Not just numbers! Improving TTO performance by balancing the soft sides of the TQM

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Abstract

Purpose – This study investigates the role of "soft" factors of total quality management – in terms of empowerment and engagement of employees – in facilitating or hindering organizational performance of the university technology transfer offices.

Design/methodology/approach – The authors developed an Ordinary Least Squares (OLS), multiple regression model to test if empowerment and engagement affect organizational performance of the university technology transfer offices.

Findings – The authors found that "soft" factors of total quality management – in terms of empowerment and engagement – facilitate the improvement of organizational performance in university technology transfer offices.

Practical implications – The authors' analysis shows that soft total quality management practices create the conditions for improving organizational performance. This study provides practical implications by showing that, in the evaluation of the technology transfer office, not only the "hard" variables (e.g. number of employees and employee experience) but also the "soft" one (e.g. empowerment and engagement) matter. Therefore, university technology transfer managers or university technology transfer delegates should take actions to promote not only empowering employees but also create a climate conducive to employees' engagement in the university technology transfer offices.

Originality/value – With regards to the differences in organizational performances of university technology transfer offices, several studies have focused their attention on technology transfer professionals in technology transfer offices, but only a few of them have examined the "soft side" of total quality management. Thus, this study examines the organizational goals of technology transfer offices through "soft" factors of total quality management in terms of empowerment and engagement employees.

Keywords Technology transfer offices, Empowerment, Engagement, Organizational performance, Total Quality Management

Paper type Research paper

1. Introduction

A wide range of literature states that university technology transfer offices TTOs) play an important role (Iacobucci *et al.*, 2021) since they promote and support relations between

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different stakeholders (Grimaldi *et al.*, 2021). Given the recognized importance of TTOs, several authors have tried to understand how their organizational performance can be improved (Bigliardi *et al.*, 2015; Goldfarb and Henrekson, 2003; Tseng and Raudensky, 2014). In particular, several authors have argued that the organizational performance of the TTOs depends on "hard" organizational elements such as the number of the personnel employed, their experience and organizational politics (Phan and Siegel, 2006). However, the success of Total Quality Management (TQM) initiatives have shown that organizational results actually require a balanced mix of "hard" and "soft" factors (Cavallone and Palumbo, 2021; Gadenne and Sharma, 2009; Rahman and Bullock, 2005), thereby suggesting that soft factors may also explicate the organizational performance of TTOs.

Although several researchers have also focused on organizational issues (Bercovitz *et al.*, 2001; Escoffier *et al.*, 2011; Siegel *et al.*, 2001), only a few studies that have analyzed whether and how "soft" organizational factors can influence the organizational performance of the TTOs (Soares and Torkomian, 2021). In fact, the "soft" side of organizational factors has usually been considered as a contingent variable in the analysis of interventions whereas the "hard" side has been recognized as crucial for improving organizational performance (Imeri *et al.*, 2014). However, within the TQM literature, several studies have investigated the role of empowered and engaged employees in improving organizational performance (Keng Boon *et al.*, 2005). Therefore, in this study, we investigate whether and how the "soft" factors of total quality management – in terms of employees' empowerment and engagement –facilitate the organizational excellence of TTOs. Indeed, empowerment and engagement of employees, considered as two dimensions of continuous improvement can contribute to the literature on the organizational performance of technology transfer activities, as argued by several authors (Cartaxo and Godinho, 2017; Chapple *et al.*, 2005; Siegel *et al.*, 2003; Soane *et al.*, 2012; Spreitzer, 1995). Their work provides important insights for TTOs, given the recognized centrality of TTO professionals in influencing TTO performance (Campbell *et al.*, 2020; Bianchi, 2012; Thursby *et al.*, 2001). Thus, in this study we analyze the organizational performance of TTOs through the soft tools of the TQM, i.e. on the basis of the level of responsibility and involvement of technology transfer professionals (TTPs) in Italian university TTOs.

While the organizational literature has clearly identified the distinction between engagement and empowerment, in this study we find that these two dimensions are rather overlapped or at least correlated. A key insight of this study is that the coexistence of engagement and empowerment affects the organizational performance of TTOs. Drawing on these findings, this study contributes to the discussion of the literature on TQM and human resources management of TTOs in two different ways: (1) we find that the coexistence of empowerment and engagement leads to a better organizational performance in TTOs; (2) in the TQM literature it is the first time that in the context of TTOs we find evidence that only the coexistence of empowerment and engagement employees influence the organizational behavior of the individuals as well as organizational performance.

The article is organized as follows. Section 2 reviews the literature and proposes the conceptual framework and research hypotheses that inspired this research. Section 3 shows the methodology used for the analysis and provides information on data collection. Section 4 illustrates the results while the last section discusses the conclusions and the main implications for theory and practice.

2. Theoretical background

2.1 An overview of the antecedents on the evaluation of university TTOs

In evaluating and explaining organizational performance in the knowledge transfer activities, it is important to recognize their organizational outcomes (Hockaday and

Piccaluga, 2021). Specifically, consistently with previous studies on TTO performance (Anderson *et al.*, 2007; Chapple *et al.*, 2005; Siegel *et al.*, 2003), we consider licensing arrangements as an outcome of organizational performance (Jensen and Thursby, 2016; Son *et al.*, 2019; Ustundag *et al.*, 2011). Several analyses on TTOs performance used the number of license agreements or licenses income as an outcome measure of organizational performance of technology transfer (Son *et al.*, 2019; Ustundag *et al.*, 2011). Thus, we define TTO licensing as the legal mechanism for using the university's intellectual property (Goldfarb and Henrekson, 2003). In particular, we use this performance variable because a licensing agreement is an activity that involves considerable effort for TTPs and involves their entire office organization (Lach and Schankerman, 2004; Wu *et al.*, 2015; Ustundag *et al.*, 2011). Therefore, it is important for TTPs to be empowered and committed to achieving organizational performance goals.

Moreover, drawing on Siegel *et al.* (2003) and Chapple *et al.* (2005), we hypothesize seven organizational input variables and two contextual variables that can influence organizational TTO performance: (1) invention disclosures; (2) number of full-time TTPs in the TTO; (3) expenses for external consulting related to intellectual property; (4) the legal nature of the university and the presence of a medical school; and (5) the age of the TTO; (6) regional gross domestic product (per capita) and (7) regional research and development intensity of industry (per capita expenditure in R&D). Based on these assumptions, we assume that these seven variables combined with the commitment of TTPs are able to influence organizational performance.

2.2 Human resource management practices in TTOs

Regarding the evaluation of TTO performance, some authors pointed out that certain organizational levers can increase TTO performance (Caldera and Debande, 2010; Thursby and Kemp, 2002). Examples include the quality of staff employed, the organization of the office, the division of labor (Phan and Siegel, 2006), the design of organizational structures (Siegel and Wright, 2015), organizational incentives (Link and Siegel, 2005), the active involvement in technology transfer activities at the individual level, and multidisciplinary staffing within the university technology transfer office (Cucino *et al.*, 2021; Hockaday and Piccaluga, 2021; Micozzi *et al.*, 2021).

Given the importance attached to organizational issues in the literature, we decided to investigate this issue by adopting microfoundation theory (Felin *et al.*, 2012) to understand the origins and dynamics of collective concepts such as organizational performance of TTOs. Specifically, microfoundation theory identifies a number of variables related to the employees of a TTO, the management of the licensing process, and the organization of the structure that can be associated with the performance of TTOs (Bianchi, 2012). Therefore, we analyze TTPs and their characteristics, such as inclinations, expectations, and more generally their behaviors (Felin *et al.*, 2012), and investigate whether differences in TTO performance can be explained by different ways in which TTPs are managed.

Within the technology transfer office, TTPs lead the knowledge transfer activities by balancing hard and soft skills (Luo and Lee, 2015; Ustundag *et al.*, 2011). Indeed, on the one hand, the TTPs have the scientific and patent competencies to "imagine" the technology in its context use (Miller *et al.*, 2009). On the other hand, TTPs are able to establish a relationship of mutual trust with the licensee (Amidon, 1996).

Given the importance of these actors, several authors explored the role of TTPs in influencing TTO performance by studying their competencies (Markman *et al.*, 2005) and capabilities (Lockett and Wright, 2005), and emphasizing their importance for TTOs (Alessandrini *et al.*, 2013). In this vein, Abidin *et al.* (2013) showed that a positive organizational context is crucial in influencing the performance of technology transfer.

Although some researchers have also focused on organizational issues (Good *et al.*, 2019), no one has yet investigated the role of soft TQM practices in influencing organizational performance. Nonetheless, the soft TQM approach is based on human-based management practices aimed at supporting employee engagement in making decisions regarding the management and resolutions of the organizational issues it characterizes (Aoun and Hasnan, 2017). Thus, employees' engagement in organizational decisions making was conceived in this study as a frame for implementing a whole TQM approach, setting the conditions for engaging employees in actions directed at improving organizational performance and excellence (Cavallone and Palumbo, 2021; Georgiev and Ohtaki, 2019).

Indeed, empowerment and engagement are two soft levers that can contribute to the literature on TTO performance because they have a direct influence on the behavior of TTPs (Ahmed and Idris, 2021; Cartaxo and Godinho, 2017; Chapple *et al.*, 2005; Siegel *et al.*, 2003; Soane *et al.*, 2012; Spreitzer, 1995). More concretely, engagement and empowerment of employees play a role in continuous improvement (Keng Boon *et al.*, 2005) and allow TTPs to better perform their tasks by contributing to the achievement of TTO goals.

Thus, in our study, we consider that the organizational performance of TTOs also depends on *soft variables* (Figure 1) and we argue that such elements are engagement (Soane *et al.*, 2012) and empowerment (Spreitzer, 1995). On one side Spreitzer (1995) defined employees' empowerment as a motivation for employees to carry out their work; on the other one, Soane *et al.* (2012) defined employees' engagement as the connection between emotional, physical, and cognitive energy towards job activities. Based on this, we first analyze the effect of each one of the two components and then analyze their combined effect.

2.2.1 TTPs empowerment. Empowerment is a management philosophy based on the transfer of a part of organizational decision-making authority to employees (Randeniya, 1995). More concretely, empowerment aims to provide employees with the motivation and the means to constantly improve all their job activities. In this regard, Dawson (1992) observed how managerial motivational behaviors promote this objective, namely *maintaining employee self-*

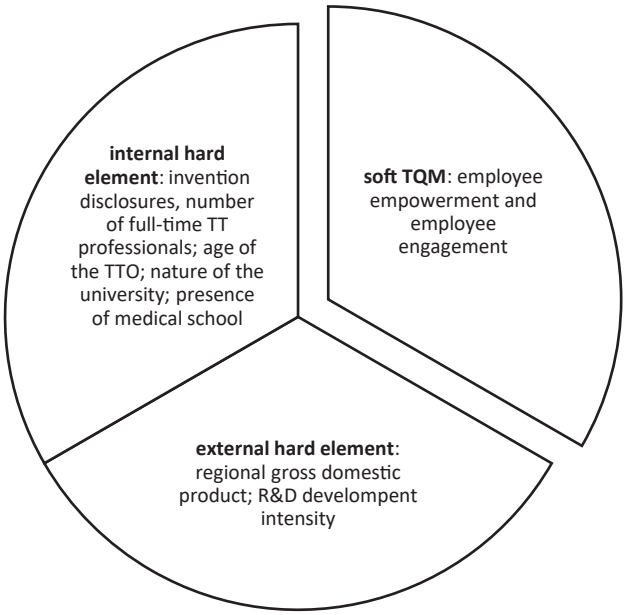

Figure 1.
The hard and soft balance in technology transfer offices

esteem, *listening and responding with empathy*, *soliciting help in problem-solving* and *offering help without assuming responsibility*. Moreover, Peak (1991) believed that an employee empowerment approach would result in greater organizational performance when management is committed to integration at different levels of the corporate structure. Indeed, among the actions suggested, Peak (1991), he argues that human resources should exchange roles with management to enable this integration. However, the underlying assumption of organizations employing TQM is that empowerment is a tool to perform organizational goals (Randeniya, 1995).

In the literature on organizational performance, several authors supported the existence of a positive relationship between organizational performance and employee empowerment (Fernandez and Moldogaziev, 2011; Yin *et al.*, 2019). Indeed, some studies highlight a positive relationship between empowerment and several drives that influence organizational office performance such as work attitude (Spreitzer, 1995), involvement at work (Amor *et al.*, 2021), job satisfaction (Savery and Luks, 2001; Ugboro and Obeng, 2000), and organizational responsibility (Kirkman and Benson, 1999). In addition, empowerment is a motivational construct related to self-evaluation (Conger and Kanungo, 1988) and it is a tool that reflects the organizational support at the workplace (Yin *et al.*, 2019).

Within this literature, we follow Spreitzer (1995) who described empowerment as "the manifestation of an increased intrinsic motivation within four constructs that show an individual attitude toward job role". Thus, we define empowerment as a motivation of the TTPs during workplace activities using the multidimensional measure of empowerment proposed by Spreitzer (1995).

As mentioned before, the activation of a licensing agreement requires considerable effort and commitment of part of TTPs because it requires a high degree of self-assessment and self-determination and a great deal of control over what happens in the institution (Hockaday and Piccaluga, 2021; Micozzi *et al.*, 2021). Thus, based on these arguments, we hypothesize that TTPs empowerment positively influences licensing agreements.

H1. Employees' empowerment is positively related to licensing agreements

2.2.2 TTPs engagement. Engagement shows how employees within an organization "... *are encouraged and enabled to contribute to achieving organizational goals and continually improving the organization*" (Rahman, 2002, p. 497). Indeed, engagement concerns various management activities such as the dynamics related to job improvement processes (Palumbo, 2020; Stanojeska *et al.*, 2020). Kahn (1990) recognized engagement as "harnessing the self of the members of the organization with respect to their working roles through which they employ and express physically, cognitively and emotionally during the performance of the roles". Thus, engagement allows the members of the organization to direct their vigor (physical and cognitive) towards an organizational goal (Kahn, 1990). More concretely, engagement influences organizational performance (Schneider *et al.*, 2018). Indeed, the theory of engagement suggests that the members of the organizations who perceive more engagement improve their work performance in the organization (Bayona *et al.*, 2020; Halbesleben and Wheeler, 2008; Schaufeli *et al.*, 2001). Indeed, on the one hand, some studies suggest that engagement is positively linked to the provision of a high-quality service (Guglielmetti *et al.*, 2020); on the other one, they show how employee engagement creates a healthy work atmosphere healthy by improving organizational performance (Anitha, 2014; Bayona *et al.*, 2020; Schneider *et al.*, 2018). Moreover, the positive effect of employee engagement in building a climate that supports an approach to quality and nurtures a commitment to organizational excellence has been emphasized in the literature (Cavallone and Palumbo, 2021). Thus, following Soane *et al.* (2012), we define engagement as an involvement of the TTPs during workplace activities. Thus, we assess TTPs' engagement through the ISA-scale developed by Soane *et al.* (2012) to evaluate TTPs engagement. More

concretely, engagement is a motivational component made up of three items: "*performance of activities, behavior of organizational citizenship, and intention to quit*" (Soane *et al.*, 2012).

The process leading to the activation of a licensing agreement requires considerable effort from all TTPs in a TTO. In particular, creating a behavior of organizational citizenship and a sense of belonging to the TTOs could lead TTPs to work with less pressure contributing to improve organizational performance (Cucino *et al.*, 2021; Hockaday and Piccaluga, 2021; Micozzi *et al.*, 2021). Thus, based on these arguments, we hypothesize that TTPs engagement positively influences licensing agreements.

H2. Employees' engagement is positively related to licensing agreements

2.2.3 The coexistence of empowerment and engagement. Current literature also points to the importance of the coexistence of empowerment and engagement. Indeed, Bhatnagar (2005) investigated how the perception of greater empowerment of members of the organization is related to their effective engagement, but only a few studies have investigated the coexistence of engagement and empowerment in the workplace (Amor *et al.*, 2021; Anitha, 2014; Saks, 2006; Vigoda-Gadot *et al.*, 2013). However, employee empowerment and engagement are key drivers of achieving organizational performance, as they positively influence employees to produce better results and achieve personal and corporate goals (Bekirogullari, 2019). Engagement implies empowering employees to contribute to organizational decisions as well as to resolve organizational challenges to improve organizational performance (Tortorella *et al.*, 2021). Thus, engagement develops an employee empowerment path (Cavallone and Palumbo, 2021; Ciasullo *et al.*, 2017), through which employees are enabled to collaborate with supervisor to make key organizational decisions (Andrade *et al.*, 2017).

The relationship between empowerment and engagement in the organization exists along this line (Amor *et al.*, 2021; Joo and Shim, 2010; Seibert *et al.*, 2004). Indeed, while empowered employees are in a better position to make thoughtful and appropriate choices in order to solve particular problems on their own (Andrew and Sofian, 2012) engaged employees succeed in building a positive work environment (Bakker and Schaufeli, 2008).

Thus, the combined effect of empowerment and engagement turns out to be crucial in directing the achievement of TTPs' goals. Indeed, the combined effect would help to creates a better organizational climate and a philosophy conducive to achieving the final goals (Assarlind and Gremyr, 2014; Cucino *et al.*, 2019) following two directions: on the one hand, it enables TTPs to strengthen the sense of belonging of people to the organization (Lu and Liu, 2014); on the other, the empowerment encourages the willingness of employees to spend efforts aimed at achieving the final goals (e.g. licensing agreement) (Zaware *et al.*, 2020).

Building on these premises, we combine empowerment and engagement of TTPs and we hypothesize that the coexistence of engagement and empowerment positively influences licensing agreements, which represent one of their most relevant expected outputs.

H3. The co-presence of employees' empowerment and engagement is positively related to licensing agreements

3. Research methodology

3.1 Sample and data collection

Data collection was carried out in three steps. In the first step, data on the performance inputs of Italian TTOs were collected through the Netval database. The Netval database is a well-recognized database that provides data on the technology transfer activities of all Italian universities, public research organization and research hospitals (Cucino *et al.*, 2021; Hockaday and Piccaluga, 2021; Micozzi *et al.*, 2021; Muscio *et al.*, 2016; Sciarelli *et al.*, 2022). In particular, Netval every year performs a survey of Italian universities, public research

organizations, and research hospitals to monitor their technology transfer activities. Specifically, the data collected through the Netval survey regard licensing, number of inventions identified, and other items related to the generality of TTOs (e.g. number of employees, year of establishment, external expenditures allocated to technology transfer activities, etc.).

In the second step, in line with Siegel *et al.* (2003) and Chapple *et al.* (2005), context data such as regional gross domestic product (per capita) and regional research and development intensity of industry (per capita expenditure in R&D) were collected through the Eurostat database (www.ec.europa.eu).

In the third step, data on the empowerment and engagement of Italian TTPs were collected through an *ad hoc* questionnaire. Specifically, following Spreitzer (1995) and Soane *et al.* (2012), we constructed our questionnaire with the aim of measuring the empowerment and engagement of TTPs in Italy (220 in 2018). To achieve this objective, we translated the items of the questionnaire used by Spreitzer (1995) and Soane *et al.* (2012) and we shared the questionnaire with 10 volunteer TTPs in order to increase comprehension and adaptation to the Italian language [1], After revising a few changes that were inspired by the pilot sample, we submitted the questionnaire to all the population of TTPs in Italy. More specifically, the survey was conducted between 2017 and 2018, addressing all 220 TTPs. We received 187 full questionnaires with an 85% participation rate, which is a very high response rate. Among that we received, 51 were compiled by managers and/or coordinators of TTOs while 136 of them did not have full-time positions in the TTOs. Lastly, respondents had an average age of 41 years. The descriptive statistics of our sample are shown in the following Table 1.

3.2 Measures

In Table 2 we illustrate descriptive statistics and a correlation matrix. Following previous studies (Spreitzer, 1995; Soane *et al.*, 2012), all items were measured on a seven-point Likert scale (1 strongly disagree; 7 strongly agree).

3.2.1 Dependent variables. Our dependent variable is the number of university or research hospital licensing agreements per year (LICENSE). A license agreement is an activity that requires a relevant commitment of TTPs working in TTOs since it requires the combination of different abilities and competencies, as well as frequent and intense interactions with academic researchers and industrial managers (Macho-Stadler and Castrillo, 2010; Lach and Schankerman, 2004; Micozzi *et al.*, 2021; Wu *et al.*, 2015; Thursby *et al.*, 2001; Thursby and Kemp, 2002).

3.2.2 Independent variables. More specific considerations should be made with regards to the variables that belong to the group of latent variables. MEANING is the value attributed to a goal; this value depends on personal ideals (Thomas and Velthouse, 1990). COMPETENCE

Variable name	Mean	Standard deviation
LICENSE	7.60	11.17
ENGAGEMENT	2.96	0.80
EMPOWERMENT	3.65	0.65
AGE	9.51	5.31
DIMENSION	3.95	2.37
INV_DISC	11.25	20.29
LEGAL	68,162.57	80,387.17
D_PRIVATE	0.13	0.34
GDP_REG	28,002.94	6,950.95
RD_REG	359.08	144.66
MED_DEP	0.72	0.45

Table 1.
Descriptive statistics

Table 2.
Correlation matrix

Variable name											
LICENSE	1										
ENGAGEMENT	0.08	1									
EMPOWERMENT	0.07	−0.03	1								
AGE	0.12	0.17	0.12	1							
DIMENSION	0.21	0.15	0.21	0.36*	1						
INV_DISC	0.50*	0.04	0.37*	0.21	0.17	1					
ST_LEGAL	0.47*	−0.01	0.37*	0.07	0.29*	0.52*	1				
D_PRIVATE	−0.17	−0.17	−0.06	−0.36	−0.24	−0.09	0.11	1			
ST_GDP_REG	0.07	−0.22	0.14	0.10	−0.05	0.13	0.14	0.16	1		
RD_REG	0.08	−0.29*	0.14	0.13	−0.05	0.13	0.17	0.16	0.88*	1	
MED_DEP	−0.22	0.06	−0.17	−0.03	−0.05	−0.18	−0.01	0.14	0.02	−0.01	1

is the capacity to accomplish activities with capacity and competence (Gist, 1987). This ability is linked to expectations and leadership (Bandura, 1989). DETERMINATION reflects an employee's autonomy in starting and ending tasks (Spector, 1986). IMPACT is the ability to influence one's work (Ashforth, 1989). TASK expresses employee performance self-assessment (Brown *et al.*, 2005; Kahn, 1990). ORG_CITIZ is the organizational citizenship behavior (OCB). OCB is the prosocial behavior of organization members that goes beyond formal job descriptions (Organ, 1988). QUIT expresses the intention to change a job (Shuck, 2011). ENGAGEMENT is connected with a significant degree of cognitive activity; consequently, it includes the notion of activation (Kahn, 1990). EMPOWERMENT is linked to motivation and in particular to the notion of personal efficacy (Conger and Kanungo, 1988).

3.2.3 Control variables. To exclude the effects of extraneous variables, we controlled for eight variables. Dimension is represented by the number of researchers working at each research center calculated as the logarithm of the number of TTPs working in the TTO (DIMENSION). To control for the age of the TTO, we used the age of the TTO in its logarithm form (AGE) (Chapple *et al.*, 2005; Siegel *et al.*, 2003). INV_DISC is the annual invention disclosure (Chapple *et al.*, 2005; Siegel *et al.*, 2003). ST_LEGAL represents the standardized value of expenses for external consulting related to intellectual property (Chapple *et al.*, 2005). D_PRIVATE provides information regarding whether the institution is private (Chapple *et al.*, 2005). ST_GDP_REG is the standardized value of regional GDP (Siegel *et al.*, 2003). RD_REG is the regional research and development intensity of industrial firms (Siegel *et al.*, 2003). Finally, we controlled for the presence of a medicine department within the University (MED_DEP).

3.2.4 Analysis and results. Following Anderson and Gerbing (1988) we used a two steps approach. In the first step, we generated a measurement model by using CFA to assess the reliability of our measurement scales. Results of the CFA are reported in Table 3. The composite reliability of all constructs was above 0.60 (Bagozzi and Yi, 1988), indicating adequate reliability. Moreover, all Average Variance Extracted (AVE) values were above 0.5, indicating sufficient convergent validity (Fornell and Larcker, 1981). In addition, factors loadings of each item are above 0.50, indicating the belongingness to the same factor (Stevens, 1992).

In the second step, we developed an ordinary least squares (OLS), multiple regression model to test the hypothesis developed in our theoretical section. As shown in Table 4, the results suggest that we can support Hypothesis 1 (in Model 2) and Hypothesis 3 (in Model 4) whereas we cannot confirm Hypothesis 2 (in Model 3). In particular, Model 2 shows that the EMP coefficient is significant with the value of 6.915 (0.00) and Model 4 reports the significance of the variable EMP*ENG with a value of 1.825 (0.016). On the other hand, Model

Second order factor	First order factor	Items	Loadings	Reliability
Empowerment	Meaning	• The work I do is very important to me; • My job activities are personally meaningful to me; • The work I do is meaningful to me	0.879 0.888 0.902	Alpha 0.87 CR 0.92 AVE 0.79
	Competence	• I am confident about my ability to do my job; • I am self-assured about my capabilities to perform my work activities; • I have mastered the skills necessary for my job	0.868 0.901 0.872	Alpha 0.85 CR 0.91 AVE 0.78
	Self Determination	• I have significant autonomy in determining how I do my job; • I can decide on my own how to go about doing my work; • I have considerable opportunities for independence and freedom in how I do my job	0.851 0.894 0.909	Alpha 0.86 CR 0.92 AVE 0.78
	Impact	• The impact of my work on what happens in my department is significant; • I have a great deal of control over what happens in my department; • I have significant influence over what happens in my department	0.877 0.893 0.870	Alpha 0.85 CR 0.91 AVE 0.77
Engagement	Task Performance	• I always complete the duties specified in my job description; • I meet all the formal performance requirements of the job; • I fulfill all responsibilities required in my job; • I never neglect aspects of the job that I am obligated to perform; • I often fail to perform essential duties	0.789 0.756 0.806 0.788 0.753	Alpha 0.84 CR 0.88 AVE 0.61
	Organizational Citizenship Behavior	• Attend functions that are not required but that help the organizational image; • Offer ideas to improve the functioning of the organization; • Take action to protect the organization from potential problems; • Defend the organization when other employees criticize it	0.698 0.823 0.827 0.625	Alpha 0.73 CR 0.83 AVE 0.56
	Intention to Quit	• During the next year, I will probably look for a new job outside my current employer; • I am seriously considering quitting my current employer for an alternative employer	0.903 0.903	Alpha 0.77 CR 0.90 AVE 0.82

Table 3.
Construct reliability and validity

	Model 1	Model 2	Model 3	Model 4
D_PRIVATE	−5.299	−5.327	−5.351	−4.641
RD_REG	−0.004	0.015	0.005	0.007
ST_GDP_REG	0.002	−0.001*	−0.008	−0.002
MED_DEP	−2.833	−3.001	−3.549	−1.925
AGE	−0.055	−0.191	−0.124	−0.179
DIMENSION	0.300	−0.320	0.154	−0.126
INV_DISC	0.161*	0.113*	0.160*	0.098
ST_LEGAL	0.001*	0.001*	0.004*	0.001
EMP		6.785***		2.274
ENG			1.403	−3.828*
EMP*ENG				1.732**
F Value	9.60***	18.46***	8.69***	17.57***
R squared	0.56	0.73	0.57	0.77
Adjusted *R* squared	0.50	0.69	0.50	0.72
R Change		0.19	0.19	0.22

Table 4.
Results of our analysis

3 highlights that the ENG variable is not significant with a value of 1.715 (0.197). The results show that the co-presence of a high level of empowerment and engagement influences the organizational performance of TTPs. In particular, the results of the Model 4 imply that employees are at the same time empowered and engaged the performance of the organization, measured by the number of license agreement per year increases.

3.2.5 Robustness checks. In this subsection, we aim at testing our models by changing the specification of some control variables to verify the robustness of our results. In order to do that, we provide an alternative specification of two control variables (i.e. DIMENSION and AGE). Specifically, for the control variable DIMENSION we build a categorical variable starting from the number of employees of each TTO. For what concerns the variable AGE we build a dichotomous variable taking the value of 1 if the age of the TTO was higher than medium value and 0 if the value was below. Appendix 1 reports the results of the regression with the different operationalization of the control variables. As reported in Appendix 1, results of the robustness check are consistent with results of our model.

4. Discussion

It is recognized that the organizational performance of the TTO depends on "hard" organizational elements such as the number of staff employed, experience and organizational policies (Phan and Siegel, 2006). However, the success of TQM initiatives has shown that organizational results actually require a balanced mix of "hard" and "soft" factors (Cavallone and Palumbo, 2021; Gadenne and Sharma, 2009; Rahman and Bullock, 2005). Thus, in this study we investigated this issue by adopting the microfoundation theory (Felin *et al.*, 2012) in TTOs. In particular, to understand the origins and dynamics of collective concepts such as the organizational performance of TTOs, we have identified a series of "soft" variables relating to TTO employees (named empowerment and engagement) that can be associated with the performance of TTOs (Bianchi, 2012; Cucino *et al.*, 2021; Micozzi *et al.*, 2021). More concretely, this study aims to analyze the performance of TTOs on the basis of TQM soft practices of empowerment and engagement of TTPs.

The study contributes to the discussion of the literature into three different perspective. First, the research findings suggest that employee engagement and empowerment should be managed in combination to increase performance commitment organizational. This study is in line with Cavallone and Palumbo (2021) who argue that employee empowerment helps establish greater individual commitment to organizational excellence. Thus, it turns out that

the coexistence of empowerment and commitment leads to high performance in TTOs. This result provides guidance to managers in TTOs, demonstrating that responsible and engaged employees influence organizational outcomes by creating a positive work environment (Bakker and Schaufeli, 2008). Furthermore, this finding is consistent with the literature emphasizing the role of TTPs in the technology transfer process (Lockett and Wright, 2005; Luo and Lee, 2015; Markman *et al.*, 2005; Micozzi *et al.*, 2021), but provides two motivational elements in the evaluation of excellence (i.e. empowerment and engagement).

Second, our study is one of the few that examines the "soft" effect of TTO organizational performance, but it is also one of the few that jointly examines the impact of TQM soft practices on organizational performance. Indeed, previous studies have documented positive performance reports (although not in TT activities), but only when engagement and empowerment were analyzed separately (Fernandez and Moldogaziev, 2013; Rich *et al.*, 2010; Spreitzer, 1995). Once again, it should be noted that similar results are not supported if we look at the case of the Italian TTOs, where the increase in performance was instead due to a simultaneous increase in engagement and empowerment.

Third, we find evidence that to improve organizational performance it is necessary to consider and evaluate not only the "hard" but also the "soft" elements. In fact, the "difficult" elements to consider in the literature on TTOs (for example, the year the office was established, the number of employees and the expenditure on intellectual property) are accompanied by the need to consider the effect combined with some "soft" elements such as empowerment and engagement. Therefore, our study also includes the coexistence of a high level of empowerment and involvement as an additional element in assessing the TTOs organizational performance. Thus, we add TQM variables in the evaluation of TTOs, showing how the combined effect of engagement and empowerment influences the individual's organizational behavior (Rich *et al.*, 2010; Spreitzer, 1995).

Albeit its implications, the study presents several limitations, some of which represent a fertile ground for cultivating future research. First, other cognitive variables can influence the activity of TTPs. Second, our analysis focuses on Italian TTOs. Several studies have emphasized the specificities of the Italian technology transfer context (Alibrandi *et al.*, 2021; Battaglia *et al.*, 2022; Bianchi and Piccaluga, 2012; Grimaldi *et al.*, 2021). In particular, in Italy TTOs are not an independent profit center and, for this reason they represent a unique background for the analysis of organizational behavior (Cucino *et al.*, 2021; Feola *et al.*, 2021; Micozzi *et al.*, 2021) where the investigation of soft TQM approaches is relevant as it can provide implications for improving organizational performance. Therefore, future research could replicate this study in other countries by pointing out the differences between the various contexts. Third, our study was limited to performance analysis on the licensing agreements (Campbell *et al.*, 2020; Hockaday and Piccaluga, 2021; Siegel *et al.*, 2003) due to a lack of concrete qualitative performance indicators. We are aware that other performance indicators can be used to measure TTOs' performance (e.g. spin-off or patent applications). Therefore, we invite scholars to enrich the findings of our analysis by using other indicators in the future.

5. Conclusions

The analysis showed how soft TQM practices create the conditions for achieving organizational excellence in TTO. Given the importance of the role of TTOs in the development and enhancement of public and private research in different contexts (Hockaday and Piccaluga, 2021; Micozzi *et al.*, 2021; Wolson, 2007), we focus our attention on these organizations. More concretely, our study provides practical implications by showing how it is necessary to consider in the evaluation of the TTO not only the "hard" variables (e.g. number of employees, employee experience) but also the "soft" variables of technology transfer. Moreover, engagement and empowerment appear to be complementary

rather than potentially opposing organizational characteristics that enable the motivations of TTPs. Therefore, managers or delegates should take actions to foster not only empowering employees (e.g. through formal delegation actions) but also create a climate conducive to employees' engagement. Some examples of actions could be a) providing regular feedback from managers, b) welcoming employee suggestions and c) ensuring employee engagement and empowerment. Another key strategy is to maintain effective communication. The engagement of members of the organization (employees and office managers) can be interpreted as a combination of commitment to the organization and its values in supporting colleagues with prosocial behaviors of organizational citizenship. Furthermore, as suggested by Palumbo (2021), team autonomy contributes to increasing the vigor and dedication of employees at workplace. This evidence implies that it is necessary for decisions makers to go beyond the elements of job satisfaction. In fact, in order for organizational excellence to be achieved, it is necessary to create an environment conducive to motivation within the office. To motivate people and increase the quality of the organizational environment, university and technology transfer managers should encourage TTPs to share their ideas, recognize their achievements (not only through financial rewards) (Cucino *et al.*, 2021), and offer opportunities for growth, learning opportunities (Ferrigno *et al.*, 2022), and professional development.

Note

1. The questionnaire items are reported in Table 3.

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Appendix 1: Robustness check

	Model 1	Model 2	Model 3	Model 4
D_PRIVATE	−4.429	−4.938*	−4.617	−4.17
RD_REG	0.158*	−0.023**	0.007	0.001
ST_GDP_REG	−1.822	2.538*	−0.574	−0.321
MED_DEP	−2.813	−2.833	−3.556	−2.066
AGE_Check	0.212	0.338	0.044	−0.566
DIMENSION_Check	1.152	−1.73	0.347	−0.668
INV_DISC	0.167**	0.085	0.155**	0.089*
ST_LEGAL	3.526**	2.481**	3.687**	2.034*
EMP		7.166***		1.881
ENG			1.51	−4.188**
EMP*ENG				1.825**
F Value	9.52***	19.21***	8.61***	17.50***
R squared	0.55	0.74	0.56	0.77
Adjusted *R* squared	0.49	0.70	0.50	0.72
R Change		0.19	0.19	0.22

Note(s): *p*-value: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

Appendix 2: Variable names

Variable names	Name
Observed variables:	
Number of researchers	DIMENSION
Number of licensing agreements	LICENSE
Age of TTO (year, logarithmic transformation)	LN_AGE_TTO
Number of TTO employees (logarithmic transformation)	LN_STAFF_TTO
Number of invention disclosures	INV_DISC
Expense for external consulting related to intellectual property	LEGAL
Expense for external consulting related to intellectual property, standardized value	ST_LEGAL
Private institute (Yes = 1/No = 0)	D_PRIVATE
Regional GDP	GDP_REG
Regional GDP, standardized value	ST_GDP_REG
Regional R&D intensity	RD_REG
Age of the respondent	AGE
Gender of the respondent (Female = 1/Male = 0)	GEN
Head office (Yes = 1/No = 0)	HEAD_TTO
Type of contract (Full-time = 1/Part-time = 0)	FULL_IND
Latent variables, estimated with CFA from the questionnaire:	
Meaning (see Table 3)	MEANING
Competence (see Table 3)	COMPETENCE
Self-determination (see Table 3)	DETERMINATION
Impact (see Table 3)	IMPACT
Task performance (see Table 3)	TASK
Organizational citizenship behavior (see Table 3)	ORG_CITIZ
Intention to turnover (see Table 3)	QUIT
Perceived engagement	ENGAGEMENT
Perceived empowerment	EMPOWERMENT

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