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The Mediating Roles of Solidarity and Intellectual Capital on the Relationship between Resource Dependency Sub-dimensions and Innovation Performance

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Abstract

The purpose of this study is to investigate the mediator role of solidarity and intellectual capital elements within technocities on the relationship between resource dependency sub-dimensions and innovation performance. Research data's obtained from 234 participants who work in technocities were tested with structural equation model. Resource dependency dimensions, which are independent variables, were evaluated in two sub-dimensions; the importance of the resource (RIMP) and the availability of alternatives (AA). Uncertainty scale was evaluated in three sub-dimensions; ability to be a resource (AbiR), resource scarcity (RS) and resource interconnectedness (RINT). Mediating variables were planned as solidarity (SOL) and intellectual capital- human capital (H_C), social capital (S_C) and organizational capital (O_C)- The results of the analysis emphasized the importance of solidarity and intellectual capital in terms of dependency and uncertainty. In analyzing the mediation effects, three different models were tested and were determined to be parallel. The SOL and O_C dependents found to have a direct effect on the innovation performance (INP). According to Model 1; it can be stated that the RIMP has a direct and positive effect on INP, O_C and SOL. In the model 2; AA has a direct and positive effect on INP, O_C and SOL. In Model 3, the RINT has a direct effect on the INP, O_C and SOL. Based on AIC and R2 values calculated for comparison the SOL and O_C, the second model found to be best model among the others.

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Keywords: Resource dependence theory; Intellectual capital; Innovation performance; Solidarity; Technocity;

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1. Introduction

Today, due to the globalization and the continuously improvement of the information technologies enterprises face with an intense competition (Sanchez and Marin, 2005). For this reason enterprises have to adapt their structure and technologies to changes for their viability (Mintzberg, 2003). Especially businesses in sectors such as information technologies have to constantly innovate their products and services in order to maintain their existence (D'Aveni, 1995). To this end, organizations benefit more from collaborations in creating new products and services in actualizing innovation (Capaldo and Petruzzelli, 2014). The intense competition requires the strategic partnerships, the effective management of information and the use of technology based on intellectual capital (Capaldo and Petruzzelli, 2014; Pfeffer and Salancik, 1978). In a study by Nonaka and Takeuchi (1995), it was stated that future societies would be knowledge-based societies and that knowledge, and its implementation would play a leading role in economic growth and capital accumulation (Hsu and Fang, 2008). Intellectual capital; -human capital, organizational capital and social capital- increase the innovation capability of enterprises (Polo and Vazquez, 2008; Subramaniam and Youndt, 2005). Therefore, there is a close relationship between innovation and information infrastructure in enterprises at strategic level.

In this context, it is stated that organizations can survive through solidarity that will ensure the continuity of the resource flow against environmental uncertainties (Wisnieski and Dowling, 1997). In the related literature, it is stated that R&D studies are the most important aspect of innovation capacity on the technocity structuring plays a facilitating role in creating new products (Hollen et al., 2013; Roersen, 2008). Thus university-industry-state solidarity creates a high level of value through technocities. By means of the established communication, the actors can find a solution to the collective problems easier and create new value by revealing their own abilities (Huppé and Creech, 2012). In addition to geographical closeness, it plays a facilitating role in inter-organizational solidarity in terms of cognitive, social, cultural and technological aspects (Capaldo and Petruzzelli, 2014). From this point of view, technocities provide a suitable environment for strategic partnerships and intellectual capital. The aim of this study is to question the role of solidarity between organizations and intellectual capital in the relationship between resource dependency theory and innovation performance.

2. Literature Review and Theoretical Framework

2.1. Solidarity within Technocity through the Perspective of Resource Dependence Theory

One of the basic assumptions of resource dependence theory is how the organizations can effectively reduce the dependencies on the resources they need in uncertain environmental conditions (Hillman et al., 2009). Resource dependence theory states that the resources needed affects the behaviour of the organization and that the organization needs resources to survive (Pfeffer and Salancik, 2003:44). In this context, organizations with strategic resources create dependency and manage power relations (Mudambi and Pedersen, 2007). When knowledge is accepted as the source valuable (Burkhardt and Brass, 1990), it is understood that enterprises that adopt and use new technologies can reduce transaction costs, decrease the dependency between buyers and suppliers, and balance power relations between organizations (Davis and Cobb, 2009). One of the resources that organizations use for information retrieval and innovation is to benefit from the basic skills of the stakeholders and to have the required workforce (Spekman et al., 1998). Strategic solidarity is a way to reach this resource. When the formation process of technocities is considered, it is understood that the businesses chose to be in technocities to reduce the uncertainty to access to resources (Etzkowitz and Leydesdorff, 2000). The solidarity among university-firm, firm-firm and firm-industry within technocities were supported as the triple spiral model by several researches (Etzkowitz and Leydesdorff, 2000; Gertner et al., 2011).

2.2. The Relationship between Solidarity, Intellectual Capital and Innovation Performance

Stewart's defined intellectual capital as intellectual material, information, knowledge, intellectual property and experience that can create value (Stewart, 1997). Chang et. al. (2006) highlight the intellectual capital's definition from the side of an abstract value without a physical presence based on knowledge. It is clearly seen that, the intersection point of all definitions is creating the value. In addition to definitions, intangible assets in creating value

for enterprises are included in intellectual capital (Petty and Guthrie, 2000). Intellectual capital in the literature is defined by three sub-dimensions; human capital, social capital and organizational capital (Torres, 2006; Tseng and Goo, 2005). Human capital consists of the skills of the employees (Sydler et al., 2013). For this reason, enterprises want to attract qualified and competent employees to their institutions. Social capital is defined as how businesses can acquire, discover and use new knowledge. In this sense, social capital includes the relationship of enterprises with stakeholders (Mehralian et al., 2013). Organizational capital refers to intangible assets embedded in the organization (Calabrese, et al., 2013). They accelerate innovation processes by developing knowledge sharing, joint learning ability, joint analysis and solution approaches to problems. Especially, the relationship between social capital and innovation is more evident (Yang, 2016; Egeland and Birkeland, 2012). Hence, networks by way of technocities can be seen as part of a broad cooperative learning process for innovation (Huppé and Creech, 2012). According to social network theory, social capital is considered as a determining factor in creating innovation (Kashi and Afsari, 2014). As Masellell stated, knowledge-based economy is based not only on competitiveness, costs and prices but also on innovation through the creation of information and dissemination of information faster than its competitors (Miguélez et al. 2008).

3. Hypothesess Framing:

The solidarity and innovation are among the variables to foster the existence and to achieve the competitive advantage of firms (Haned et al., 2014). Hence, the technocities are accepted as areas where organizations can create values together. On this basis, it is envisaged that in technicities' solidarity and intellectual capital may have mediator effect in the relationship between resource dependency sub-dimensions and innovation performance. In this context, the following hypotheses are formed;

H_1: Resource dependency sub-dimensions have statistically significant effect on solidarity and intellectual capital.

H_{1a}: Importance of resource has a statistically significant effect on solidarity and intellectual capital.

H_{1b}: Availability of alternative resources have a statistically significant effect on solidarity and intellectual capital.

H_{1c}: Ability to be a resource has a statistically significant effect on solidarity and intellectual capital.

H_{1d}: Resource scarcity has a statistically significant effect on solidarity and intellectual capital.

H_{1e}: Resource interconnectedness has a statistically significant effect on solidarity and intellectual capital.

H_2: Solidarity and intellectual capital have a statistically significant effect on the innovation performance

H_3: Resource dependency sub-dimensions have statistically significant effect on the innovation performance

H_4: There are mediator effects of solidarity and intellectual capital between resource dependency sub-dimensions and innovation performance.

4. Research Method

4.1. Sample and Data Collection

The sample set of the research consists of 234 participants, who work in Technology Transfer, Project Management Office, Incubation Centers of all seven regions in Turkey. As the sample of the research, convenience (snowball) sampling technique is used. The survey has been conducted on participants by face-to-face interviews and e-mails. Exploratory and confirmatory factor analyses were conducted to evaluate the validity and reliability of the scales. Then, the research model and related hypotheses were tested by the structural equation modelling technique.

4.1.1. Analyses

The first part of the survey encompass descriptive statistics. In the second part; within independent variables; in the context of resource dependency theory, (i) "dependency in sub-dimension; RIMP (5 items) and AA (3 items)"; (ii) with "uncertainty in sub-dimension; AbiR (2 items), RS (3 items) and RINT (3 items)" and mediating variable "SOL (3 items)" and "intellectual capital in sub-dimensions; H_C (5 items), O_C (4 items) and S_C (5 items)". The variables are constructed by help of Saidel 1991; Pfeffer & Salancik, 2003; Fink et.al, 2006; Ömürbek and Halıcı, 2012 and

Subramaniam and Youndt, 2005. The dependent variable in the third section, "questions on measuring the impact of innovation performance (6 items)", was adapted by the "innovation performance scale" of Günday et.al, 2011.

5. Findings

5.1. Descriptive Analyzes

53 of the employees are female, 181 are male and 47,4 % are undergraduate. There are 42 participants with 11-15 years and 6-10 years of professional experience and 92 participants with 2-3 years in the technocity. Technocities are mostly located in Marmara and Central Anatolia Region. The employees are composed of a maximum of 144 persons, 0-9 persons and 68 persons, 10-49 persons. For the duration of the activity, there are 106 enterprises, maximum 2-5 years.

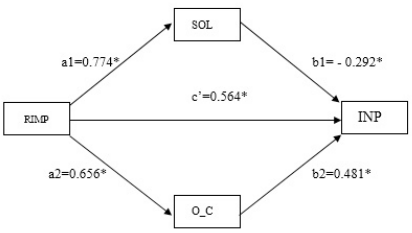
5.2. Factor Analysis and Reliability

Dependency scale was examined with 2 factors as RIMP and AA sub-dimension. According to the results of factor analysis; Kaiser-Meyer-Olkin (KMO) adequacy scale 0.646; total variance explanation rate was found as 75.888%. χ^2= 396.808 (p <0.000) was obtained according to the Bartlett Sphericity Test result; Cronbach's alpha was found to be 0.737 for the reliability of the overall scale. AbiR, RS and RINT subscales were analyzed with 3 factors. According to the results of factor analysis; KMO adequacy scale 0.856; total variance explanation rate was found as %88.029. According to the Bartlett Sphericity Test result was obtained as, χ^2= 608.283 (p <0.000); for the overall scale, the Cronbach's alpha value for reliability analysis was 0.883. The intellectual capital scale was examined with 3 factors as H_C, S_C and O_C. According to the results of factor analysis; the KMO competence scale was 0.897; total variance explanation rate was found as %71.680. According to the Bartlett Sphericity Test result was obtained as χ^2=1758.637 (p <0.000); The Cronbach's alpha value for reliability analysis for the overall scale was 0.897.

5.3. Research Models and Hypotheses Testing

The application of the models was made using the "lavaan" Studio package in R Studio 1.1.163 program. Due to the data were ordinal variable, the models were obtained using the DWLS (Diagonally Weighted Least Squares) estimation method. The missing values on the data are estimated by regression imputation method. In the analyzes, resource dependency dimension, which is an independent variable, was evaluated in 2 sub-dimensions as dependency and uncertainty, while the dependency scale was two factors as RIMP and AA sub-dimensions, and on the other hand while the uncertainty scale was three factors as AbiR, RS ve RINT sub-dimensions. The intellectual capital scale, which mediator impact is estimated; H_C, S_C and O_C are examined in three sub-dimensions. Three different structural equation models have been established to test the research hypotheses. In analyzing the mediation effect, three different models were established in which the dependent variable's INP and independent variables were RIMP, AbiR and RINT, and these values were determined to be parallel. In parallel with the installed models, the SOL and O_C variables have a direct effect on the INP variable. AIC and R2 values were calculated for comparison among the determined models. These values are determined as the second best model. With the results of the analysis emphasized the importance of solidarity and intellectual capital in terms of dependence and uncertainty, which are sub-dimensions of resource dependency theory.

Model 1:

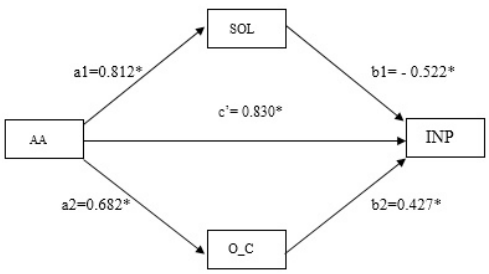


		Estimate	Std. Error	t values	p	Standardized Estimate
SOL ~ RIMP	a_1	0.989	0.075	13.122	0.000*	0.774
O_C ~ RIMP	a_2	0.778	0.074	10.482	0.000*	0,656
INP ~ RIMP SOL O_C	c'	0.595	0.162	3.681	0.000*	0.564
	b_1	-0.240	0.122	-1.968	0.000*	-0.292
	b_2	0.427	0.098	4.366	0.000*	0.481
Indirect Effect 1	$a_1 b_1$	-0.238	0.129	-1.839	0.066	-0.226
Indirect Effect 2	$a_2 b_2$	0.332	0.078	4.275	0.000*	0.315
*p<0,05						

Fit Indexes	Good Fit	Acceptable Fit Value	Result
CFI	0.95≤CFI≤1.00	0.90≤CFI≤1.00	0.926
NNFI	0.95≤NNFI≤1.00	0.90≤NNFI≤1.00	0.916
AIC=1209.269, **R^2**=0.593			

The results of the compliance criteria in the table are examined as CFI = 0.926, NNFI = 0.916; It was determined that our models were significance. In the model, it can be said that RIMP variable has a direct effect against INP, O_C and SOL variables (p <0.05). It can be said that the variables SOL and O_C have a direct effect on the INP variable (p <0.05). While the O_C variable was found to have an indirect effect (p <0.05), it can be said that there is no indirect effect of the SOL variable (p> 0.05). Since the RIMP independent variable has a direct effect on the INP dependent variable, it can be said that the variable O_C has a partial mediator effect to the INP variable. In our model; it can be said that the RIMP independent variable explained the INP dependent variable by 59.3% with the parallel effect of O_C and SOL variables.

Model 2:



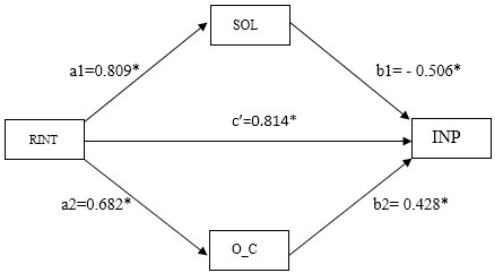
		Estimate	Std. Error	t values	p	Standardized Estimate
SOL ~ AA	a_1	0.784	0.033	23.474	0.000*	0.812
O_C ~ AA	a_2	0.608	0.057	10.686	0.000*	0,682
INP ~ AA SOL O_C	c'	0.660	0.117	5.621	0.000*	0.830
	b_1	-0.430	0.104	-4.155	0.000*	-0.522
	b_2	0.381	0.106	3.601	0.000*	0.427

Indirect Effect 1	a_1b_1	-0.337	0.084	-3.996	0.000*	-0.424
Indirect Effect 2	a_2b_2	0.231	0.062	3.742	0.000*	0.291
*p<0,05						

Fit Indexes	**Good Fit**	**Acceptable Fit Value**	**Result**
CFI	0.95≤CFI≤1.00	0.90≤CFI≤1.00	0.938
NNFI	0.95≤NNFI≤1.00	0.90≤NNFI≤1.00	0.930
AIC=1082.546, **R^2**= 0.676			

The results of the compliance criteria in the table are examined with CFI = 0.938, NNFI = 0.930; it was determined that our models were significance. In the model, it can be said that AA has a direct effect on INP, O_C and SOL variables (p <0.05). It can be said that the variables SOL and O_C have a direct effect on the INP variable (p <0.05) and there is an indirect effect of SOL and O_C in the model (p <0.05). Since the AA independent variable has a direct effect on the INP dependent variable, it can be said that the variables SOL and O_C have a partial mediator effect on the INP variable. In our model; the RIMP argument can be said to explain the INP dependent variable by %67.6 with the parallel effect of O_C and SOL variables.

Model 3:



		Estimate	**Std. Error**	**t values**	**p**	**Standardized Estimate**
SOL ~ RINT	a_1	0.878	0.036	24.579	0.000*	0.809
O_C ~ RINT	a_2	0.683	0.067	10.154	0.000*	0,682
INP ~ RINT	c'	0.729	0.128	5.701	0.000*	0.814
SOL	b_1	-0.417	0.098	-4.275	0.000*	-0.506
O_C	b_2	0.383	0.107	3.589	0.000*	0.428
Indirect Effect 1	a_1b_1	-0.366	0.089	-4.122	0.000*	-0.409
Indirect Effect 2	a_2b_2	0.261	0.071	3.692	0.000*	0.292
*p<0,05						

Fit Indexes	**Good Fit**	**Acceptable Fit Value**	**Result**
CFI	0.95≤CFI≤1.00	0.90≤CFI≤1.00	0.935
NNFI	0.95≤NNFI≤1.00	0.90≤NNFI≤1.00	0.926
AIC=1113.353, **R^2**=0.672			

The results of the compliance criteria in the table are examined as CFI = 0.935, NNFI = 0.926; it was determined that our models were significance. It can be said that the RINT variable has a direct effect on INP, O_C and SOL variables (p <0.05) and the variables SOL and O_C have a direct effect on the INP variable (p <0.05). It can be said

that there is an indirect effect of SOL and O_C tool in the model (p <0.05). Since the AA independent variable has a direct effect on the INP dependent variable, it can be said that the variables SOL and O_C have a partial mediator effect on the INP variable. In our model; the RINT argument can be said to explain the INP dependent variable %67.2 with the parallel effect of O_C and SOL dependent variables. AIC and R2 values were calculated for comparison among the determined models. The best model with these values was determined as (AIC = 1082.546, R2 = 0.676).

6. Conclusion and Discussion

As a result of the analysis, O_C and SOL values were found to be parallel according to 3 different structural equation models. In parallel with the installed models, the SOL and O_C variables have a direct effect on the INP variable. AIC and R2 values were calculated in order to compare among the determined models and the best model was determined as the second model with these values. According to Model 1; it can be said that the RIMP variable has a direct effect on INP, O_C and SOL variables and this effect is positive. It is possible to say that the O_ C variables have a direct effect on the INP variable, and that the O_C variable has a positive effect when there is an indirect effect.

In the model 2; it is possible to say that that AA has a direct effect on INP, O_C and SOL variables and this effect is positive. It can be said that the variables SOL and O_C have a direct effect on the INP variable and that the O_C variable has a positive effect while the SOL variable has an indirect effect (p <0.05), and that the model SOL and O_C have an indirect effect (p <0.05).

In Model 3; it is possible to say that the RINT variable has a direct effect against the INP, O_C and SOL variables in the model (p <0.05) and it can be said that the variables of the SOL and O_C have a direct effect on the INP variable and that the variable has a partial mediator effect while the variable O_C has a positive effect.

In our previous study, it was observed that there was an indirect mediating effect of SOL in relation to uncertainty resource and in obtaining resource between INP (Pınar et al., 2018). In this study, AIC and R2 values were calculated in order to compare within the determined models and it was seen that the best model was the second best model with these values.

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