

SME-DESI: A DIGITAL DEVELOPMENT INDEX

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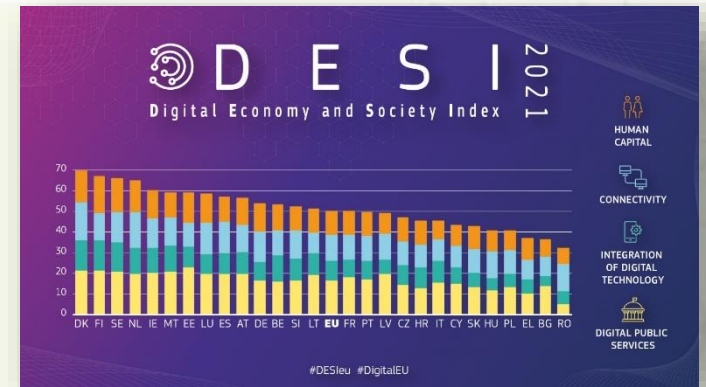
**Inspiration:
DESI (EU)**

**Representative survey
of 2500 firms**

**Entropy-
based
objective
weights**

**Firm size
and digital
readiness**

INSPIRATION: DESI



EU DESI REPORT

Aim: monitor the digital development of the EU and its 27 member states

Three levels (principal dimensions, sub-dimensions, and individual indicators)

Equal weights (25%) for all dimensions, arbitrary weights for the lower levels

Source: Digital Economy and Society Index (DESI) 2022. European Commission, 2022. URL: <https://digital-strategy.ec.europa.eu/en/library/digital-economy-and-society-index-desi-2022>

DESI AND SME-DESI

Original DESI dimensions	SME-DESI dimensions
Connectivity (CN)	Devices and network access (CN)
Human Capital (HC)	ICT skills and knowledge (HC)
Integration of Digital Technology (IT)	General (external) applications (IT1)
	Specific (internal) applications (IT2)
Digital Public Services (DP)	Use of digital public services (DP)

Differences: A richer set of indicators in the IT₁ and IT₂ SME-DESI dimensions
Subjective, arbitrary weights (EU DESI) v. entropy-based weights (SME-DESI)

OUR DATASET



ENTERPRISE SURVEY (2020)

Representative survey of 2500 companies
(600 retailers, 600 service providers,
800 industrial manufacturers)

19 question blocks: digital readiness of
Hungarian companies (mostly SMEs)

2 phases: Early 2020 (pre-Covid) and Fall
of 2020 (after the first wave)

SME-DESI DIMENSIONS

Of the 19 questions blocks of our survey, we used 13 to construct the SME-DESI

No.	Question blocks in the questionnaire	Number of questions	SME-DESI dimensions
1	Material access (IAS, devices)	6	CN
2	e-Government, administration	2	DP
3	Use of online financial services	8	DP, IT1
4	Web presence, online marketing	2	IT1
5	Enterprise Resource Planning (ERP) systems, CRM, SCM	3	IT1, IT2
6	Digital HR practices and systems	2	IT2
7	Cloud services	1	HC
8	e-Commerce	8	IT2
9	e-Invoice	4	IT1
10	Big Data	4	IT2
11	Online communication	1	IT2
12	ICT security	1	HC
13	ICT expertise	4	HC

ENTROPY-BASED WEIGHTS

Normalizing the data:

$$y_{ji} = \frac{x_{ji} - x_j^{\min}}{x_j^{\max} - x_j^{\min}}, \quad (j = 1, 2, \dots, n, i = 1, 2, \dots, m)$$

Entropy-based objective weights:

$$H_i = - \frac{1}{\ln(n)} \cdot \sum_{j=1}^n \frac{y_{ji}}{\sum_{j=1}^n y_{ji}} \cdot \ln \left(\frac{y_{ji}}{\sum_{j=1}^n y_{ji}} \right), \quad (i = 1, 2, \dots, m).$$

$$w_i = \frac{1 - H_i}{n - \sum_{i=1}^m H_i}, \quad (i = 1, 2, \dots, m).$$

Source: Zou Z. H., Yi Y., Sun, J. N. Entropy method for determination of weight of evaluating indicators in fuzzy synthetic evaluation for water quality assessment // Journal of Environmental Sciences. 2006. Vol. 18, iss. 5. P. 1020–1023.

WEIGHTS OF DIMENSIONS

The main SME-DESI dimensions and their weights

Devices and network access (CN)	0.200
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ICT skills and knowledge (HC)	0.273
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General (external) applications (IT1)	<i>0.045</i>
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Specific (internal) applications (IT2)	0.249
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Use of digital public services (DP)	0.233
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SUB-DIMENSIONS

Dimensions	Sub-dimensions	Weights
Devices and network access (CN)	Internet access	0.152
	Mobile broadband	0.158
	Devices	0.042
	Portable devices	0.247
	Desktop	0.171
	Laptop	0.230
ICT skills and knowledge (HC)	Cloud	0.100
	ICT security	0.098
	ICT full time employee	0.803
Use of digital public services (DP)	e-Government	0.217
	Company gateway	0.085
	Electronic signature	0.699

As for the sub-dimensions, the weights are equal for all sub-dimensions in the IT1 and IT2 dimensions, but are all different in the other three dimensions.

Dimensions	Sub-dimensions	Weights
General (external) applications (IT1)	Online interface	0.111
	Online access	0.111
	Bank transaction	0.111
	Bank electronic	0.111
	Instant payment	0.111
	Loan calculator	0.111
	Digital banking solutions	0.111
	Billing	0.111
	e-Invoice	0.111
	Specific (internal) applications (IT2)	e-Commerce
Full ERP		0.125
Smaller systems		0.125
ERP modules		0.125
Digital HR		0.125
Digital advertising		0.125
Big Data		0.125
Company database		0.125

SIZE DISTRIBUTION OF FIRMS

No.	Category	Employees	Companies
1	Micro (SME)	5-9	1463
2	Small I (SME)	10-19	415
3	Small II (SME)	20-49	169
4	Medium (SME)	50-249	355
5	Large	250+	98

THE RESULTS



ANOVA METHOD (SPSS 26)

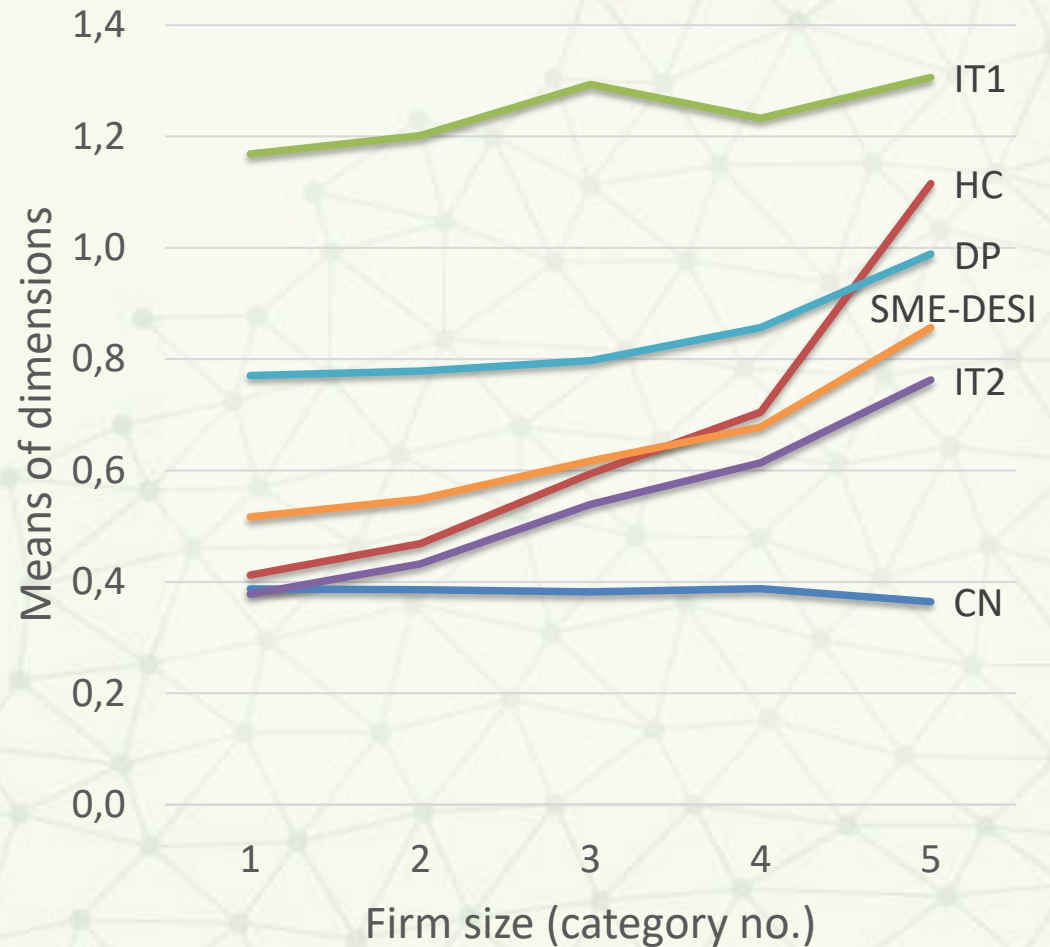
The means are different for all firm sizes, except for the Devices and network access (CN) dimension

The variances in the CN and DP dimensions are roughly identical, while they differ for the other four variables

SIZE MOSTLY MATTERS

Measures of association

	R	R ²	η	η ²
CN * Firm size	-0.011	0.000	0.020	0.000
HC * Firm size	0.385	0.148	0.412	0.170
IT1 * Firm size	0.115	0.013	0.130	0.017
IT2 * Firm size	0.444	0.197	0.449	0.201
DP * Firm size	0.087	0.008	0.097	0.009
SME- DESI * Firm size	0.365	0.133	0.381	0.145



The results for CN could indicate that internet and device penetration is almost the same across all groups and is no longer a barrier for small businesses.

CONCLUSIONS

In terms of other further research avenues, our SME-DESI indicator (and the enterprise survey) offer several additional possibilities for analysis and ranking. For example, in addition to firm size, we can also examine the impact of the region or type of municipality in which the firm is located or explore the relationship between firms' digital sophistication and profitability.

Firm size
& SME-
DESI

HC, IT₂:
Size
matters

Further
research

In conclusion, our results on the relationship between firm size and the dimensions show that the number of employees in firms will be significant for ICT skills (HC) and for the sophisticated digital applications. This result is not entirely unexpected, as economies of scale mean that primarily medium-sized or larger firms (outside the ICT sector) can afford to employ IT specialists (in-house) and use complex ERP modules, but further research would be needed to assess how much of a disadvantage this difference may represent for these smaller firms in terms of business efficiency, competitiveness, or financial performance.

**Thank you for your
attention!
Any questions?**



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