

WHAT ARE THE ENGINEERING PROFESSIONAL COMPETENCES?



Questions

Focusing on the labour market expectations:

- › What competences are being highlighted in the existing literature, is there agreement among experts as to what they are?
- › What are the methods commonly employed to find these competences?

Systematic literature review

- › Large scale literature review utilising the following databases:
 - › Taylor and Francis
 - › Wiley online Library
 - › Springer international publishing
 - › ASEE Peer

- › Search terms used:

“engineering competences”, “generic competences”, “graduate competences”
“graduate engineer”,

- › Identified **115 published papers** relating to engineering competences **within the last decade**

Selection Criteria

- › Paper must be published from **2010 onwards**
- › Paper must contain a list of **rated professional competences (Likert scale)**
- › Ratings must come from Engineering professionals and HR
- › Ratings must be with regard to graduate competences
- › **9 paper identified**

#	Author	Year	Country	Cohort	Methods	Competence list	Data type	Publisher
1	Baytiyeh [4]	2010	Lebanon	Civil engineers Mechanical Engineers Electrical Computer Engineering management	Survey	ABET	Likert	ASEE/IEEE
2	Han Ahn et al [7]	2012	USA	Project manager Project engineer HR manager Director Vice President Other	Survey	Generated	Likert	Journal of professional issues in engineering and practice
3	Hinchcliff and Jolly [11]	2011	UK	HR & other management HR & other management	Survey Interview		Likert Qualitative	British Educational Research Journal
4	Husain et al [5]	2010	Malaysia	Managers (Engineers) Supervisor (Engineers) Others	Survey	SCANS Model	Likert	Procedia Social and Behavioral Sciences
5	Robles [15]	2012	USA	CEO's, presidents	Expert panel	Generated	Likert	Business Communication Quarterly
6	Warnick [6]	2011	USA	Mechanical Engineers	Survey	Generated	Likert	American Society for Engineering Education
7	Ortiz-Marcos [10]	2013	Spain	Engineers	Mixture	PMI Framework	Likert	Project management journal
8	Peiro et al [9]	2016	Jordan	Telecom engineers	Survey	Generated	Likert	European journal of engineering education
9	Pons [8]	2015	New Zealand	Engineers	Survey	Washington Accord	Likert	European journal of engineering education

Findings

- › **The lists of competences**
- › No consistency found in how the lists of competences were created
 - › Difficult to find meaningful comparisons across multiple studies

The Data

- › Difficult to determine *how much more important* one competence is over another using Likert scales (not an equal measures scale)
- › All authors quoted 2 decimal places of accuracy on a Likert scale (Data does not form a continuum)
 - › Nonparametric analysis not utilised in any of the studies to determine statistical significance of differences between competence scores.
 - › Some use of parametric statistics found

Conclusions

- › No agreement found in literature as to what competences are most important to the cohorts investigated here
 - › Mainly due to lack of standardised methods for compiling lists of competences
 - › Also due to assumptions about relative importance of competences that emerge from Likert scale data

New approach will be essential if we are to evaluate what competences will be important for the success of future engineering graduates . .

PREFER project & Expert panels

- › Utilising PREFER model of professional roles developed at KU Leuven
- › 12 expert panels carried out across Europe, 13th meta-panel to finalise competences
- › All panels drew competences from the same list, provided by experts in human capital, BDO. Allows direct comparison on a company by company basis.
- › Competences have no relative importance scores, each is equally important in each of the professional roles.
- › **Allows for a meaningful picture of the functions of an engineer (in various roles) to be investigated.**

Expert panel with ESBI, Ireland

Operational Excellence	Product Leadership	Customer Intimacy
Stakeholder engagement	Conceptualisation	Client focus
Focus on results	Creativity	Stakeholder engagement
Clear communication	Innovation	Solution orientated
Solution oriented	Solution-Orientated	Integrity
Work organisation	Client focus	Focus on results
Responsibility	Initiative	Persuasiveness
Client focus	Clear communication	Conflict management
Networking		Initiative
Performance motivation		Clear communication
		Stress resistance

Future work

- › With a reliable source of competences drawn directly from industry experts the PREFER project aims to develop a psychometric test that will increase engineering students' awareness of the multitude of professional roles in engineering and (2) to make them reflect on their motivations towards work and their relative strengths and weaknesses in a particular engineering professional competence
- › The test was developed over the summer of 2018 and passed internal evaluation yesterday
- › External evaluation commences **1st October** with Engineering Academics, Practicing engineers and HR professionals.

Thank you for your attention!

www.preferproject.eu

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