

Analysis of the Dynamical Capabilities into the Public Research Institutes to their Strategic Decision-Making

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Table S1. Questionnaire elaborated in the first stage from framework of DCs for Mexican public research institutes, considering the period of time of January 2014 to December 2019.

Question number (Q)	Sensing capabilities
1	How many researchers work at the Public Research Institute?
2	How many technical research support staff work at PRI?
3	How many research lines are developed in the research center
4	What percentage of the developed research at the center is focused on basic science?
5	What percentage of the carried out research is focused on applied science?
6	What percentage of the developed research is focused on R&D?
7	For the new research development and / or change of the research in development trajectory, are scientific publications (papers and patents) consulted?
8	For the new research development and / or change of the research in development trajectory, are relevance studies carried out?
9	For the new research development and / or change of the research in development trajectory, are market studies carried out?
10	For the new research development and / or change of the research in development trajectory, are SWOT analysis carried out?
11	For the new research development and / or change of the research in development trajectory, are environmental analyzes carried out?
12	For the new research development and / or change of the research in development trajectory, is benchmarking performed?
13	For the new research development and / or change of the research in development trajectory, is bibliometrics used?
14	Is the experience of the researchers used to update the research lines?
15	Is the information obtained in scientific and academic events used to update the lines of research?
16	Is collaboration in national and / or international networks used to updated research lines?
	Seizing capabilities
17	In what percentage of the investigations carried out are aimed at providing solutions in the short term.
18	In what percentage of the investigations carried out are aimed at providing solutions in the medium term
19	In what percentage of the investigations carried out are aimed at providing solutions in the long term.
	Reconfiguration capabilities
20	Is your center currently developing projects related to the industry?
21	Is your center currently developing projects related to public services?
22	Is your center currently competing to obtain projects through calls from state and / or federal authorities?
23	In order to strengthen and direct the lines of research to the future, studies of relevance trees are carried out?
24	In order to strengthen and direct the lines of research into the future, panels of experts are held
25	In order to strengthen and direct the lines of research to the future, brainstorming is practiced
26.	In order to strengthen and direct the lines of research to the future, is the Delphi method practiced?
27.	In order to strengthen and direct the lines of research to the future, are questionnaires and / or surveys carried out?
28.	In order to strengthen and direct the lines of research into the future, is trend extrapolation practiced?
29.	In order to strengthen and direct the lines of research to the future, is cross-impact analysis practiced?
30.	In order to strengthen and direct the lines of research to the future, is time series analysis practiced?
31	In order to strengthen and direct the lines of research to the future, is the method of elaboration of scenarios used?

Table S2. Second survey proposed to identify factors that impact in the global productivity and knowledge integration or transfer; considering the period of time of January 2014 to December 2019.

GENERAL DATA FOR PRI	KNOWLEDGE INTEGRATION OR TRANSFER
<p>S1. Name of each scientific and technological research centers/institutes belonging to the institution</p> <p>S2. Name of the locality where each research center/institute is placed, including main campus and each regional branch.</p> <p>S3. Total number of researchers, from each main campus and branch</p> <p>S4. Total number of the National Research System (SNI) members by level (Candidate, I, II, III, Emeritus), from each main campus and branch</p> <p>S5. Total number of research technical staff, from each main campus and branch</p>	<p>S13. Total number of national or international patent applications from each main campus and branch</p> <p>S14. Total number of national or international patents granted, from each main campus and branch</p> <p>S15. Total number of applications for national or international utility models, from each main campus and branch</p> <p>S16. Total number of utility models granted (national or international) from each main campus and branch</p> <p>S17. Total number of registered (national or international) trademarks, from each main campus and branch</p> <p>S18. Total of technology transfers in process, from each main campus and branch national or international).</p> <p>S19. Total of technology transfers made, from each main campus and branch (national or international)</p> <p>S20. Total number of research groups (with national links), from each main campus and branch</p> <p>S21. Total number of research groups with international links, from each main campus and branch</p> <p>S22. Total number of national thematic networks to which researchers belong, from each main campus and branch</p> <p>S23. Total number of international thematic networks to which researchers belong, from each main campus and branch</p> <p>S24. Total number of projects related to the industry, from each main campus and branch</p> <p>S25. Total number of projects related to public services, from each main campus and branch</p> <p>S26. Total number of projects related to calls from federal/state institutions carried out by each main campus and branch</p> <p>S27. Total of technology foresight studies carried out by each main campus and branch</p>
PRODUCTIVITY	
<p>S6. Total number of research lines, from each main campus and branch</p> <p>S7. Total number of laboratories, from each main campus and branch</p> <p>S8. Total number of scientific articles published including JCR journals, articles published in national and peer-reviewed journals from each main campus and branch</p> <p>S9. Total number of book chapters published, from each main campus and branch</p> <p>S10. Total number of books published, from each main campus and branch</p> <p>S11. Total number of graduated students of postgraduate programs, from each main campus and branch</p> <p>S12. Total of quality-standard postgraduate programs , from each main campus and branch</p>	

Table S3. Anova test and Pearson's correlation results carried out to evaluate the factors that impact the global productivity of PRI. The descriptive statistics were analyzed between the groups that presented a strong interaction in the first stage and the variables of the survey 2.

	SENSING						SEIZING	RECONFIGURATION		
	Q2	Q3	Q8	Q12	Q13	Q16	Q19	Q23	Q27	Q29
S7	M: 21.12 F: 15.94 p: 0.001 r: 0.50	M: 21.12 F: 53.61 p: 0.001 r: 0.73	M: 21.12 F: 0.31 p: 0.582 r: -0.88	M: 21.12 F: 0.04 p: 0.835 r: 0.03	M: 21.12 F: 0.02 p: 0.905 r: 0.02	M: 21.12 F: 1.84 p: 0.181 r: 0.19	M: 21.12 F: 0.57 p: 0.456 r: 0.20	M: 21.12 F: 0.16 p: 0.688 r: 0.06	M: 21.12 F: 0.01 p: 0.923 r: 0.01	M: 21.12 F: 0.61 p: 0.441 r: 0.11
S8	M: 431.22 F: 15.86 p: 0.001 r: 0.50	M: 431.22 F: 13.46 p: 0.001 r: 0.47	M: 431.22 F: 2.28 p: 0.137 r: 0.22	M: 431.22 F: 1.78 p: 0.188 r: 0.19	M: 431.22 F: 2.36 p: 0.131 r: 0.22	M: 431.22 F: 3.36 p: 0.073 r: 0.26	M: 431.22 F: 1.29 p: 0.261 r: 0.16	M: 431.22 F: 0.99 p: 0.325 r: 0.14	M: 431.22 F: 1.19 p: 0.280 r: 0.16	M: 431.22 F: 5.90 p: 0.019 r: 0.33
S9	M: 36.61 F: 7.75 p: 0.008 r: 0.38	M: 36.61 F: 8.18 p: 0.006 r: 0.39	M: 36.61 F: 0.70 p: 0.406 r: 0.12	M: 36.61 F: 1.07 p: 0.307 r: 0.15	M: 36.61 F: 0.01 p: 0.915 r: 0.01	M: 36.61 F: 2.61 p: 0.113 r: 0.22	M: 36.61 F: 1.94 p: 0.170 r: 0.20	M: 36.61 F: 0.79 p: 0.378 r: 0.13	M: 36.61 F: 0.24 p: 0.622 r: 0.07	M: 36.61 F: 1.51 p: 0.225 r: 0.18
S10	M: 6.89 F: 0.46 p: 0.502 r: 0.10	M: 6.89 F: 3.89 p: 0.065 r: 0.28	M: 6.89 F: 0.01 p: 0.931 r: 0.01	M: 6.89 F: 2.36 p: 0.131 r: 0.22	M: 6.89 F: 0.32 p: 0.577 r: 0.08	M: 6.89 F: 2.81 p: 0.100 r: 0.24	M: 6.89 F: 2.10 p: 0.158 r: 0.21	M: 6.89 F: 1.00 p: 0.322 r: 0.15	M: 6.89 F: 0.77 p: 0.384 r: 0.13	M: 6.89 F: 11.37 p: 0.002 r: 0.44
S11	M: 130.41 F: 2.45 p: 0.124 r: 0.22	M: 130.41 F: 2.11 p: 0.153 r: 0.20	M: 130.41 F: 1.16 p: 0.287 r: 0.16	M: 130.41 F: 0.24 p: 0.625 r: 0.07	M: 130.41 F: 2.10 p: 0.154 r: 0.21	M: 130.41 F: 1.41 p: 0.241 r: 0.17	M: 130.41 F: 0.05 p: 0.828 r: 0.03	M: 130.41 F: 2.03 p: 0.161 r: 0.20	M: 130.41 F: 3.11 p: 0.084 r: 0.25	M: 130.41 F: 4.39 p: 0.04 r: 0.30
S12	M: 21.12 F: 3.43 p: 0.070 r: 0.26	M: 21.12 F: 8.78 p: 0.005 r: 0.40	M: 21.12 F: 0.72 p: 0.399 r: 0.12	M: 21.12 F: 5.80 p: 0.020 r: 0.33	M: 21.12 F: 12.40 p: 0.001 r: 0.46	M: 21.12 F: 1.52 p: 0.224 r: 0.18	M: 21.12 F: 0.95 p: 0.335 r: 0.14	M: 21.12 F: 10.19 p: 0.003 r: 0.42	M: 21.12 F: 1.83 p: 0.182 r: 0.19	M: 21.12 F: 6.49 p: 0.014 r: 0.35

Note: M is the mean of the data (N= 49), F is the fisher's exact test; higher values indicated the existence of a strong influence between analyzed variables, *p* is statistical significance ≤ 0.05 (*p*) indicating a direct relation between variables. *r* is the Pearson's correlation with a confidence value ≥ 0.95 .

Table S4. Anova test and Pearson's correlation results carried out to evaluate the factors that impact the knowledge integration or transfer of PRI. The descriptive statistic was analyzed between the groups that presented a strong interaction in the first stage and the variables of the survey 2.

	SENSING						SEIZING	RECONFIGURATION		
	Q2	Q3	Q8	Q12	Q13	Q16	Q19	Q23	Q27	Q29
S13	M: 15.51 F: 7.77. p: 0.008 r: 0.38	M: 15.51 F: 1.16 p: 0.287 r: 0.16	M: 15.51 F: 0.09 p: 0.761 r: 0.04	M: 15.51 F: 1.23 p: 0.272 r: 0.16	M: 15.51 F: 0.03 p: 0.958 r: 0.01	M: 15.51 F: 1.92 p: 0.171 r: 0.20	M: 15.51 F: 0.54 p: 0.466 r: 0.11	M: 15.51 F: 3.10 p: 0.088 r: 0.06	M: 15.51 F: 0.29 p: 0.590 r: 0.01	M: 15.51 F: 3.3 p: 0.076 r: 0.06
S14	M: 6.49 F: 3.67 p: 0.062 r: 0.27	M: 6.49 F: 0.30 p: 0.586 r: 0.080	M: 6.49 F: 0.20 p: 0.656 r: 0.06	M: 6.49 F: 3.8 p: 0.057 r: 0.27	M: 6.49 F: 0.07 p: 0.793 r: 0.03	M: 6.49 F: 1.41 p: 0.241 r: 0.17	M: 6.49 F: 1.11 p: 0.298 r: 0.15	M: 6.49 F: 4.29 p: 0.044 r: 0.30	M: 6.49 F: 1.26 p: 0.267 r: 0.16	M: 6.49 F: 9.46 p: 0.004 r: 0.41
S15	M: 0.36 F: 1.85 p: 0.180 r: 0.19	M: 0.36 F: 0.10 p: 0.749 r: 0.05	M: 0.36 F: 0.36 p: 0.552 r: 0.09	M: 0.36 F: 0.01 p: 0.969 r: 0.01	M: 0.36 F: 1.00 p: 0.322 r: 0.15	M: 0.36 F: 1.47 p: 0.232 r: 0.17	M: 0.36 F: 0.12 p: 0.727 r: 0.05	M: 0.36 F: 0.06 p: 0.810 r: 0.04	M: 0.36 F: 0.02 p: 0.906 r: 0.02	M: 0.36 F: 0.04 p: 0.839 r: 0.030
S16	M: 0.41 F: 0.83 p: 0.368 r: 0.13	M: 0.41 F: 0.61 p: 0.439 r: 0.11	M: 0.41 F: 0.41 p: 0.525 r: 0.09	M: 0.41 F: 2.79 p: 0.107 r: 0.23	M: 0.41 F: 1.42 p: 0.239 r: 0.17	M: 0.41 F: 0.03 p: 0.864 r: 0.03	M: 0.41 F: 0.33 p: 0.571 r: 0.08	M: 0.41 F: 11.37 p: 0.020 r: 0.44	M: 0.41 F: 0.04 p: 0.837 r: 0.03	M: 0.41 F: 0.28 p: 0.601 r: 0.08
S17	M: 2.18 F: 2.59 p: 0.114 r: 0.23	M: 2.18 F: 3.18 p: 0.081 r: 0.25	M: 2.18 F: 1.02 p: 0.319 r: 0.15	M: 2.18 F: 0.06 p: 0.805 r: 0.04	M: 2.18 F: 1.05 p: 0.310 r: 0.15	M: 2.18 F: 0.059 p: 0.446 r: 0.11	M: 2.18 F: 0.01 p: 0.982 r: 0.01	M: 2.18 F: 0.40 p: 0.534 r: 0.09	M: 2.18 F: 0.08 p: 0.778 r: 0.04	M: 2.18 F: 0.02 p: 0.902 r: 0.02
S18	M: 0.39 F: 2.99 p: 0.090 r: 0.25	M: 0.39 F: 19.39 p: 0.001 r: 0.54	M: 0.39 F: 0.11 p: 0.745 r: 0.05	M: 0.39 F: 1.65 p: 0.204 r: 0.18	M: 0.39 F: 0.38 p: 0.845 r: 0.03	M: 0.39 F: 0.27 p: 0.871 r: 0.02	M: 0.39 F: 2.47 p: 0.122 r: 0.08	M: 0.39 F: 0.47 p: 0.496 r: 0.10	M: 0.39 F: 1.23 p: 0.273 r: 0.16	M: 0.39 F: 1.02 p: 0.317 r: 0.15
S19	M: 0.69 F: 8.86 p: 0.005 r: 0.40	M: 0.69 F: 6.33 p: 0.015 r: 0.35	M: 0.69 F: 2.18 p: 0.146 r: 0.21	M: 0.69 F: 0.85 p: 0.363 r: 0.13	M: 0.69 F: 0.37 p: 0.549 r: 0.09	M: 0.69 F: 1.63 p: 0.208 r: 0.18	M: 0.69 F: 0.32 p: 0.579 r: 0.08	M: 0.69 F: 0.12 p: 0.729 r: 0.05	M: 0.69 F: 1.50 p: 0.226 r: 0.17	M: 0.69 F: 0.86 p: 0.357 r: 0.13
S20	M: 10.94 F: 5.66 p: 0.021 r: 0.33	M: 10.94 F: 4.16 p: 0.047 r: 0.29	M: 10.94 F: 0.13 p: 0.719 r: 0.05	M: 10.94 F: 0.12 p: 0.726 r: 0.05	M: 10.94 F: 1.00 p: 0.322 r: 0.14	M: 10.94 F: 4.33 p: 0.043 r: 0.29	M: 10.94 F: 0.01 p: 0.957 r: 0.081	M: 10.94 F: 1.72 p: 0.197 r: 0.19	M: 10.94 F: 0.07 p: 0.797 r: 0.04	M: 10.94 F: 0.01 p: 0.952 r: 0.01
S21	M: 8.88 F: 1.08 p: 0.304 r: 0.15	M: 8.88 F: 0.97 p: 0.330 r: 0.14	M: 8.88 F: 0.01 p: 0.912 r: 0.01	M: 8.88 F: 0.46 p: 0.502 r: 0.10	M: 8.88 F: 0.02 p: 0.901 r: 0.02	M: 8.88 F: 2.32 p: 0.134 r: 0.22	M: 8.88 F: 0.16 p: 0.689 r: 0.06	M: 8.88 F: 0.26 p: 0.615 r: 0.07	M: 8.88 F: 0.36 p: 0.725 r: 0.07	M: 8.88 F: 0.34 p: 0.682 r: 0.13
S22	M: 5.49 F: 0.90 p: 0.347 r: 0.14	M: 5.49 F: 3.30 p: 0.076 r: 0.26	M: 5.49 F: 0.02 p: 0.883 r: 0.02	M: 5.49 F: 0.14 p: 0.707 r: 0.05	M: 5.49 F: 0.01 p: 0.960 r: 0.01	M: 5.49 F: 2.74 p: 0.104 r: 0.24	M: 5.49 F: 0.08 p: 0.773 r: 0.04	M: 5.49 F: 0.41 p: 0.527 r: 0.09	M: 5.49 F: 0.24 p: 0.628 r: 0.07	M: 5.49 F: 0.34 p: 0.563 r: 0.09
S23	M: 2.08 F: 1.54 p: 0.221 r: 0.18	M: 2.08 F: 2.88 p: 0.096 r: 0.24	M: 2.08 F: 0.090 p: 0.765 r: 0.04	M: 2.08 F: 0.01 p: 0.932 r: 0.01	M: 2.08 F: 0.16 p: 0.694 r: 0.06	M: 2.08 F: 2.23 p: 0.142 r: 0.21	M: 2.08 F: 0.08 p: 0.776 r: 0.04	M: 2.08 F: 0.04 p: 0.837 r: 0.03	M: 2.08 F: 0.50 p: 0.482 r: 0.10	M: 2.08 F: 0.277 p: 0.601 r: 0.08
S24	M: 50.75 F: 14.08 p: 0.001 r: 0.48	M: 50.75 F: 4.93 p: 0.031 r: 0.31	M: 50.75 F: 1.73 p: 0.195 r: 0.18	M: 50.75 F: 1.87 p: 0.178 r: 0.19	M: 50.75 F: 0.21 p: 0.652 r: 0.07	M: 50.75 F: 0.635 p: 0.430 r: 0.11	M: 50.75 F: 0.68 p: 0.413 r: 0.12	M: 50.75 F: 0.54 p: 0.467 r: 0.11	M: 50.75 F: 2.02 p: 0.162 r: 0.20	M: 50.75 F: 0.32 p: 0.574 r: 0.08
S25	M: 17.26 F: 3.30 p: 0.076 r: 0.26	M: 17.26 F: 0.79 p: 0.378 r: 0.13	M: 17.26 F: 2.18 p: 0.147 r: 0.21	M: 17.26 F: 1.04 p: 0.313 r: 0.15	M: 17.26 F: 3.69 p: 0.061 r: 0.27	M: 17.26 F: 1.84 p: 0.182 r: 0.19	M: 17.26 F: 0.30 p: 0.875 r: 0.02	M: 17.26 F: 2.70 p: 0.107 r: 0.23	M: 17.26 F: 0.41 p: 0.527 r: 0.09	M: 17.26 F: 4.66 p: 0.036 r: 0.31
S26	M: 67.18 F: 9.26 p: 0.004 r: 0.41	M: 67.18 F: 7.22 p: 0.010 r: 0.37	M: 67.18 F: 0.27 p: 0.603 r: 0.06	M: 67.18 F: 0.52 p: 0.476 r: 0.01	M: 67.18 F: 0.022 p: 0.883 r: 0.01	M: 67.18 F: 2.24 p: 0.141 r: 0.05	M: 67.18 F: 0.17 p: 0.684 r: 0.01	M: 67.18 F: 2.83 p: 0.099 r: 0.06	M: 67.18 F: 0.093 p: 0.762 r: 0.01	M: 67.18 F: 1.45 p: 0.235 r: 0.03
S27	M: 0.63 F: 0.01 p: 0.995 r: 0.01	M: 0.63 F: 0.22 p: 0.638 r: 0.07	M: 0.63 F: 5.42 p: 0.024 r: 0.32	M: 0.63 F: 5.23 p: 0.016 r: 0.34	M: 0.63 F: 0.01 p: 0.913 r: 0.02	M: 0.63 F: 0.66 p: 0.421 r: 0.12	M: 0.63 F: 1.09 p: 0.200 r: 0.16	M: 0.63 F: 0.39 p: 0.535 r: 0.09	M: 0.63 F: 4.36 p: 0.042 r: 0.30	M: 0.63 F: 0.273 p: 0.604 r: 0.08

Table S5. Analysis of the responses of the first stage from framework of DCs for Spain public research institutes.

<i>Sensing</i>					
Question		%	Question		%
Q4	Basic science	43	Q11	Environment scanning	29
Q5	Applied research	31	Q12	Benchmarkig	7
Q6	R&D	26	Q13	Bibliometrics	50
Q7	Scientific literature review	64	Q14	Researchers experience	50
Q8	Relevance studies	-	Q15	Academic events	57
Q9	Market studies	14	Q16	Networks colaboration (national/international)	100
Q10	SWOT analysis	14			
<i>Seizing</i>					
Question		%	Question		%
Q17	Short term research	31	Q19	Long term research	29
Q18	Medium term research	40			
<i>Reconfiguration</i>					
Question		%	Question		%
Q20	Industry related projects	64	Q26	Delphi	-
Q21	Public services related projects	50	Q27	Surveys	21
Q22	Projects by gubernamental calls	93	Q28	Trends extrapolation	14
Q23	Relevance trees studies	7	Q29	Cross-impact analysis	35
Q24	Expert panels	64	Q30	Time series analysis	14
Q25	Brainstorming	14	Q31	Scenarios building	14