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Models before Code

Exploring the business opportunity from model driven software

The Cube, Athens, Greece, October 18 ,2018

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Numerical Investigation of Psychosocial Risk Indicators

S/W Modelling for Organizational Change Management Apps

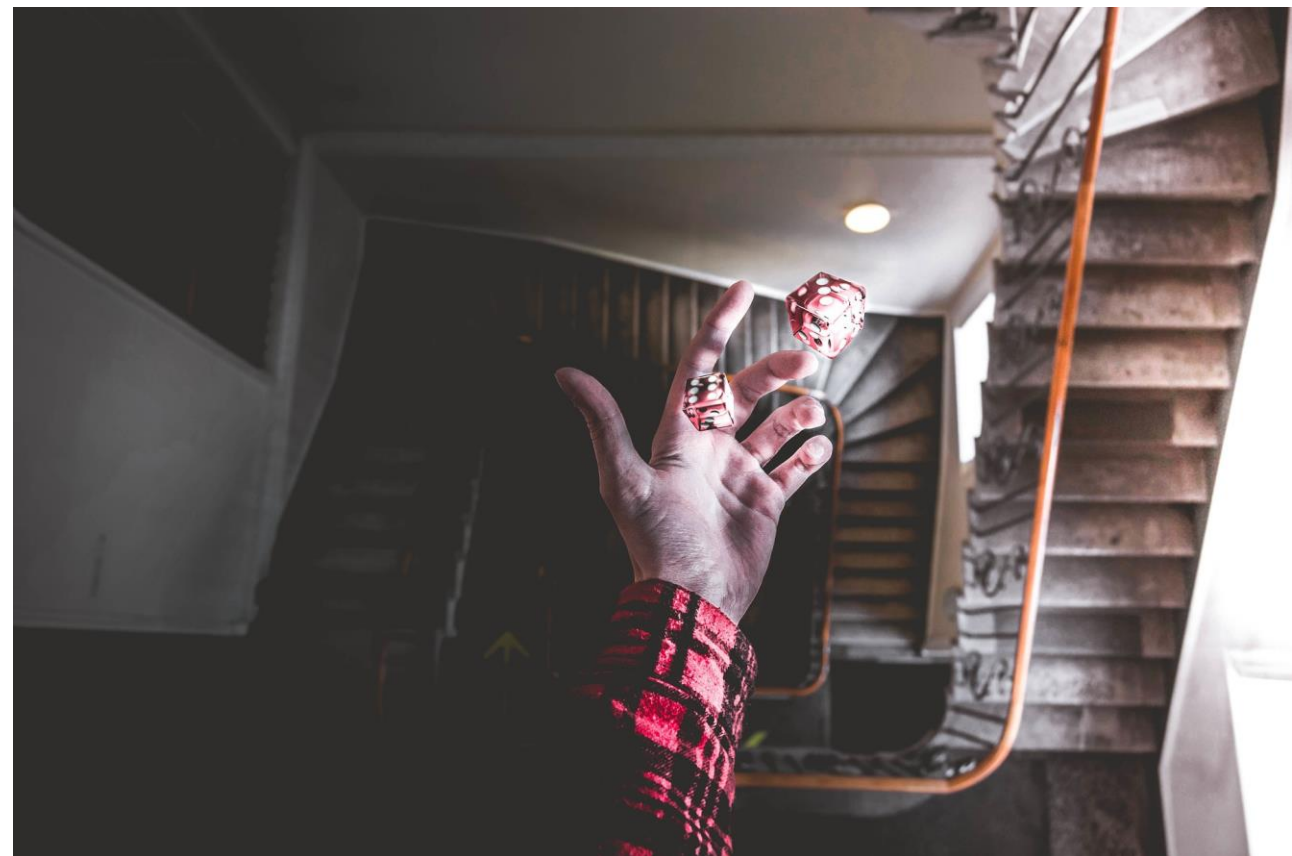
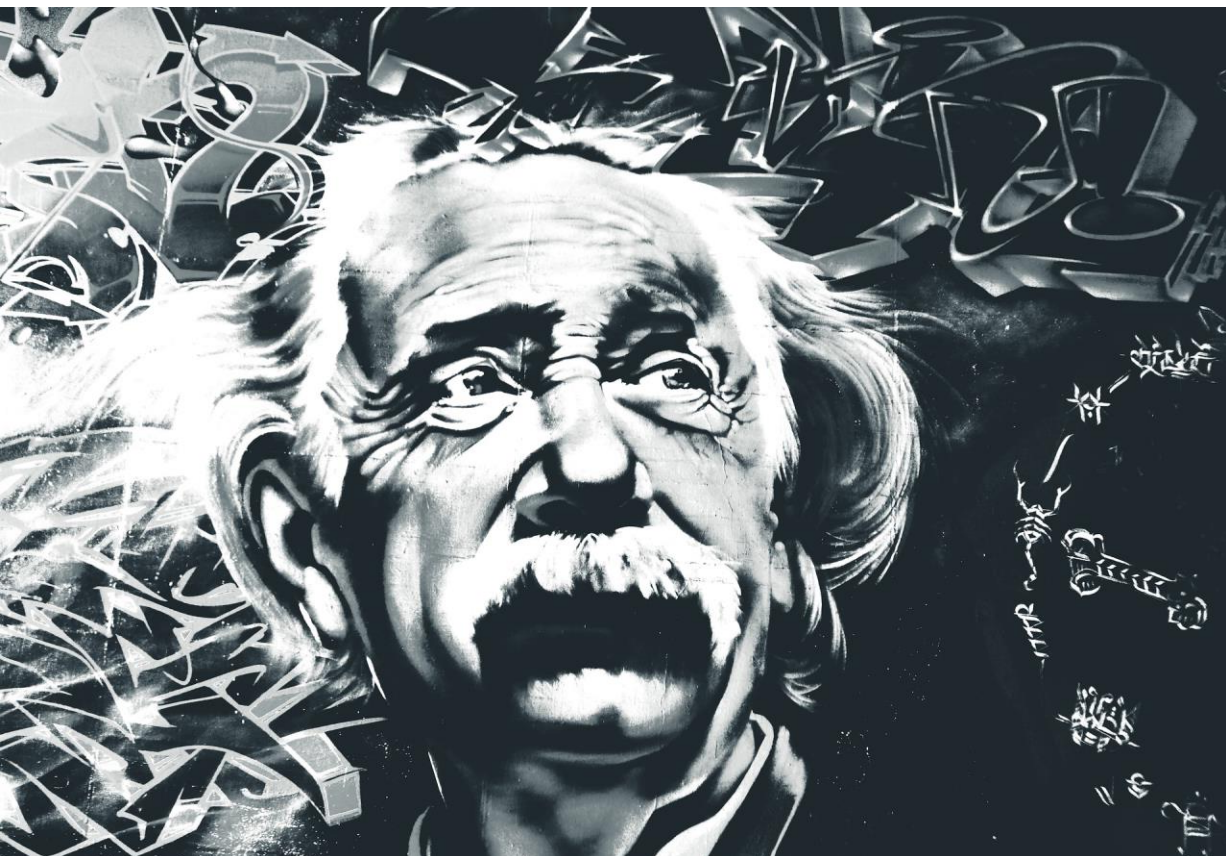
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Research question

Do the risk factors occur by chance ?

Introduction

Numerical modelling of natural systems

Numerical modelling of social systems

Necessity of data analysis

Managerial aspects

Numerical Investigation of Psychosocial Risk Indicators

Data Modelling & Analysis as a tool for Decision Making

Bullying - Threats of Violence
(from Colleagues)

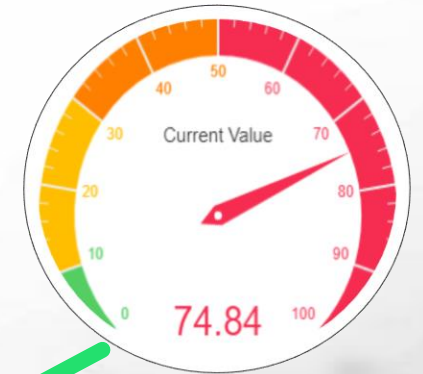


? **knowledge
extraction**

Work Life Balance



Personal Well Being



Is linear thinking & analysis enough ?
(*e.g linear regression)

Stressor Name	Mean Value	Resource Name	Mean Value
bullying_from_colleagues	0.983	lack_of_influence	0.599
lack_of_personal_well_being	0.748	lack_of_job_attractiveness	0.594
lack_of_work_life_balance	0.672	lack_of_general_health	0.556
work_enviroment_related_risk	0.595	lack_of_meaning_of_work	0.544
quantitative_demands	0.577	lack_of_trust_social_capital	0.514
burnout	0.574	lack_of_job_satisfaction	0.505
job_insecurity	0.555	lack_of_mental_health	0.500
emotional_demands	0.454	lack_of_quality_of_leadership	0.495
bullying_from_customers	0.252	lack_of_justice_so_cap	0.472
		lack_of_arrangements_and_prcedures_at_work	0.463
		intension_to_leave	0.462

Copsoq Diagnostic Instrument
STRESSORS VS RESOURCES (standard research model)

Context/Impact Classification	
Context SCALES	Impact SCALES
Influence	Work Life Balance
Job Attractiveness	Job Insecurity
Meaning of Work	Personal Well Being
Arrangements & Procedures at Work	Job Satisfaction (Intention to Leave)
Quality of Leadership	Job Satisfaction Overall
Trust	General Health
Justice	Burnout
Work Environment	Mental Health
Mobbing	
Quantitative Demands	
Emotional Demands	
Bullying - Threats of Violence (from Colleagues)	
Bullying - Threats of Violence (from Customers)	

IMPACT VS CONTEXT (new research model)

Basic Analysis

Multiple Correlations

Clustering maps

In Depth Analysis

Linear Regression

Optimal, Higher-order Regression

Deep Neural Networks

k-Nearest Neighbors

Decision Making

Sensitivity analysis

Conceptual Interpretation

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Correlations Table

	quantitative_demands	emotional_demands	lack_of_work_life_balance	lack_of_influence	lack_of_job_attractiveness	lack_of_meaning_of_work	lack_of_effective_work_procedures	lack_of_quality_of_leadership	lack_of_trust_social_capital	lack_of_justice_so_cap	work_environment_related_risk	job_insecurity	bullying_from_colleagues	bullying_from_customers	lack_of_personal_well_being	intention_to_leave	lack_of_job_satisfaction	lack_of_perceived_good_health	burnout	lack_of_mental_health
quantitative_demands	1	0.14	0.43	0.09	0	-0.12	-0.24	-0.23	0.31	-0.23	-0.1	-0.22	0.33	0.07	-0.02	0.3	-0.25	0.29	0.27	-0.25
emotional_demands	0.14	1	0.43	-0.15	-0.21	-0.08	0.1	0.02	-0.16	0.04	0.24	0.36	-0.14	0.44	0.46	0.09	0.02	-0.09	0.49	0.06
lack_of_work_life_balance	0.43	0.43	1	-0.11	-0.16	-0.21	-0.04	-0.11	-0.01	-0.07	0.15	0.09	0.05	-0.14	0.29	0.1	-0.15	0.07	0.55	-0.13
lack_of_influence	0.09	-0.15	-0.11	1	0.32	0.18	-0.06	-0.05	0.29	-0.15	-0.11	-0.13	0.2	0.04	-0.12	-0.16	-0.09	0.17	-0.11	-0.05
lack_of_job_attractiveness	0	-0.21	-0.16	0.32	1	0.54	0.2	0.25	-0.07	0.16	0.13	-0.06	-0.23	0.03	0.1	0.27	0.29	-0.28	-0.16	0.34
lack_of_meaning_of_work	-0.12	-0.08	-0.21	0.18	0.54	1	0.54	0.62	0.29	0.59	0.28	0.16	0.55	-0.08	-0.11	0.67	0.72	0.58	-0.18	0.71
lack_of_effective_work_procedures	-0.24	0.1	-0.04	-0.06	0.2	0.54	1	0.56	-0.53	0.58	0.43	0.33	-0.76	-0.22	0.18	0.66	0.58	0.7	-0.02	0.67
lack_of_quality_of_leadership	-0.23	0.02	-0.11	-0.05	0.25	0.62	0.56	1	-0.37	0.77	0.26	0.19	-0.58	-0.12	0.02	0.66	0.79	-0.59	-0.08	0.63
lack_of_trust_social_capital	0.31	-0.16	-0.01	0.29	-0.07	-0.29	-0.53	-0.37	1	-0.39	0.5	-0.31	0.8	0.28	-0.23	-0.67	-0.46	0.74	-0.06	-0.56
lack_of_justice_so_cap	-0.23	0.04	-0.07	-0.15	0.16	0.59	0.58	0.77	-0.39	1	0.23	0.19	-0.6	-0.14	0.02	0.71	0.83	-0.64	-0.04	0.66
work_environment_related_risk	-0.1	0.24	0.15	-0.11	0.13	0.28	0.43	0.26	0.5	0.23	1	0.28	-0.62	0.3	0.23	0.46	0.3	-0.53	0.08	0.43
job_insecurity	-0.22	0.36	0.09	-0.13	-0.06	0.16	0.33	0.19	-0.31	0.19	0.28	1	-0.33	-0.33	0.33	0.3	0.24	-0.29	0.2	0.26
bullying_from_colleagues	0.33	-0.14	0.05	0.2	-0.23	-0.55	-0.76	-0.58	0.8	-0.6	-0.62	-0.33	1	0.34	-0.24	-0.86	-0.66	0.89	0.01	-0.76
bullying_from_customers	0.07	0.44	-0.14	0.04	0.03	-0.08	-0.22	-0.12	0.28	-0.14	0.3	-0.33	0.34	1	-0.58	-0.23	-0.16	0.27	-0.32	-0.17
lack_of_personal_well_being	-0.02	0.46	0.29	-0.12	-0.1	-0.11	0.18	0.02	-0.23	0.02	0.23	0.33	-0.24	-0.58	1	0.03	0	-0.15	0.49	0.03
intention_to_leave	0.3	0.09	0.1	-0.16	0.27	0.67	0.66	0.66	-0.67	0.71	0.46	0.3	-0.86	-0.23	0.03	1	0.78	-0.85	-0.09	0.8
lack_of_job_satisfaction	-0.25	0.02	-0.15	-0.09	0.29	0.72	0.58	0.79	-0.46	0.83	0.3	0.24	-0.66	-0.16	0	0.78	1	0.7	0.1	0.76
lack_of_perceived_good_health	0.29	-0.09	0.07	0.17	-0.28	-0.58	-0.7	-0.59	0.74	-0.64	-0.53	-0.29	0.89	0.27	-0.15	-0.85	-0.7	1	0.04	-0.78
burnout	0.27	0.49	0.55	-0.11	-0.16	-0.18	-0.02	-0.08	-0.06	-0.04	0.08	0.2	0.01	-0.32	0.49	-0.09	-0.1	0.04	1	-0.12
lack_of_mental_health	-0.25	0.06	-0.13	-0.05	0.34	0.71	0.67	0.63	-0.56	0.66	0.43	0.26	-0.76	-0.17	0.03	0.8	0.76	-0.78	-0.12	1

- Multiple Correlations
- Pairwise all the variables

Basic Analysis

Multiple Correlations

Clustering maps

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Sensitivity analysis

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	<i>Coefficients</i>	<i>P-value</i>
Intercept	0.181904544	0.004834596
quantitative_demands	0.015705101	0.704613292
emotional_demands	-0.002591273	0.916563166
lack_of_work_life_balance	-0.054642522	0.091827185
lack_of_influence	-0.043095489	0.164925368
lack_of_job_attractiveness	0.014784014	0.44389558
lack_of_meaning_of_work	0.195605965	5.38111E-08
lack_of_arrangements_and_procedures_at_work	-0.063394967	0.209874478
lack_of_quality_of_leadership	0.217818696	3.97225E-09
lack_of_trust_social_capital	-0.146315309	0.138193075
lack_of_justice_so_cap	0.365758193	4.10521E-20
work_environment_related_risk	-0.004109033	0.874747129
job_insecurity	0.038715007	0.14423052
bullying_from_colleagues	0.021285819	0.496493793
bullying_from_customers	-0.02262006	0.469986523
lack_of_personal_well_being	0.005325473	0.875382047
intention_to_leave	0.125549546	4.50224E-05

- MS EXCEL Regression Analysis
- A lot of high p-values (>0.05), imply highly unreliable mathematical model

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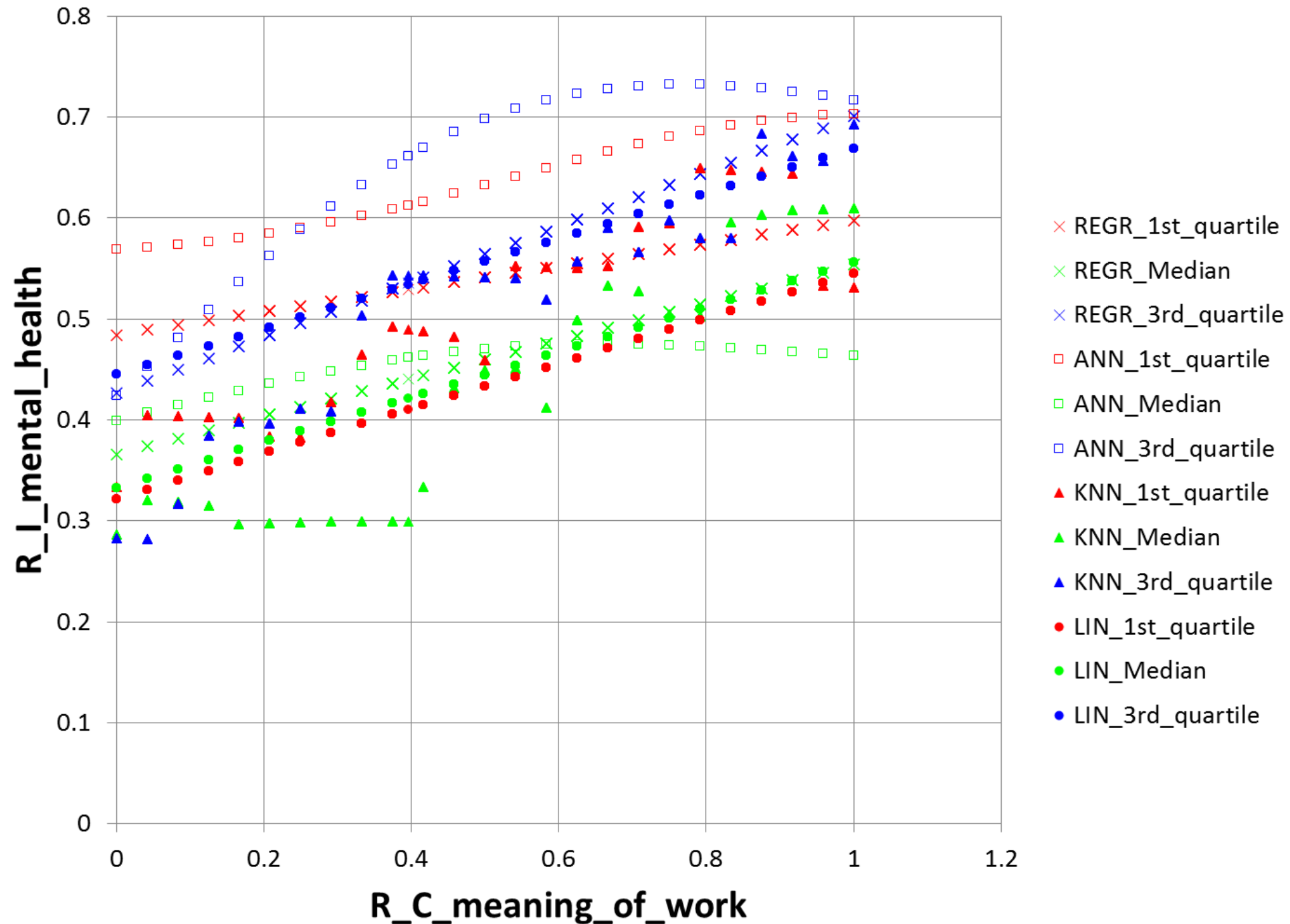
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- Artificial Neural Networks – Sensitivity Analysis
- Confirm the results of Regression Analysis



Decision Making

1. $c_{ij} := \text{contingency table}$ (co-occurrence of objects)

2. $s_{ij} := \text{similarity}$

3. $ds_{ij} := \frac{1}{s_{ij}}$ (dis-similarity)

4. $d_{ij} = \|x_i - x_j\|$ (distance on map)

5. $f_{ij} := |ds_{ij} - d_{ij}|$ (objective function)

6. Optimality criteria satisfied?

↓ YES

NO ↺

Optimization Algorithm

7. End => drawing of the bibliometric map

Clustering Map Constitution Algorithm

Lack of job satisfaction =

+0.170*const
+0.142*lack_of_meaning_of_work+0.327*lack_of_justice_so_cap
+0.309*quantitative_demands*lack_of_work_life_balance
-0.63*quantitative_demands*lack_of_effective_work_prcedures
+0.282*quantitative_demands*lack_of_quality_of_leadership
-0.38*lack_of_work_life_balance*lack_of__influence
+0.122*lack_of_work_life_balance*work_enviroment_relate
d_risk-0.34*lack_of_work_life_balance*burnout
+0.225*lack_of_work_life_balance*lack_of_mental_health
+0.241*lack_of__influence*bullying_from_colleagues
+0.202*lack_of__influence*intension_to_leave
+0.512*lack_of_effective_work_prcedures*burnout
-0.19*work_enviroment_related_risk*bullying_from_colleagues
+0.057*job_insecurity^2
-0.09*bullying_from_colleagues*intension_to_leave

- Your Organization's Equation
- How to illuminate?

- Sensitivity Analysis

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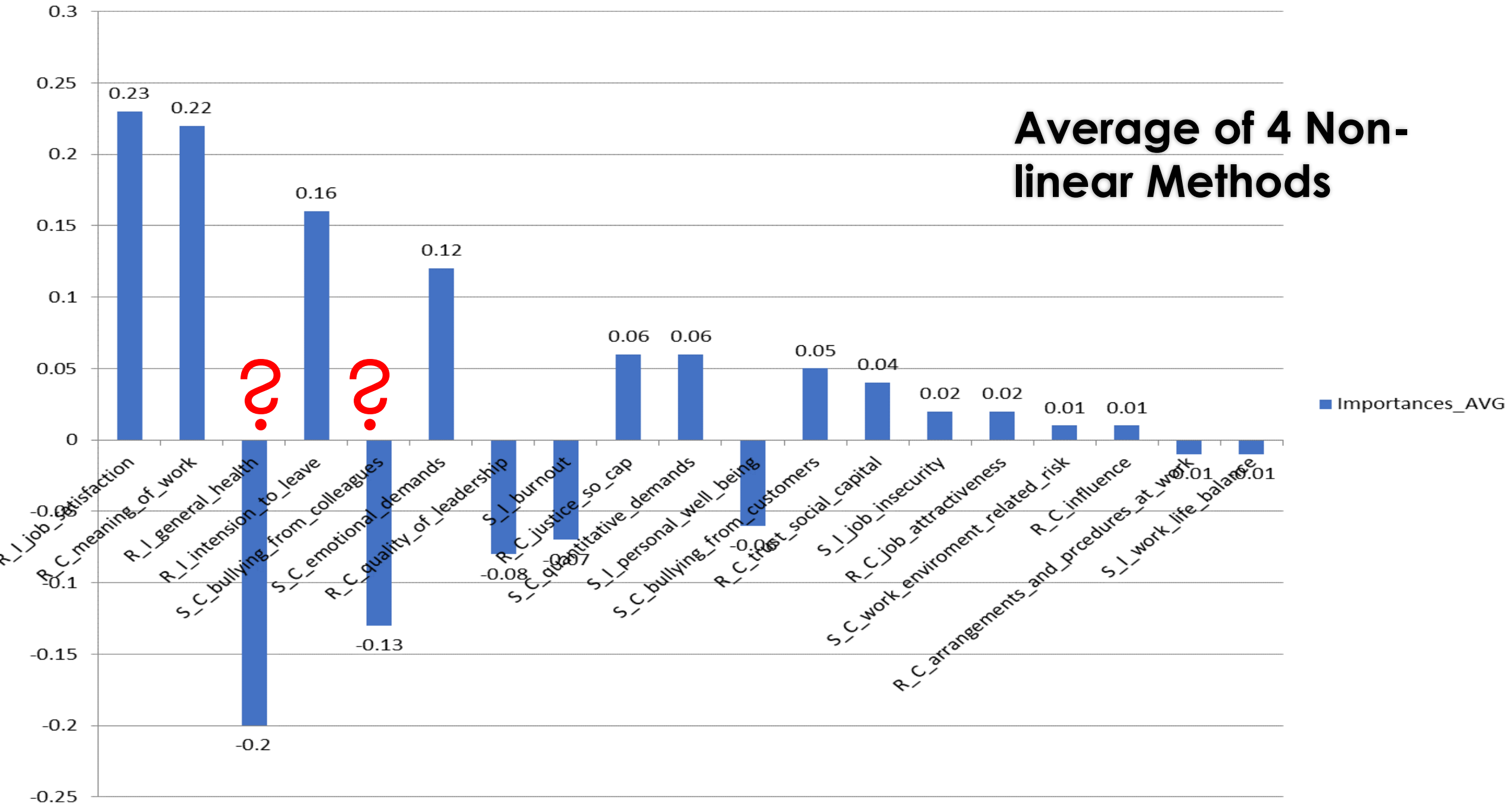
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Importances for R_I_mental_health

Average of 4 Non-linear Methods



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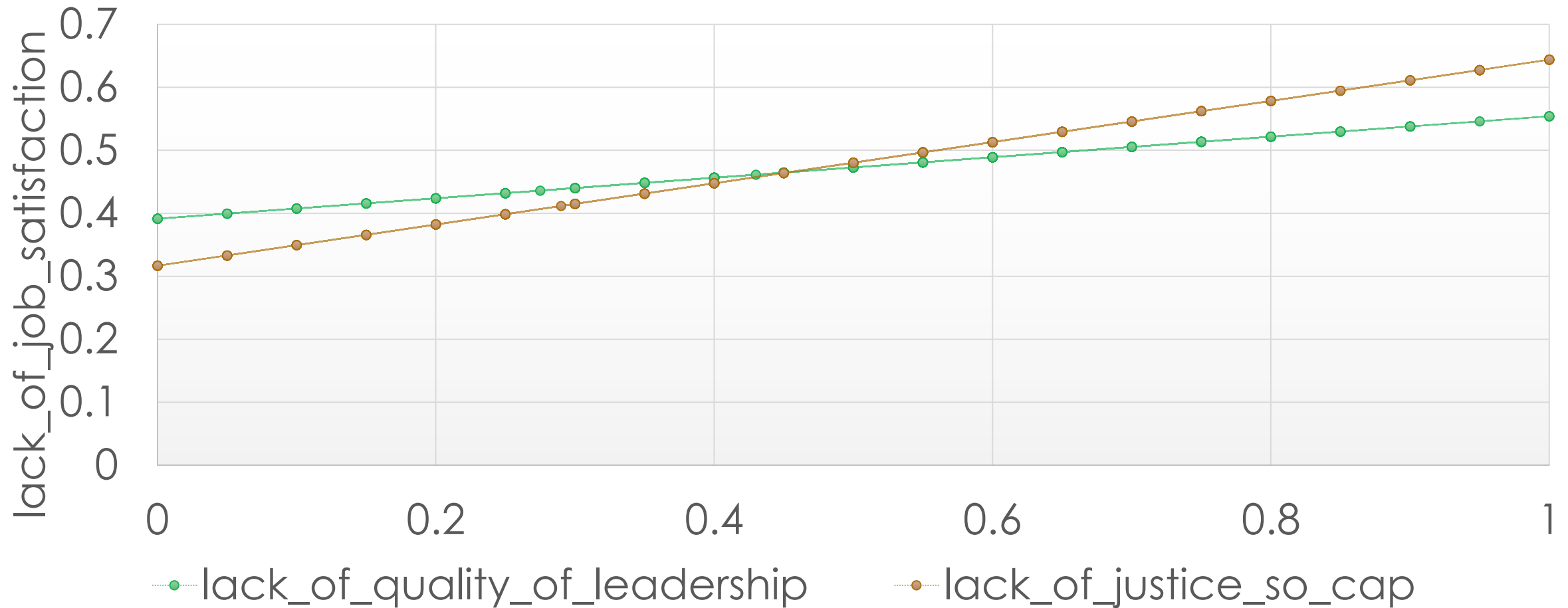
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**Conceptual
Interpretation**

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4.2.3. Job satisfaction

Several factors under investigation seem to be influential regarding job satisfaction. Job satisfaction increased when emotional demands decreased ($\beta = -0.11$, $p < 0.001$), role clarity increased and role conflict decreased ($\beta = 0.10$, $p < 0.001$), and effort-reward balance increased ($\beta = 0.40$, $p < 0.001$). The overall model fit is $R^2 = 0.941$.

$$Depe - Var = \frac{Var-01 + Var-03^2 + Var-05 * Var-07 + \log(Var-09 + 1) + \sin(Var-11) * \cos(Var-13) * e^{Var-15}}{2}$$

- **Applied Algorithms**
- **Hidden Equation**
- **16 independent Variables**
- **Only 8 exist in model, highly non-linear**
- **Accuracy 99.6%**

Simple Verification Example

Numerical Investigation of Psychosocial Risk Indicators

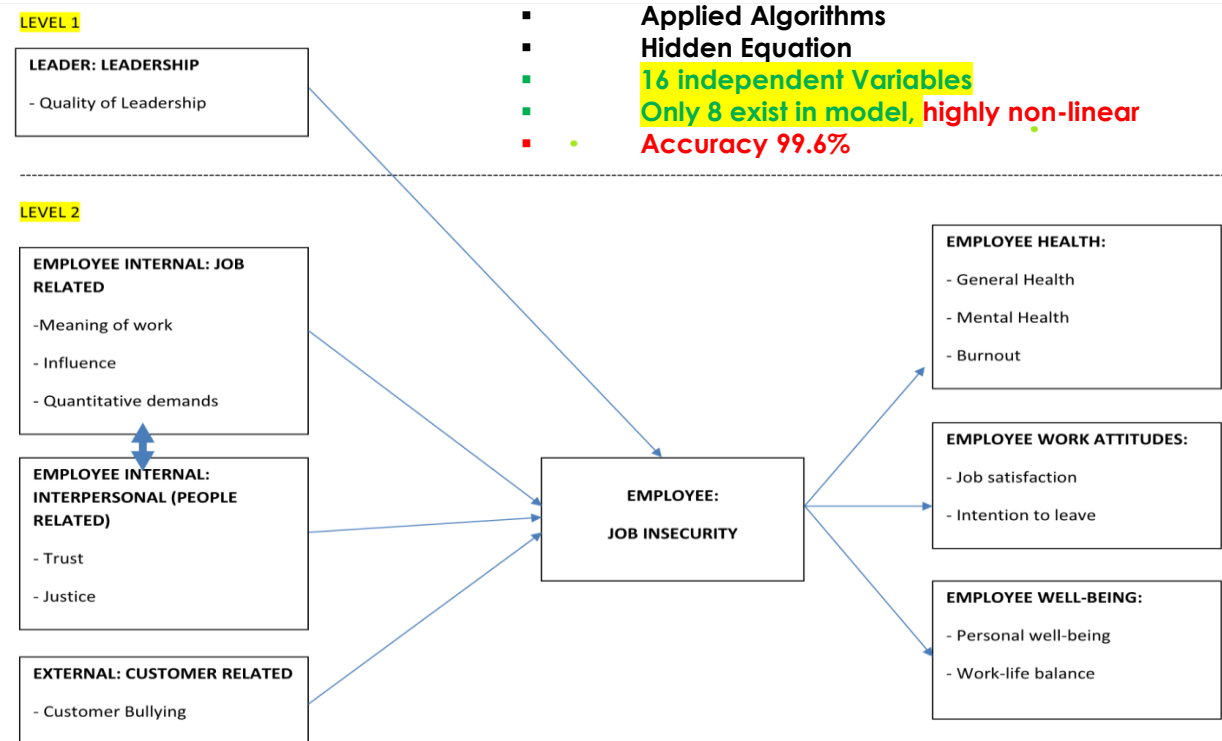
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(Kotsakis et. al , 2018 , Brussels, www.employability21.com)

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