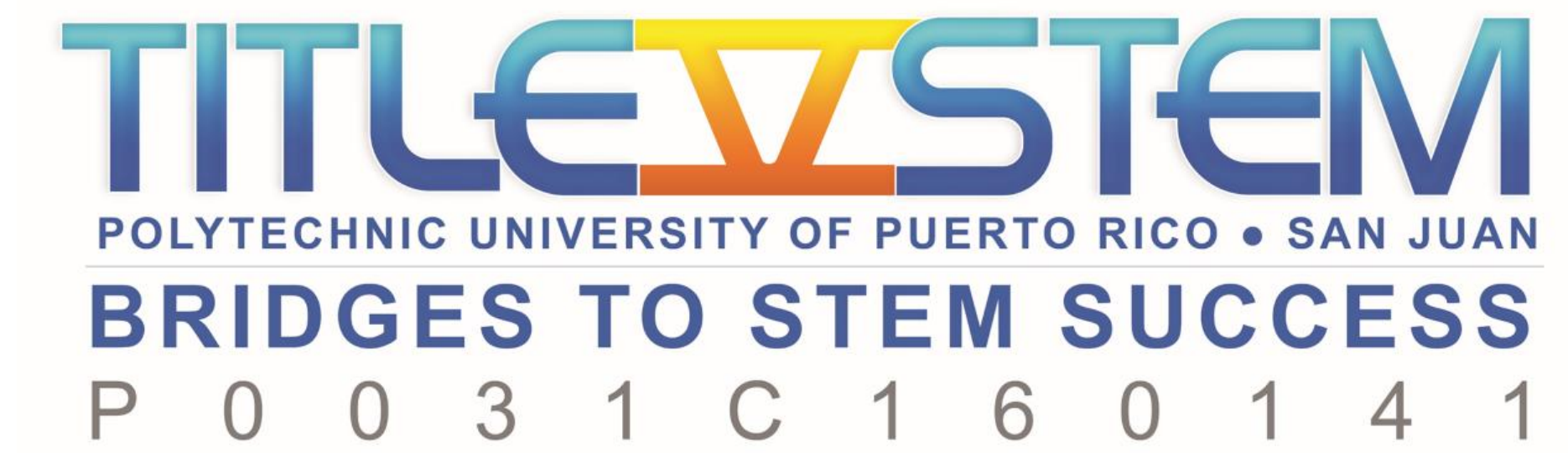


The 2017-2018 Evaluation of the National Operational Excellence Index in Puerto Rico



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ABSTRACT

Puerto Rico has not participated in the evaluation of the World Forum Competitive Index (WFCI) since 2015; consequently, the Puerto Rico Manufacturers Association (PRMA) created an index to measure productivity on a project level, known as the National Operational Excellence Index (OEI). As part of the evaluation, three out of the twelve pillars of competitiveness were covered: Innovation, Technological Readiness and Labor Market Efficiency. This study measured the impact of the implementation of the OEI in 2017 versus the actual 2018 performance. Each evaluation criteria was compared to identify the project development that needs attendance: Results and Culture categories. It was found that, overall, Biomedical had the higher scores for 2017 (but did not improve for 2018) and Pharmaceutical for 2018. It as also found that the variation decrease could suggest higher competitiveness over the years. This index can attract other industries to participate in the evaluation in order to be part of a competitive environment that promotes a collaborative business as part of a continuous improvement mentality, and not just an annual evaluation with no continuity.

INTRODUCTION

Since 2015, Puerto Rico has not participated in the World Economic Forum (WEF) evaluation of the WFCI, as seen in Figure 1; subsequently, the productivity of the island has not been properly measured. The PRMA has created an index that may be used to measure productivity on a project level, known as the National OEI (Desueza, 2018). With comparative statistical analysis tools between the years 2017 and 2018, the OEI of the industries' projects can be studied to create feedback reports that would support the importance of the use of operational excellence practices in many industries, including benchmarking practices. Figure 2 shows part of Puerto Rico's last WFCI evaluation results in 2015, pointing only the areas that the investigation will cover, which are: Innovation, Technological Readiness and Labor Market Efficiency. With the use of the OEI, this study contributes to competitiveness initiatives as an innovative value added assessment for the participating industries over the years.

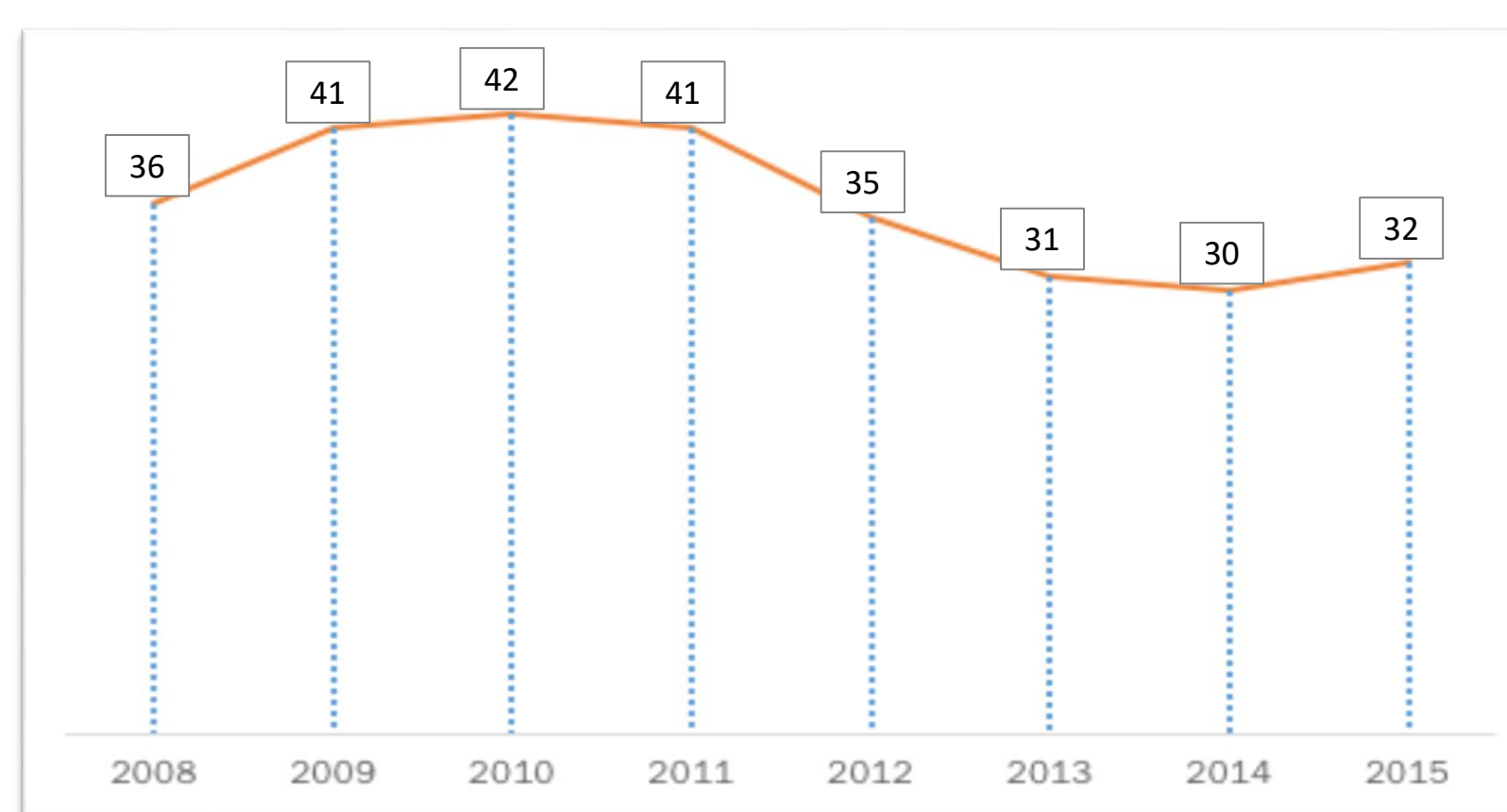


FIG. 1: PUERTO RICO COMPETITIVENESS INDEX RANK
(SOURCE: THE GLOBAL COMPETITIVENESS REPORT, 2008-2015)

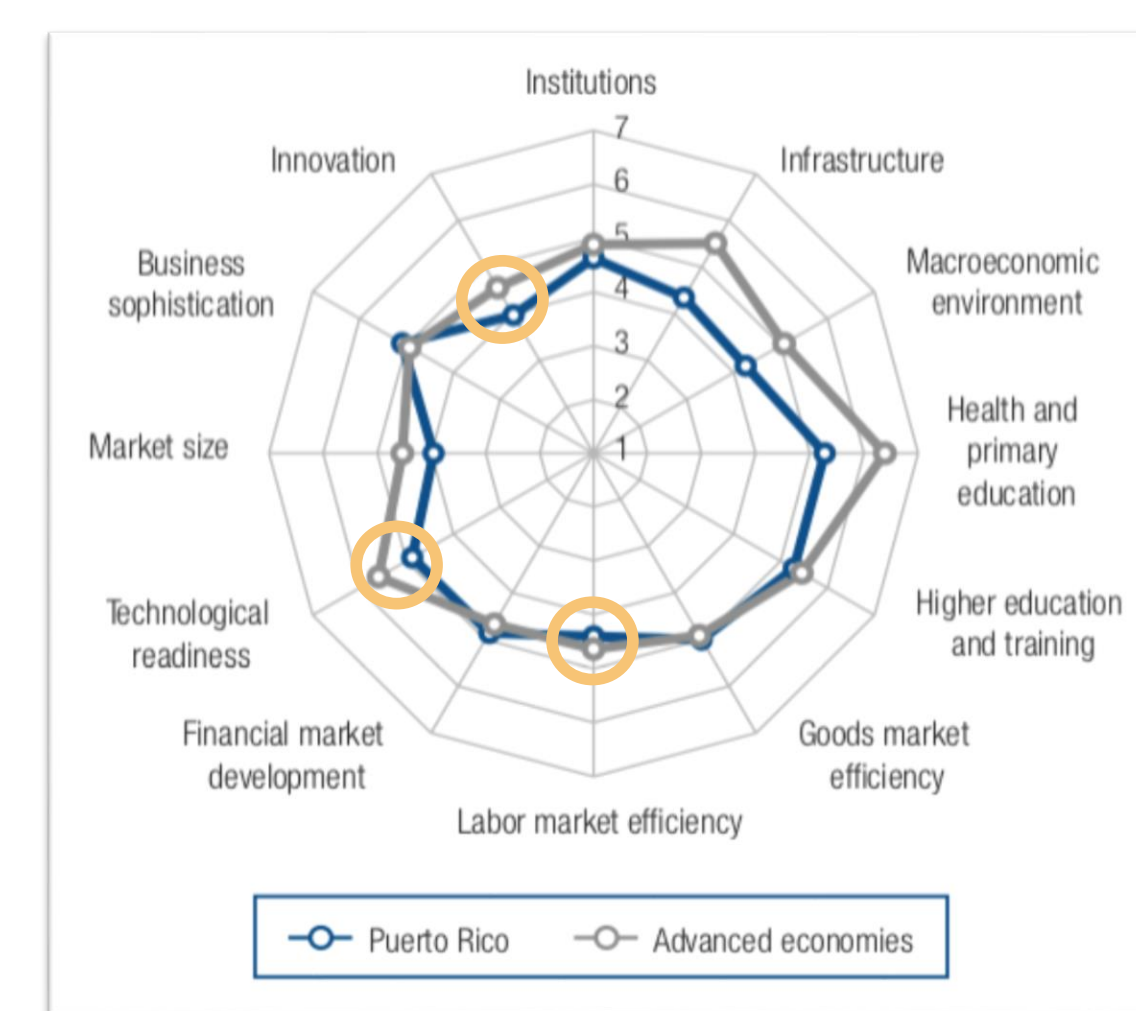


FIG. 2: PUERTO RICO'S GLOBAL COMPETITIVENESS INDEX
(SOURCE: THE GLOBAL COMPETITIVENESS REPORT, 2014)

OBJECTIVES AND SCOPE

- ❑ OEI evaluation to promote benchmarking practices and continuous improvement mentality.
- ❑ OEI evaluation for participating industries trough 2017 and 2018: Medical Devices, Pharmaceutical, Biomedical, Aerospace, Confectionary, Manufacturing, Service, and Agriculture.
- ❑ Analyze the data collected from the Quest rubrics (2017-2018), based on a Lean Six Sigma project structure:
 - Define, Measure, Analyze, Improve and Control (DMAIC)
 - Results section
 - Culture section
- ❑ Develop conclusions and recommendations.

METHODOLOGY

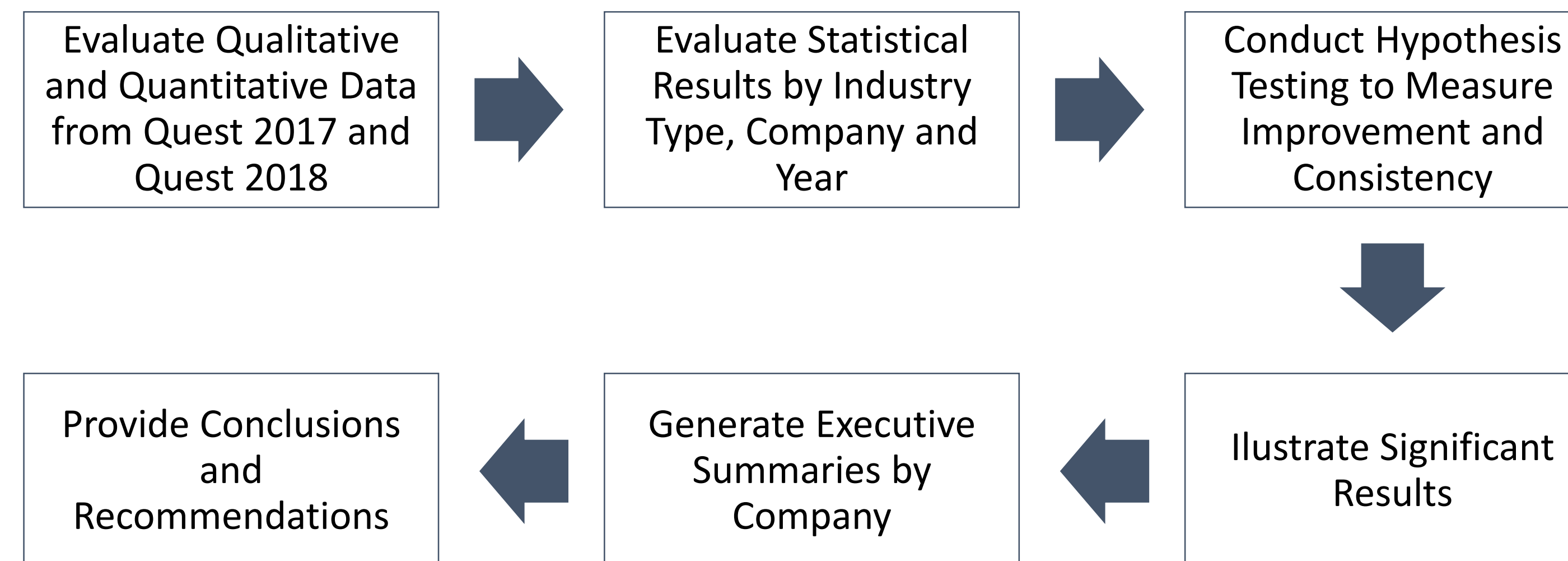


FIG. 3: METHODOLOGY OVERVIEW

OEI COMPONENTS

Results	Culture	OEI Structure
Savings = $\frac{\text{Savings}}{\text{Department's Budget}}$	Ideas = $\frac{\# \text{ Implemented Ideas}}{\# \text{ Employees in the area}}$	DMAIC
Improvement = $\frac{\text{KPI after}}{\text{KPI before} - 1}$	Training = $\frac{\# \text{ Certified Employees}}{\# \text{ Employees in the area}}$	Results
		Culture
		OEI TOTAL: 10 points (100%)

DATA

QUEST 2017				
TYPE	QUANTITY	MEAN	STD. DEV.	COEF. VAR.
MEDICAL DEVICE	13	5.05	1.43	28%
PHARMACEUTICAL	10	5.84	1.00	17%
BIOMEDICAL	6	8.63	0.78	9%
AEROSPACE	6	7.25	1.21	17%
CONFECTIONARY	3	4.79	1.14	24%
SERVICE	2	5.96	0.04	1%
AGRICULTURE	1	7.10	N/A	N/A

TABLE 1: OEI RESULTS FROM QUEST 2017 BY INDUSTRY TYPE

QUEST 2018				
TYPE	QUANTITY	MEAN	STD. DEV.	COEF. VAR.
MEDICAL DEVICE	18	6.52	1.39	21%
PHARMACEUTICAL	4	7.26	0.62	9%
BIOMEDICAL	7	7.09	0.66	9%
AEROSPACE	2	6.82	0.40	6%
MANUFACTURING	2	6.88	0.79	11%
AGRICULTURE	1	6.50	N/A	N/A

TABLE 2: OEI RESULTS FROM QUEST 2018 BY INDUSTRY TYPE

ANALYSIS AND RESULTS

One-Way ANOVA	One-Way ANOVA
H_0 : All means are equal H_A : At least one mean is different $\alpha = 0.05$ 2017 P-Value = 0.000 2018 P-Value = 0.819	H_0 : All variances are equal H_A : At least one variance is different $\alpha = 0.05$ 2017 P-Value = 0.392 2018 P-Value = 0.797

- Mean results for 2018 show more consistency (std. dev.)
- Overall, the **Biomedical** industry had the highest index scores for 2017 (except in Culture). The **Pharmaceutical** industry had the highest index scores for 2018 (except in Measure, Analyze, Results and Culture).
- For 2017 at least one mean is statistically different, but for 2018 all means might be statistically equal.
- An improvement was observed for each DMAIC phase over the years, except for the **Biomedical** industry in every category, **Agriculture** in Define, and **Aerospace** in Improve.
- For **Results**, only Medical Devices improved. For **Culture**, only Pharmaceutical improved.

CONCLUSIONS AND RECOMMENDATIONS

- Although the industries improved in most of the categories, the **Results** and **Culture** categories need to be assessed to boost scores and promote competitiveness.
- The improvement in overall consistency suggests more competitiveness along industries.
- Offer support to those with a lower performance, in scores deficiency and consistency.
- Promote participation to those with inconsistent presence in the competition, or complete absence.
- Continue study to monitor and evaluate industries' performance over the years. A **Culture** Index will be implemented in the next Quest competition.

REFERENCES

- Desueza, E. (2018). *The Evaluation of The National Operational Excellence Index Impact Over The Private Sector Sustainability In Puerto Rico*. Undergraduate Research Program, Polytechnic University of Puerto Rico, Industrial Engineering Department, San Juan, PR.
- Schwab, K. (2014). *The Global Competitiveness Report 2014-2015*. Retrieved September 21, 2018, from World Economic Forum: http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf

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