	41	47	10	23	38	71	19	45	60	81	58	29	10
Max	2	62	599	65	27	48	74	96	79	89	80	100	90	66	50

Application

- Higher Education Reference Model (HERM) - V2.6
- 205 Ratings from the Digital Survey of Business Capabilities in German HEIs
- Yellow – past 5 years
Blue – next 5Y
Red – ongoing mix
Intensity ~ DMI



Summary

- Assessment of status of 11 items across 3 time scales (now, 5y, long-term) sufficee adaptation of sector specific DMI.
- Judgement of current situation requires 11 yes/no questions of same items.
- DMI is calculated as average accross subset of weights.
- DMI is generic and can be used to compare multiple institutions.
- DMI is independent of organisational changes, size, or type of institution.
- DMI can be applied to generic models like the HERM.

Sources concerning Dx survey in Germany (2022)

Data, tools and questionnaire of the original Dx survey: DOI [10.5281/zenodo.6383770](https://doi.org/10.5281/zenodo.6383770)

Description of procedures and methods: DOI [10.5281/zenodo.6383774](https://doi.org/10.5281/zenodo.6383774)

Results of the survey (German): DOI [10.5281/zenodo.6948103](https://doi.org/10.5281/zenodo.6948103)