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Creativity in research and development laboratories: A new scale for leader behaviours

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Abstract In this paper, we report an inventory of leader behaviours that can promote creativity among R&D professionals. Specifically, we constructed and quantitatively validated a scale that was previously developed using a qualitative approach. We surveyed 584 scientists from 11 R&D laboratories in India. Exploratory and confirmatory factor analyses of the rating responses disclosed five leader behaviour factors: task-orientation; recognising and inspiring; empowering; team building and developing; and leading by example. Given acceptable evidence for convergent and discriminant validities of the factors, we argue for the use of this scale in future research in and management of creativity in R&D laboratories.

Introduction

Employee creativity, typically defined as the production of novel and useful ideas for organisational products, services, or processes (Amabile, 1983; Zhang & Bartol, 2010), has become one of the key drivers of growth, performance, and valuation in organisations today. Research and Development (R&D) teams provide an organisation with competitive advantage by generating, deploying, transferring, and integrating new technological knowledge (Ángel & Sánchez, 2009). Engaging in behaviours conducive to creative outcomes is an integral part of an R&D professional's role requirement (Montag, Maertz, & Baer, 2012). The identification of key factors that can foster and sustain R&D professionals' engagement in creative behaviours, therefore, carries significant implications for enhancing organisational competitiveness (Manolopoulos, 2006; Zheng, Khoury, & Grobmeiher, 2010).

The self-image of R&D employees is usually that of individuals who are independent in thought and action, who make things work, but avoid wasting time, capital, or labour. When an occupational group sees itself, and is also

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seen by others, as playing a critical role in the achievement of broader societal goals, it tends to demand a different kind of authority relationships as compared to those who are seemingly performing less critical roles (Clarke, 2002; Elkins & Keller, 2003; Kakar, 1971, 1977). These characteristics of R&D professionals pose unique challenges to leadership (Ángel & Sánchez, 2009; Zheng et al., 2010). However, leaders of R&D teams are often more experienced in technical than in managerial tasks (Elkins & Keller, 2003). The effectiveness of such leaders can be substantially improved if the skills necessary to lead R&D professionals are known. Berson and Linton (2005) lamented that there is no such information in the extant literature.

Through the present study we examine the behaviours of R&D leaders to understand their effectiveness in R&D organisations. Specifically, we build on a set of studies carried out in government-owned R&D laboratories in India and develop a scale to measure important leader behaviours that promote creativity in a R&D work environment.

Literature review

Measuring leadership in R&D environments

Most studies testing the impact of leadership on employee creativity have been inspired by the popular two-factor behavioural conceptualisation (e.g. initiating structure/task-oriented and consideration/relation-oriented — Blake & Mouton, 1964; Fleishman, 1953; transformation and transactional — Bass, 1985). The apparent differences between the leadership requirements of traditional and R&D environments suggest that conventional measures of leadership may apply only partially to empowered R&D environments (Arnold, Arad, Rhoades, & Drasgow, 2000; Khatri, 2005; Yukl, 1999, 2008). For example, the transformational leadership, as conceptualised by Bass (1985) and measured by the popular Multifactor Leadership Questionnaire (Bass & Avolio, 1990), does not include behaviours like inspiring, developing, empowering, team building, and leading by example (Yukl, 1999). Thus, a new behavioural measure of leadership that is sensitive to the requirements of R&D environment is needed.

Gupta and Singh (2013) identified a set of leader behaviours that may impact employee creativity in the R&D context. The item inventory was derived through an inductive or bottom—up investigation of leadership behaviour in R&D laboratories across India. Such an approach circumvented the difficulties associated with relying on incomplete or poorly integrated theory and research. Further, it improved the comprehensiveness and validity of the leader behaviour instrument (Arnold et al., 2000; Khatri, Templer, & Budhwar, 2012). The study was based on in-depth interviews conducted with 52 scientists of five Indian R&D labs located in different parts of India. The interview transcripts were content coded and a list of behaviour items was generated. The list of items was given to five doctoral students for sorting into different behaviour categories. Each incident was coded using a modified version of the leader behaviour taxonomy presented in the Managerial Practices Survey (MPS) (Yukl, Wall, & Lepsinger, 1990). Based on the consistency score, a final list of 52 behaviour items representing 13 behaviour categories was generated. The leader behaviours identified included the following: clarifying, problem solving, monitoring, buffering, inspiring, supporting, developing, informing, recognising, consulting, delegating, team building, and leading by example. Table 1 lists those behaviours along with their definitions.

In this article, we validate the item inventory developed by Gupta and Singh (2013) for measuring effective leadership in R&D environments. We perform a quantitative analysis of the behavioural items to (a) provide evidence regarding the underlying factor structure; and (b) assess the psychometric properties using data collected from professionals in R&D laboratories across India.

Method

Participants

We collected data from 11 R&D laboratories of the largest civilian research organisation in India. With 37 laboratories and more than 5000 researchers, the organisation is one of the world's largest collections of industrially-oriented public research laboratories and is India's main producer of scientific and technical publications and patents (Dahlman, Dutz, & Goel, 2007). The laboratories were sampled from the set of 37 R&D laboratories such that at least two laboratories operating in each of the major research domains of the organisation, namely, biological sciences, chemical sciences, physical sciences, and engineering sciences, were selected.

One researcher stayed for one week in each laboratory, and collected data, using a survey questionnaire. Each respondent received an envelope in which to return the completed questionnaire. Responses were anonymous and respondents were asked not to mention any personal details on the envelopes. All cases where subordinates had been associated with a senior for less than two years were dropped from the sample to ensure that subordinates understood their leader's leadership style very well. Of the 1260 distributed surveys, 584 usable ones (males = 438, females = 146) were returned (return rate = 46%). They had an average tenure of 13.4 years. Of the respondents, 5% were graduates, 33% were post graduates, and 62% had a doctoral degree; 41% were from the junior level, 39% from the middle level, and 20% from the senior level.

Measure

R&D leader behaviours

Research and development leader behaviours were measured using the 55-item inventory developed by Gupta and Singh (2013). Each scientist was asked to rate how frequently his/her leader exhibited the listed behaviours. The responses were measured using a 5-point Likert scale (1 = *not at all*, 5 = *great extent*). Before conducting the large sample survey, the leader behaviour items were tested for their clarity and redundancy. The survey was