

From Knowledge to Wisdom

Management Studies

Volume 3, Number 3-4, April 2015



David Publishing Company
www.davidpublisher.com

ISSN 2328-2185
DOI:10.17265/2328-2185

Management Studies

Volume 3, Number 3-4, April 2015 (Serial Number 11)



David Publishing Company
www.davidpublisher.com

Publication Information:

Management Studies is published monthly in hard copy (ISSN 2328-2185) and online by David Publishing Company located at 240 Nagle Avenue #15C, New York, NY 10034, USA.

Aims and Scope:

Management Studies, a monthly professional academic journal, covers all sorts of researches on Engineering Management, Project Management, Environmental Management, Technology Management, International (Business) Management, Operations Management, Financial Management, Marketing, Human Resource Management, Logistics Management, Leadership, Tourism Management, Knowledge Management, Administration Management, Information Management, Hospitality Management, Electronic Commerce, and other latest findings and achievements from experts and scholars all over the world.

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Scholarsteer, USA
Universal Impact factor, USA
WorldCat, USA

Subscription Information:

Price (per year): Print \$520 Online \$320 Print and Online \$600
David Publishing Company, 240 Nagle Avenue #15C, New York, NY 10034, USA
Tel: +1-323-984-7526, 323-410-1082 Fax: +1-323-984-7374, 323-908-0457
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Exploring If an Embedded Study-away Experience Impacts Change in Undergraduate Students' Intercultural Competence and Awareness

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This research considers the value of an embedded intercultural experience and if it is critical to the development of intercultural knowledge and awareness. Undergraduate students' obtainment of intercultural knowledge and awareness were tested under three conditions: (1) students in a course intentionally designed to develop intercultural self-awareness and intercultural related critical thinking skills (no travel component); (2) students in a course intentionally designed to develop intercultural self-awareness and intercultural related critical thinking skills (including an embedded one-week travel component); and (3) students in a course not specifically designed to develop intercultural self-awareness and intercultural related critical thinking skills (including an embedded one-week travel component). The initial findings suggest that, on average, students who enrolled in courses with the intention of building intercultural competence experienced a positive change in intercultural learning, while students in the course not specifically designed to develop intercultural learning, on average, experienced no change in intercultural learning as measured by the intercultural development inventory (IDI). The results support other findings indicating that immersion in another culture only may not create an opportunity for intercultural learning. This finding reinforces the need for intentional learning opportunities before, during, and after a study-away immersion. However, the omission of an embedded experiential learning opportunity may not lessen intercultural learning.

Keywords: cultural development, study-abroad, intercultural competence

Introduction

Rust and Morris (2013) found very few (if any) studies considering undergraduate students' obtainment of intercultural knowledge, skills, and awareness. This study explores change in intercultural awareness under three conditions: (1) students in a course intentionally designed to develop intercultural self-awareness and intercultural related critical thinking skills (no travel component); (2) students in a course intentionally designed to develop intercultural self-awareness and intercultural related critical thinking skills (including an embedded one-week travel component); and (3) students in a course not specifically designed to develop intercultural self-awareness and intercultural related critical thinking skills (including an embedded one-week

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travel component). Students' in this study administered the intercultural developmental inventory (IDI) prior to their study-away experience or at the beginning of the intercultural course. Twelve students participated in the classroom only, while six students participated in each of the courses with a one-week embedded study-away experience. The IDI was administered again, once the students returned to compare their pre study-away and post study-away scores. It was administered to students who did not study away at the end of the course.

Literature Review

In this study, intercultural competence is defined as students' ability to adapt to cultural differences while abroad and to generalize those skills after they have returned home (Rust & Morris, 2013; Rust, Forster, Niziolek, & Morris, 2013; Sample, 2013). This study considers intercultural knowledge and awareness from a developmental perspective that emphasizes the importance of recognizing that intercultural knowledge and awareness increase as one is exposed to numerous competency-building experiences. This process has been described in Bennett's model (1986) of intercultural sensitivity, as one's experience of cultural difference becomes more complex and sophisticated, one's potential knowledge and sensitivity in intercultural relations increase (Hammer, Bennett, & Wiseman, 2003; Deardorff, 2009). As one continues to experience cultural differences, a greater potential to develop intercultural competence exists.

One way students can experience these cultural differences is through participation in a study-abroad program. Study-abroad programs can take many forms, lasting from few days to a full year (Rust & Morris, 2013; Rust et al., 2013). They may be in fairly contained programs in which they and other students from a home institution stay together and have faculty from their home institutions; or they may directly enroll in a host institution and live with a family of that culture for the duration of their time abroad. Designed to immerse students in another culture, some of the potential benefits include increased knowledge and understanding of a culture outside of one's own.

A number of studies, using a range of different measures, have attempted to discern what the impact of study-abroad is on the ability of students to sense and adapt to cultural difference. Many have found changes in students' overall awareness to cultural difference, though the results have not been entirely consistent.

Some studies found that short-term programs (fewer than 15 weeks in duration) can still make an impact in intercultural development. Anderson, Lawton, Rexeisen, and Hubbard (2006) examined the effects of a short-term study-abroad program on intercultural sensitivity and awareness and students' response to cultural difference. Results indicate that the study-abroad program had a positive impact on the overall development of intercultural knowledge and awareness.

Jackson (2009) examined advanced second language students from Hong Kong who took part in short-term programs, lasting three to seven weeks after 14 weeks of on campus preparation. While abroad, they lived with a host family, took literary/cultural studies courses, visited cultural sites, participated in debriefing sessions, and conducted ethnographic projects. As a group, the students experienced a significant average gain in intercultural knowledge and awareness. Therefore, even those who have a short-term experience can still improve intercultural knowledge and awareness.

Pederson (2009) examined the impact of curriculum and instruction on intercultural competency. Detailing a year-long study-abroad program, three different conditions existed: (1) students who received an intercultural intervention consisting of a perceptual shift activity and a "meaning-making" exercise facilitated by guided reflection, (2) students who did not receive the intervention, and (3) control students who studied at home.

Results indicate that those students who received an intercultural pedagogy intervention experienced a statistically significant change in intercultural knowledge and awareness. Similarly, Sample (2013) assessed the development of intercultural competence among a group of students who underwent an interdisciplinary approach to intercultural development to prepare for a semester-long study-abroad experience. Students in the program were required to have at least four semesters of a modern language other than English, and courses in economics, political science, and anthropology prior to their study abroad experience. The results indicated that this approach, which was designed to help students adapt to cultural changes before studying abroad and after they arrive back home, significantly increased their intercultural competence as measured by the change in their pre and post IDI mean change scores. The mean change score was 19.78 points. The difference between their IDI scores in the first semester and after they have studied abroad was statistically significant at the 0.000 level.

In a recent study, Rust and Morris (2013) examined whether 20 undergraduate business students who participated in a four week study-abroad and intercultural competency building coursework would demonstrate a greater increase in intercultural competence over those who enrolled in the study-abroad course only. An IDI was administered to each participant before and after the study-away experience. The results showed that intercultural coursework prior to this study-away experience can have a positive impact on individual intercultural development.

However, some students interested in developing intercultural knowledge may not have the means or access to a substantial study-away experience. Soria and Troisi (2014) looked at alternatives to study abroad, such as intercultural studies courses, lectures, and conferences. They found that these activities increased global, international, and intercultural (known as GII) competencies as efficiently or possibly even more efficiently than study abroad itself.

Vande Berg (2009) summarized the major conclusions of a four-year study designed to measure the intercultural and second language learning of over 1,300 U.S. undergraduates enrolled in over 60 programs abroad. Specifically, the article attempted to answer the question of whether students learn more effectively, when “left to their own devices” (Vande Berg, 2009, p. 15) or whether students learn more, when educators intervene. Results indicate the latter—when students are enrolled in programs with features that are strongly associated with student intercultural learning during their study-abroad stay, they experience greater gains in intercultural development, as measured by the IDI. Students who were merely exposed to a different culture did not have sufficient directed learning opportunities to advance their intercultural learning (Vande Berg, 2009).

These studies all utilized a model of intercultural sensitivity developed by Bennett (1993) and further developed by Hammer (2009, 2011). In addition, the IDI was used to measure the change in the participants’ intercultural development given the intercultural intervention (i.e., study abroad, intercultural course work, and etc.). This research uses a similar methodology.

Developmental Model of Intercultural Sensitivity

The developmental model of intercultural sensitivity (DMIS) (Bennett, 1993; Paige, Cohen, & Shively, 2004; Hammer, 2009, 2011) provides a theoretical framework for explaining the reactions of people to cultural difference. The underlying assumption of the model is that as one’s experience of cultural differences becomes more complex, one’s potential competence in interactions increases (Hammer & Bennett, 2001). The modified model (Hammer, 2009) divides the experience of cultural difference into monocultural (denial, polarization, defense, and reversal), transitional (minimization), and intercultural (acceptance and adaptation) mindsets.

Students with a monocultural mindset assume that their own culture is central to reality. It doesn't occur to them that other people may have different cultural frameworks. If those frameworks are recognized, they will typically judge them in light of their own limited understanding of appropriate human interaction.

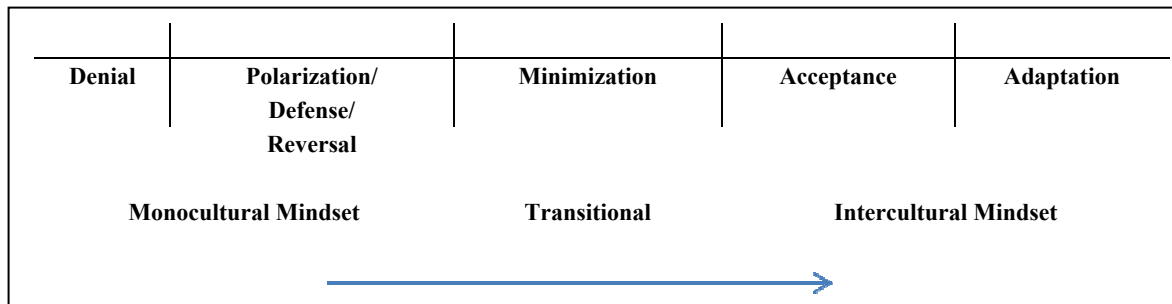


Figure 1. The intercultural development continuum.

The continuum represents a progression from a less complex perception of patterns of cultural difference to a more complex experience and understanding of cultural diversity (Hammer, 2009). In denial, people are simply unaware of cultural differences. This may be the result of isolation, occurring naturally or through deliberate avoidance of difference (Bennett, 1993). People in polarization have recognized that there are cultural differences, but other cultures are seen in fairly simple ways and not as complex as their own culture. Students in this stage of development typically rely on stereotypical interpretations of members of other cultures. People in this stage often sense the need to uphold a hierarchy of cultures as a way of making sense of the perceived cultural difference.

In defense, recognition of difference is accompanied by fear and a sense that one's own culture is threatened. From this hierarchical perspective, one's own culture is defined as right, good, and proper, and others are viewed as wrong, bad, and inappropriate. The flip side of defense is reversal; however, people in reversal have reversed the hierarchy by defining their own culture as wrong, bad, and inappropriate, and some other culture with which they are familiar as more desirable. Reversal is often believed by the people experiencing it to be quite sophisticated, because of its critical gaze on the home culture, but in truth, it fails to move beyond the simplistic polarized understanding of cultures and cultural differences (Sample, 2013). The transitional worldview of minimization is neither fully monocultural nor fully intercultural in orientation. Students who subscribe to a minimization orientation are generally able to focus on common cultural artifacts (e.g., love of family), but are less effective at understanding important cultural differences (e.g., how love of family manifests itself) (Sample, 2013). Cultural differences are recognized, but deemed as simply "surface" differences that do not interfere with a real understanding of human relations. Instead, those who minimize cultural difference argue that to really understand people, it is necessary to focus almost exclusively on similarities across cultures.

People with a minimization orientation may consider surface cultural differences interesting or even fun (particularly objective culture, visible aspects like food, art, music, and etc.), but not relevant to truly understand other people. They may well view too much consideration of culture difference to be dangerous. They are likely to think that deep down, everyone is pretty much like them, thus still seeing their own cultural framework as real and natural, and not recognizing the complexity and legitimacy of other cultures (Bennett, 1993; Sample, 2013).

Students, who move beyond the minimization stage of cultural differences to an acceptance of cultural difference, have moved to an intercultural mindset. This represents a fundamental shift in worldview. In these stages, people understand that their own culture is one of many equally complex ways of organizing human behavior. They are tolerant and are comfortable knowing that there is no “right” answer and that beliefs and practices need to be evaluated within a given cultural context. Acceptance does not mean that one has to agree with or take on a cultural perspective other than one’s own. People in this stage accept the viability of different ways of thinking and behaving (Bennett, 1993). Beyond acceptance is adaptation to cultural difference. Adaptation is the ability to see the world through the cultural framework of another or other cultures with which the person is familiar and the ability to (increasingly unconsciously) shift into a different cultural frame of reference. They can empathize with the other cultural perspective in order to understand and be understood by members of other cultures (Bennett, 1993).

Purpose

The purpose of this research is to consider the value of an embedded intercultural experience. Is it critical to the development of intercultural knowledge and awareness? This study examines whether a week-long embedded study-away experience can increase intercultural knowledge and awareness (with and without an emphasis on intercultural development) and whether students who participated in an intercultural course only can experience an increase in intercultural knowledge and awareness. The change in intercultural knowledge and awareness is determined by comparing the pre and post individual profile score of each participant.

As discussed above, prior research has found evidence that study-abroad experiences do provide opportunities for students to develop intercultural knowledge and awareness (Anderson et al., 2006). Other studies measured intercultural change in students participating in a study-abroad experience and intercultural coursework (Jackson, 2009; Paige et al., 2004; Pederson, 2009; Rust & Morris, 2013; Sample, 2013). This study examines intercultural development in students under three conditions: (1) students in a course intentionally designed to develop intercultural self-awareness and intercultural related critical thinking skills (no travel component); (2) students in a course intentionally designed to develop intercultural self-awareness and intercultural related critical thinking skills (including an embedded one-week travel component); and (3) students in a course not specifically designed to develop intercultural self-awareness and intercultural related critical thinking skills (including an embedded one-week travel component).

Intercultural Courses

In this study, students participated under one of three conditions: (A) a 16-week on campus only course without a one-week embedded experience, but designed to develop students’ intercultural competence; (B) a 16-week on campus course with a one-week embedded study-away experience not designed to develop students’ intercultural; and (C) a 16-week on campus course with a one-week embedded study-away experience designed to develop students’ intercultural competence. The IDI was used as the primary measure of intercultural development, similar to its use in the studies described earlier. This instrument was selected, because of its theoretical grounding in Bennett’s DMIS and its demonstrated validity and reliability (Hammer et al., 2003; Hammer, 2011).

The 12 students who participated under condition A were enrolled in a course focusing on the people and culture of Hawaii offered through the Department of Intercultural Studies. The course was designed to follow

Bennett's approach to intercultural development. Students not only learned about the history, cultural, and people of Hawaii, they also participated in assignments designed to learn about perceptions, assumptions, prejudices, and stereotypes, and how these may impact one's interpretation of historical events. Students were asked to analyze their own cultural background and how group affinity may impact the way they view themselves and others. Students were assigned readings that provided interpretations of events in Hawaii from a white male historian's perceptions and that of a native Hawaiian female professor of Hawaiian studies. These students did not travel to Hawaii, but they researched the state and created Hawaiian cultural artifacts, such as flower leis and an in class luau.

Given the findings of other studies, three hypotheses are proposed.

Hypothesis 1: On average, students who participated in the course without a one-week embedded study-away experience, but were intentionally designed to develop intercultural knowledge and awareness, will demonstrate a positive change score in their individual profiles as measured by the IDI.

If the findings are significant, hypothesis 1 would support the research finding that a study-away (abroad) experience may not be critical to intercultural development in undergraduate students (Soria & Troisi, 2014; Vande Berg, 2009).

The six students who participated under condition B were enrolled in a course focusing on ancient and modern day Olympics. The course was offered through the Department of Kinesiology. Students learned about the importance of play and the historical importance of the Olympic games. Students were required to complete an assignment describing themselves culturally as part of their preparation to study away in Greece one week in the middle of the 16-week term, known as Spring Break. This was the only assignment focused on intercultural development. Students were also required to complete the college's pre-departure requirements of obtaining a valid passport, knowledge of currency, transportation, personal safety, and etc.. Given the lack of intentional assignments designed to increase intercultural knowledge and awareness, hypothesis 2 is proposed.

Hypothesis 2: On average, students who participated in the course with a one-week embedded study-away experience, not intentionally designed to develop intercultural knowledge and awareness, will demonstrate a positive change score in their individual profiles as measured by the IDI after studying abroad.

If the findings are not significant, hypothesis 2 would counter research findings that suggest simple immersion in another culture does not result in a positive change in intercultural development (Vande Berg, 2009).

The six students who participated under condition C were enrolled in a course focusing on the people and culture of Hawaii that included an offered through the Department of Intercultural Studies. The course was designed to follow Bennett's approach to intercultural development. Students not only learned about the history, cultural, and people of Hawaii, they also participated in assignments designed to learn about perceptions, assumptions, prejudices, and stereotypes, and how these may impact one's interpretation of historical events. Students were asked to analyze their own cultural background and how group affinity may impact the way they view themselves and others. Students were assigned readings that provided interpretations of events in Hawaii from a white male historian's perceptions and that of a native Hawaiian female professor of Hawaiian studies.

This course differed from the course in condition A, since it included a study-away experience on the Island of Oahu, Hawaii for one week in the middle of the 16-week term, known as Spring Break. Students stayed in the resident halls at the university and attended daily lectures provided by professors of Hawaiian and Asian studies. Students also learned the hula from a native dance instructor and the rudiments of the Hawaiian language

from another university professor. In addition, students visited many important historical sites and museums. Students were also required to complete the home institution's pre-departure requirements of obtaining a valid passport, knowledge of currency, transportation, personal safety, and etc..

Hypothesis 3: On average, students who participated in the course with a one-week embedded study-away experience, intentionally designed to develop intercultural knowledge and awareness, will demonstrate a positive change score in their individual profiles as measured by the IDI after studying abroad.

If the findings are significant, hypothesis 3 would support research findings that suggest students enrolled in courses intentionally designed to enhance intercultural learning before, during, and after their study-abroad stay will experience greater gains in intercultural development, as measured by the IDI (Vande Berg, 2009).

Method

The study sample consisted of students from a small (3,500 students) liberal arts institution located in the Midwestern United States who participated in one of three courses. In two of the courses, the course topic and teaching approach used was to intentionally develop intercultural knowledge and awareness. The third course included an embedded study-away experience, but was not designed to develop intercultural knowledge and awareness. Using the IDI, data was collected from a total of 24 students: 21 women and three men. Twelve students were in the classroom only, without an embedded study-away experience, while the other 12 did have an embedded study-away experience.

IDI

Researchers, instructors, and others administering the instrument to participants must attend a two-day qualifying seminar before being allowed to purchase, administer, and analyze the resulting data. The IDI is composed of a 50-item inventory in which participants are asked to rate the level of their agreement with a series of statements about their relationship to and evaluation of cultural difference on a five-point (1 to 5 range) Likert-type scale. Examples of such statements include: People from other cultures are dishonest compared to people from my own culture; all people are basically the same. Unfortunately, due to a written agreement with the developers of the IDI, the instrument cannot be copied or provided in an appendix.

Different sets of statements assess participants' orientation toward denial, polarization (defense and reversal measured as separate scales), minimization, acceptance, and adaptation. Within a developmental model like the DMIS, increased intercultural knowledge and sensitivity means see forward movement through the stages of the model toward an intercultural mindset, which is reflected in higher scores on the IDI. As a theory-based instrument, the IDI meets the standard scientific criteria for a valid and reliable psychometric instrument (Hammer et al., 2003).

Findings

The findings in Table 1 show the pre IDI scores for the students who completed the classroom only (A) averaged at 76.80 with an average post IDI score of 83.48. This results in an 8% change in the mean score. This finding supports hypothesis 1 by measuring a significant change in intercultural development. The pre IDI scores for the students who completed the classroom and an embedded experience (B) without emphasis on intercultural development, averaged at 93.38 with an average post IDI score of 93.43 resulted in a negligible change in the score ($< 0.05\%$). This finding does not support hypothesis 2, since change in intercultural development was very small. The pre IDI scores for the students who completed the classroom and the

embedded experience (C) with emphasis on intercultural development averaged at 112.00 with an average post IDI score of 122.32. This results in an 8% change in the score. This finding supports hypothesis 3 by measuring a significant change in intercultural development.

With scores on the IDI ranging from 55 to 145, a score of 100 represents the mean or average. A score below 85 indicates that a person is primarily operating in the realm of polarization; 85 to 114.99 represents a primary orientation in minimization, and score of 115 to 129.99 indicates acceptance while scores higher than 130 indicate adaptation. Although on average students under condition (A) did not move out of the stage of polarization, these results nevertheless suggest development in students' intercultural sensitivity with scores moving closer to the realm of minimization. Students under condition (B) did not move much at all and remained in minimization, while students under condition (C) moved, on average, from high minimization into the realm of acceptance. As described above, movement into the acceptance stage represents a fundamental shift in worldview. In this stage, people are beginning to understand that their own culture is one of many equally complex ways of organizing human behavior. They are tolerant and are comfortable knowing that there is no "right" answer, that beliefs and practices need to be evaluated within a given cultural context. It appears that the combination of an emphasis on intercultural development with an embedded study-away experience can have promising results.

Table 1

Comparison of Pre-post IDI Developmental Scores

Students' Experience	Number of students	Group Pre/Post Scores	Change
Classroom, with intentional intercultural development (no embedded experience)	12	76.80/83.48	8.0%
Classroom, without an intentional intercultural development with an embedded experience	6	93.38/93.43	0.0%
Classroom, with intentional intercultural development and an embedded experience	6	112.00/122.32	8.44%

Conclusions

The purpose of this research was to consider the value of an embedded intercultural experience. Is it critical to the development of intercultural knowledge and awareness? This study examined whether a week long embedded study-away experience can increase intercultural knowledge and awareness (with and without an emphasis on intercultural development) and whether students who participated in an intercultural course only can experience an increase in intercultural knowledge and awareness. The change in intercultural knowledge and awareness was determined by comparing the pre and post individual profile score of each participant. The average changes in the group scores under three conditions are provided.

Supporting hypothesis 1, the study confirmed prior research results that an intentional focus on the development of intercultural knowledge and awareness has a significant impact on intercultural development. Overall, the mean score for the 12 students who participated under condition A increased from 76.80 to 83.48 (with a maximum possible score of 145) on the IDI instrument measuring intercultural sensitivity. This increased occurred without a study-away experience.

Hypothesis 2, which predicted an increase in pre- to post-IDI scores, when students experience an embedded study-away experience only, was not supported. Although the six students who participated in the study-abroad experience had a significantly higher pre-travel score (93.38 versus 76.80 for students with both

study away and intentional intercultural development), the change scores for the study-abroad only students were flat, with scores for these students rising 0 points, showing no change.

The results under condition C, movement from the high minimization stage (112.00) to the acceptance stage (122.32) are greater than those found by Rexeisen and Al-Khatib (2009), in which students who studied abroad had a pre-travel IDI score of 93.45 and a post-travel score of 103.48 and whose students' average score started (116.86) and ended (119.82) in the minimization stage (Anderson & Lawton, 2011). This movement into the acceptance stage suggests the students' exposure to people from another culture helped them not only to recognize and appreciate cultural differences in behavior and values, but also to understand that their own culture is one of many equally complex ways of organizing human behavior. In the acceptance stage, people are tolerant and are comfortable knowing that there is no "right" answer, that beliefs and practices need to be evaluated within a given cultural context. People in this stage accept the viability of different ways of thinking and behaving (Bennett, 1993), that represents a fundamental shift in worldview. Overall, students who were exposed to both an embedded study-away experience and an intentional focus on intercultural development had the greatest gains. However, it should be noted that several of these students were in their fourth year of study, while students under condition A were all first year with limited college coursework. However, these students experienced equivalent change in their scores. Further research is needed to determine why these differences occurred.

Limitations

An important limitation to this study is the number of participants ($n = 24$) and, in particular, the very small sub-group of students ($n = 6$) under conditions B and C. Clearly, the small sample size limits the ability to extrapolate these findings to a larger group. If a larger group could be recruited for a future study, this would not only strengthen the analysis, it could offer the possibility of comparing scores under all three conditions. However, this study did include a control group of students who did not study abroad (condition A), but who had similar coursework as students under condition C. This approach can help discern changes due to study abroad versus coursework only, as recommended by Williams (2005), Rust et al. (2013), and Sample (2013).

Implications

Despite these limitations, this study does offer additional evidence of the importance of intercultural knowledge and sensitivity-building knowledge in conjunction with an intercultural study-abroad experience. Though this pilot study is very small, with just 24 participants, this research model can be duplicated, so educators can develop courses for those students who, for a variety of reasons, cannot participate in a study-away experience.

In conclusion, regardless of how intercultural knowledge is developed, it is clearly critical to a students' success as future global leaders. Cassiday (2005) found that effective leaders were the ones who demonstrated intercultural competence. Students will be at a disadvantage in today's global marketplace, if they fail to develop intercultural cognitive, affective, and behavioral skills (Deardorff, 2009).

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New Idea Generation and Individual Motivation: A Conceptual Framework

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The adoption of specific idea management programs is becoming a strategic asset for organizations, as they are increasingly trying to adopt specific organizational solutions to detect, fertilize, evaluate, and promote new idea generation within and across their boundaries. The centrality of the ideas generation is linked to its vital characteristic of being the main source for new products, services, processes, and drivers of change. This paper copes with the controversial role of the general organizational setting and closely focuses on the rewards mechanisms that could further nurture creativity. By formulating a set of propositions, the paper submits that the understanding of the motivational drivers and the organizational settings is paramount to distill the links between idea generation and incentive structures. This paper aims also to critically analyze and assess the impact of extrinsic and intrinsic motivation on idea generation both at an individual and team level, and develop a framework within which it explores the necessary change to be adopted by firms in managing the idea generation. What is new to the field is the recognition of the impact of the individual locus of control on creative performance. In this vein, the paper sees its ultimate aim in uncovering the dynamics of individual and collective motivation related to creativity, considered as the main source for innovation. The paper concludes that new ideas could be nurtured through the adoption of routine system aligned with the companies' human resource management policy.

Keywords: idea generation, motivation, creativity, intrinsic rewards, extrinsic rewards, organization design

Introduction

The adoption of specific idea management programs is becoming a strategic asset for organizations as they are increasingly trying to adopt specific organizational solutions to detect, fertilize, evaluate, and promote new idea generation within and across their boundaries (Barsh, Capozzi, & Mendonca, 2007; Fairbank & Williams, 2001; Frese, Teng, & Wijnen, 1999; van Dijk & van den Ende, 2002). Ideas for innovation are important for the long-term survival and competitiveness of firms, being the main source for new products, services, processes, and drivers of change. Firms continuously look for new sources of ideas, by considering the organizational context as mechanism for bringing "in" ideas from the external environment ("outside") or finding alternative ways to manage the internal resources. Kanter (1988) defined "kaleidoscopic thinking" as the process of idea

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generation, since it often involves the rearrangement of already existing pieces into a new whole. The sources of innovation can be found anywhere it is possible to access information and new knowledge.

Since the translation of ideas into business process and product/service innovation is vital for firms' sustainability, it is attracting the interest of variety scholars (e.g., Von Hippel & Von Krogh, 2003). Innovation may be considered as the implementation of ideas in useful business. As a consequence, it may have creativity without innovation but not innovation without creativity. The understanding of the link between innovation and creativity requires to focus on how the ideation process works. Amabile (1996) argued that innovation is the successful implementation of creative ideas within each organization.

The topic itself has relevant implications and considers to what extent rewards affect the participation and performance of employees (internal contributors), also considering the fact with different motivation profiles. Managerial practice concerning innovation management processes could benefit from the contribution of supervisors' behavior in governing new idea generation through the usage of rewards, formal recognition, and monetary incentives. In addition, a superior awareness of the counterintuitive effects of extrinsic incentives could help avoid some crowding-out effects.

This paper aims to critically analyze and assess the impact of extrinsic and intrinsic motivation on idea generation both at an individual and team level, and develop a framework within which it explores the necessary change to be adopted by firms in managing the idea generation. In doing so, this paper sees its ultimate aim in uncovering the dynamics of individual and collective motivation related to creativity, considered as the main source for innovation. In particular, the paper explores the potential impact of incentives on individual and collective innovative behaviors.

The underlying assumption of the paper is that understanding of the motivational drivers as well as acknowledging the importance of the organizational settings on the individual learning behavior and idea generation is paramount to distill the links between idea generation and incentive structures. Within the linkage between individual motivation and the organizational context, the Amabile's model (1988) showed how the working environment influences individual's creativity and above all employees' motivation—creativity (C) results from the synergic combination of three main elements: employees' motivation (M), their professionalism (P), and the organizational context (O). The framework reported later in this paper is based on some experiences reported in previous studies, referring to the general concept of new idea generation without paying the necessary attention to the internal dynamics occurring in firms' contexts (Amabile, 1996). Such a contextualization might take place in two different thought correlated directions. The first one relates to innovative reward systems based mostly on non-monetary incentives which can be able to boost the individual creativity; to some extent, the social recognition of innovation might some time overtake some monetary rewards (Shalley, Zhou, & Oldham, 2004). The second aspect concerns the differential impact of reward systems on collective performance, since internal group dynamics and collinearity between individual motivation and contribution to teamwork could lead to unexpected individual reactions to rewards, e.g., switching from the assessment of the input/outcome ratio at the individual level towards the collective one forces to consider additional sources of complexity, such as the inclusion of equity. Further, the move of focus from individual to collective entities calls for a systemic approach to management of innovation.

This paper aims to depict a conceptual framework for understanding the generation of new ideas. Its structure is based on the four upcoming sections. The following section discusses the main organizational dimensions, spanning from the ones related to the general organizational context (information technology (IT),

climate, and routines) to the impact of human behaviors drivers, like motivation. The way such dimensions are illustrated in the section emphasizes the interlacements connecting individual and collective behaviors to creativity. The following section proposes the new conceptual framework that considers the dynamics of new idea generation embedding both the individual and the collective (teams) levels of analysis. Subsequently, the paper proposes a wider discussion that focuses on the possible operationalization of the framework. Finally, the paper draws some conclusions on the feasibility of the ideas submitted, as well as on the managerial implications of a deeper understanding of its dominant dynamics.

Literature Review

The generation of new ideas can be analyzed considering both organizational and individual enablers. The first ones are related to the use of IT, to the organizational climate, and to the group structure. Individual enablers can be instead related to motivational and cognitive elements. The illustration of the different parts of the literature review will be accompanied by a set of consistent propositions, which are going to be eventually recalled and systematized as the conceptual framework.

IT and Creativity

A relevant issue is linked to the diffusion of solutions of IT supporting the generation of new ideas, namely IT-based tools enacting the interaction among employees. Even when such technological solutions do not contribute to the creation of virtual communities, the mere existence of such possibilities influences the behavioral conduct of people. This is the case of combination of electronic communication tools, designed to support decision-making processes through analysis of alternatives, negotiating and voting (DeSanctis & Gallupe, 1987; Ellis, Gibbs, & Rein, 1991). In particular, IT-mediated relations could lead to different actions from the face-to-face interactions, enabling or constraining cooperative behaviors (Jessup & Valacich, 1993). Similar dynamics occur when competition among individuals is expected. Some side effects could also generate phenomena like production blocking, free riding, sucker effect, and evaluation apprehension (Reinig & Shin, 2002). Moreover, the influence of IT-enabled solution in innovation management generates new needs in terms of human resources systems and practices. Specifically, the whole process of idea generation should be deepened in a more general HR policy embedding both reward systems and general innovation process analysis.

Proposition 1: The availability of IT-mediated solutions might nurture the generation of new ideas through a more intense interaction among individuals.

Organizational Climate and Creativity

Organizations have high creative output characteristics and specific problems, which are not always categorized. Research showed that for most organizations, the source of innovation takes place within organizational boundaries (Prencipe, 2000), and most significant source of ideas come from employees (Van Dijk & Van Den Ende, 2002). In particular, it seems that most of new ideas for innovation are generated and diffuse by a bottom-up approach, whereas managers help employees spend a part of their time sharing and discussing new ideas. The parallel between individual creativity and organizational climate is necessary to deepen the concept of corporate creativity studied by Lubart and Sternberg (1995). This study, albeit from different perspectives, argues in a similar way that the complexity arising from unpredictable to be perceived as an opportunity for innovation, change, and creativity. In fact, creativity is necessary for evolution, since it

involves changes that can sometimes be radical but mostly incremental (O'Donovan, 2006; Schön, 1974). Innovation thus becomes the most significant moment of the creative process and the organization is not the place where new ideas are generated but rather the context in which you can put them into practice. Further, the concept of creativity is often compared to "self-organization", meant as the ability of organizational units and individuals to originate and maintain relationships, interactions, and links with the external environment to business with or without the use of macro-mechanisms of corporate governance. In fact, very creative companies grant autonomy in internal forces giving rise to the possibility of new forms, new structures, new modes, and new products.

Andriopoulos (2001) summed up the ability of management to stimulate creativity within an organization in five basic elements: (1) culture, (2) climate, (3) the organizational structure and systems, (4) leadership styles, and (5) knowledge/expertise. In this multi-faced scenario, a complex system of equilibriums needs to be found, since the internal organizational context need to balance different contrasting pressures. On one hand, the need for autonomy calls for forms of self-organization, whereas the maintenance of internal of homogeneity of task accomplishment and compliance to organizational culture still calls for some general guidelines and hierarchical relations. To this extent, the parallel with clinical innovation could be exemplary. In such a context, the innovative protocols are developed within some general guidelines and the individual autonomy find its boundaries in the mechanisms of self-responsibility, e.g., a clinician is free to experiment completely unknown paths but, at the same time, he/she is called to carry the burden of any action which is put into place.

Techniques and processes that facilitate and stimulate creativity emergence have grown rapidly (Campbell, 1960; Smith, 1975). Despite the availability of different models and solutions, these techniques and processes seem to consist of "instructions and manipulations, capable of arousing the creative potential of individuals namely when working with others, either face-to-face or mediated by computers" (Pissarra & Jesuino, 2005, p. 276). Creativity flourishes when the organization encourages it, when employees are motivated to think and pursue new ideas, and when the organization provides employees with the resources they need to play with these ideas in generative ways (Amabile, 1988; Ford, 1996; Mainemelis & Ronson, 2006, Woodman, Sawyer, & Griffin, 1993). Mainemelis (2010) studied creative deviance in evolution of new ideas and observed that individual behaviors can be nurtured by personal convincement of the validity of the ideas which results to be stronger than the organizational structural rules. The non-predictable effect of the interaction between organizational encouragement and individual convincement requires the adoption of a systemic approach and the consideration of firms as a creativity and innovation creator.

Proposition 2: The existence of a favorable (internal) climate could encourage the generation of new ideas if its constitutive (structural) elements are consistent.

Group Structure and Idea Generation

In order to stimulate an effective enactment, managers may set up specific solutions for collecting employees' ideas at different organizational levels. In detail, managers might decide how nurture organizational creativity by considering the following elements (Woodman et al., 1993): (1) individual contribution to innovation, (2) importance of reciprocal influence among individuals, and (3) dynamics of social interaction within groups. Differently from IT, which might impact the way individuals refer to the other through virtual media, group structures impact both individual and collective behaviors and eventually performance. The management's role becomes prominent to foster and facilitate collective actions, in fact evidences show that

ideas arising from large and heterogeneous groups are more valid than those resulting from smaller and therefore more manageable groups. Since some people are more creative than others (Amabile, 1983, 1988; Ford, 1996; Guildford, 1950; Woodman et al., 1993), each individual chooses how to contribute to the idea generation. This phenomenon has been theorized by Fishbein and Ajzen (1974) and Ajzen and Fishbein (1980), studying the human behavior within the framework of “reasoned action” and “planned behavior”. These theories argue that the decision to behave in a certain manner is influenced by member’s attitude toward a behavior and by member’s comprehension of norms and perception of the external environment. Individual characteristics, hence, play a large role in influencing whether someone chooses to contribute to the development of a new idea (Garfield, Taylor, Dennis, & Satzinger, 2001).

Some studies by Pissarra and Jesuino (2005) underlined that interaction processes negatively affect the efficacy of the face-to-face groups. They analyzed three relevant phenomena: previous fear, social loafing (free riding), and blocking, concluding that blocking is the main cause of the decrease in efficacy of the face-to-face brainstorming. A recent study by Girotra, Terwiesch, and Ulrich (2010) examined the effectiveness of two different group structures: (a) groups interacting in time and space, sharing a common experience based on information, (b) hybrid groups in which individuals begin working independently without interaction of any kind and lately end up in working together. The evidences showed that hybrid groups perform better than others. In fact, in the hybrid structures, each member can potentially access to different knowledge and can deal with problem solving in different ways. In a second phase, each member shares his/her findings from the individual phase to perform additional exploration together. An alternative group configuration was analyzed by Kavadias and Sommer (2009) that underlined how problem structure and team diversity might influence the quality of the best innovative solution. They studied nominal groups (the same number of individuals generating solutions in isolation) opposed to brainstorming (Osborne, 1953) concluding that nominal groups perform better in dealing with specialized problems, even when factors that affect the solution quality exhibit complex interactions. Team working can produce the relational continuity that is essential to ensure a form of routine to achieve high performance. Teams are based on building solid relationships that tend to resist over time based on frequent and ongoing interactions that allow the actors to meet, share, and create common points of view, and important experiences.

As already noted, the switch of focus from individuals to collective entities (groups) requires further speculation on the subject. Heterogeneous groups in terms of professionalism achieve better results than homogeneous or individuals who work alone (Björk & Magnusson, 2009). Lankau et al. (2007), Milliken and Martins (1996), and Pelled, Eisenhardt, and Xin (1999) coped with the reasons why team member diversity of a non-task nature (as gender-age-race) leads in non-task conflict, while individual diversity of a task nature (as work-education-function) leads to task conflict (Foo, 2009). Nevertheless, heterogeneity and homogeneity do not spring the same effects on all the group configurations and task to be performed. In particular, although a limited amount of diversity is normally preferred, different types of diversity might have opposite effects.

Best results seem to be obtained when potential members, even if coming from different experiences or background, join to the team agreeing to team’s goals and expectations (Foo, 2009), although they tend to be attracted to others with similar backgrounds, to share similar values, attitudes, and interests. Ensely and Hmieleski (2005) described team effectiveness as the degree of collective efficacy in terms of group goals achievement. A particularly hostile situation to deal with is when task accomplishment relies on both convergence and divergence at the same time, e.g., in case of modular innovation. Team performance depends

also on how members work: They may work together in time and space, or they may work as a hybrid structure, first independently—nominal group—then sharing their work together (Girotra et al., 2010). Considering the Thompson's inter-task relations (1967), in case of sequential relations, the transfer of knowledge among individuals flows with the path of collaboration. The situation in which individuals are bound together by mutual interconnections appears instead more difficult to be managed.

In knowledge-creation teams, the individual contribute by exploiting their repertoire of skills, whereas the organization define the strategies—that by definition effect and are affected by the situation—for using and combining such repertoires (C. Gore & E. Gore, 1999). So, individuals' actions are very important for continuous innovation and improvement. Innovative work behavior (De Jong & Den Hartog, 2010) aims to achieve the initiation and intentional introduction of new and useful ideas, processes, products, and procedures (Farr & Ford, 1990). It differs from employees' creativity, as stated by Amabile (1988), because it also includes implementation. Implementation requires an intensive effort and a result-oriented attitude for organizations. Innovative work behavior can be engaged allowing employees to contact more diverse views and influences that may help spark and creativity. Perry-Smith and Shalley (2003) developed propositions on the association between social relationship and the related construct of creativity.

The different configurations of groups so far exposed in this paragraph explain how different combination of individuals could create internal organizational contexts in which the generation of new idea could blossom or perish according to the equilibriums towards which such contexts converge. Nevertheless, the analysis of the impact of different reward systems could not ignore the link between creativity as an outcome and motivation as the main input of the innovation processes.

Proposition 3: Group structure could favor the blossom of new ideas depending on the nature of the task and on the final goal of the organization.

Creativity and Motivation

The understanding of the link between creativity and motivation needs to be explored through the analysis of how intrinsic and extrinsic incentives (e.g. Porter & Lawler, 1968) might impact new idea generation. While the role of intrinsic motivation (and incentives) appears to be predictable, the role of extrinsic motivation seems to be controversial on new idea generation and the creativity process over time. Starting from the consideration that motivation is the initial force that reflects the direct activation of a goal, two forms of related incentives need to be recalled in order to study creativity processes (Amabile, 1983).

Intrinsic motivation. It is linked with basic and advanced needs (Maslow, 1954)—takes place when an individual feels the pleasure of doing some activities, without external rewards. It includes: (1) the need for achievement and (2) the need for learning/knowing. In this sense, Herzberg (1959) underlined that each appreciation and each award of merit from top management is a very strong motivation for every individual. More recent studies confirm that the best gratification for employees is to admire own ideas implemented. Dworkin (1988) referred to autonomous motivation: Autonomy involves acting with a sense of volition and having the experience of choice, it means endorsing one's actions at the highest level of reflection. Intrinsic motivation is an example of autonomous motivation (Gagné & Deci, 2005; Festré & Giustiniano, 2011; Cavaliere & Lombardi, 2014).

Proposition 4: The actual implementation of his/her own ideas could help individuals develop higher motivation in their (creative) activities.

Extrinsic motivation. Conversely, it is linked to the organizational consequences rather than to the actions. “It requires an instrumentality between the activity and some separable consequences, such as tangible or verbal rewards, so satisfaction might not come from the activity itself, but rather from the extrinsic consequences to which the activity leads” (Gagné & Deci, 2005, p. 331). The analysis of the impact extrinsic incentives have on creativity is quite controversial: Sternberg and Lubart (1995) in an effective metaphoric way stated that extrinsic motivation is to creativity “what strychnine is to orange juice”. From a different perspective, Amabile (1988) drew the same conclusion by stating that monetary incentives in exchange of new ideas induce individuals to be interested in money and not towards innovative ideas, so they will be looking for safe and rapid solutions to gain money.

The above mentioned elements lead to an apparent paradox, rooted in the idea that extrinsic incentives would constrain creativity, for instance, Amabile, Conti, Coon, Lazenby, and Herron (1996) showed that students creativity in exchange for a premium (or bonus) was lower and less effective (innovative) than students creativity without any reward. Further, as interestingly noted that by Rossman (1931) through an experiment based on 700 inventors on the biggest motivating elements to create and study new ideas, extrinsic motivation could play a role in developing new ideas. By analyzing such evidences, it seems that humans find “need to gain” and “need to get better” above “love to invention” and “desire for personal growth” which contradicts the Sternberg and Lubart’s model (1995). Deci (1971, 1975) tested the additivity hypothesis that tangible extrinsic rewards undermined intrinsic motivation whereas verbal rewards enhanced it, thus implying that intrinsic and extrinsic motivation can be both positively and negatively interactive rather than additive.

Proposition 5: The consistency of extrinsic positively impacts individual motivation.

Cognitive Factors and Creativity

Cognitive evaluation theory also suggested that external factors, such as tangible rewards, deadlines (Amabile, DeJong, & Lepper, 1976), surveillance (Lepper & Greene, 1975), and evaluations (Smith, 1975) tend to diminish feelings of autonomy and undermine intrinsic motivation. In contrast, some external factors, such as providing choice about aspects of task engagement, tend to enhance feelings of autonomy and increase intrinsic motivation (Zuckerman, Porac, Lathin, Smith, & Deci, 1978). In fact, feelings of competences as well as feelings of autonomy are important to nurture intrinsic motivation. The adoption of the wider organizational perspective does not help either: On one hand, the process of ideation should be considered by organization as part of their business and consequently should be paid by usual rewards; on the other hand, contrarily, when ideas are directly rewarded, the ideation process could be perceived as an extra-work activity.

The analysis of some recent contributions coming from the economic and psychological fields justifies the existence of a “crowding out” effect of extrinsic incentives on the intrinsic ones (Festré & Giustiniano, 2011; Cavaliere & Lombardi, 2014). In actual facts, the possible detrimental effect of extrinsic motivation on performance can be found on the extension of the Self-Determination Theory (SDT) made by Gagné and Deci (2005), starting from the assumption that human behaviors are driven by three main innate psychological needs: competence, autonomy, and relatedness. The novelty of such approach relies on the fact that psychological needs can be fostered or undermined by the external social context. To this extent, the process of internalization of extrinsic motivation leads to the equivalence between extrinsically motivated behavior and autonomy. According to SDT, there are three main ways of “regulation”, defining different “degrees” of extrinsic motivation (Gagné & Deci, 2005): (a) introjection: Regulations are followed but not accepted by the agent (e.g.

acting in order to feel valuable or to avoid penalties); (b) identification: Individuals perceive greater freedom and volition, since the overlapping between the expected behavior and the individual cultural and motivational basis; and (c) integration: When the identification involves other aspects of oneself (beliefs, interests, and values), the required activity itself becomes instrumental for the achievement of personal goals, while still being considered as extrinsic motivation. The usage of SDT for analyzing innovative behaviors conducts to two main managerial implications: (a) Intrinsic and extrinsic incentives can be considered as a continuum of possible states within the underlying needs driving the human behavior; (b) extrinsically motivated behavior can be efficient, when an external regulation has been internalized; in such cases, extrinsically motivated behavior will end up in a higher autonomy; and (c) as a consequence, control based on regulation rather than on the external influence exercised by a principal may be efficient because of the cognitive feedback gained by the agent (which nurtures the need for competence). Ultimately, different regulatory styles are in their turn consistent with a gradation of perceived loci of causality from impersonal and external to internal perceived locus of control. As for the managerial implications, it is possible to argue that in pure innovative contexts (e.g. creative activities), the internal locus of control and the self-determined behavior is compatible with relevant regulatory processes based on interest, enjoyment, and inner satisfaction. When innovation takes instead place within codes of conducts and general guidelines (e.g. clinical innovation), extrinsic motivation should be compatible with the self-involvement of agents.

Proposition 6: The individual cognitive evaluation of the task and the perception of the locus of control influence the (motivational) impact of both intrinsic and extrinsic rewards. In this sense, the higher the consistency is between loci of control and regulatory styles, the more the individual could react to intrinsic and extrinsic stimuli with generation of new ideas.

Conceptual Framework

The previous section described the several elements that were taken in consideration as organizational dimensions. The underlying assumption was to describe their impact on creativity without considering their mutual interdependence. The framework proposed in Figure 1 tries to overtake such an assumption by distinguishing between organizational context and individuals' attitudes. Considering the set of propositions 1-3 IT-mediated solutions, internal climate and group structure could have a potential positive impact on creativity. Despite the acknowledgement of mutual interaction, the framework keeps the assumption of their independence in order to simplify the framework itself, believing that the interlacing facets could only boost the existing positive impact on creativity (e.g. positive internal climate in which could enable a more diffused use of IT solutions). So far it is hence quite clear that if organizations invest in such elements, or at least in the direction addressed by the propositions, the relative management programs should be more capable to fertilize the generation of new ideas and/or reduce the leaks in the innovation processes.

While the organizational dimensions are still kept separate, the loop (interaction) rewards-motivation could still explain the individual behavior. On one hand, there is no doubt that creative performance is a sub set of the outcome of the general organizational conduct. Innovation comes out of motivated behaviors rather than from pure creative pulse—excluding a minor part given to pure improvisation. If so, the impact of intrinsic and extrinsic rewards cannot be ignored. Hence, considering the mere individual-organization dyadic relation, creativity could be nurtured by a proper system of rewards governance.

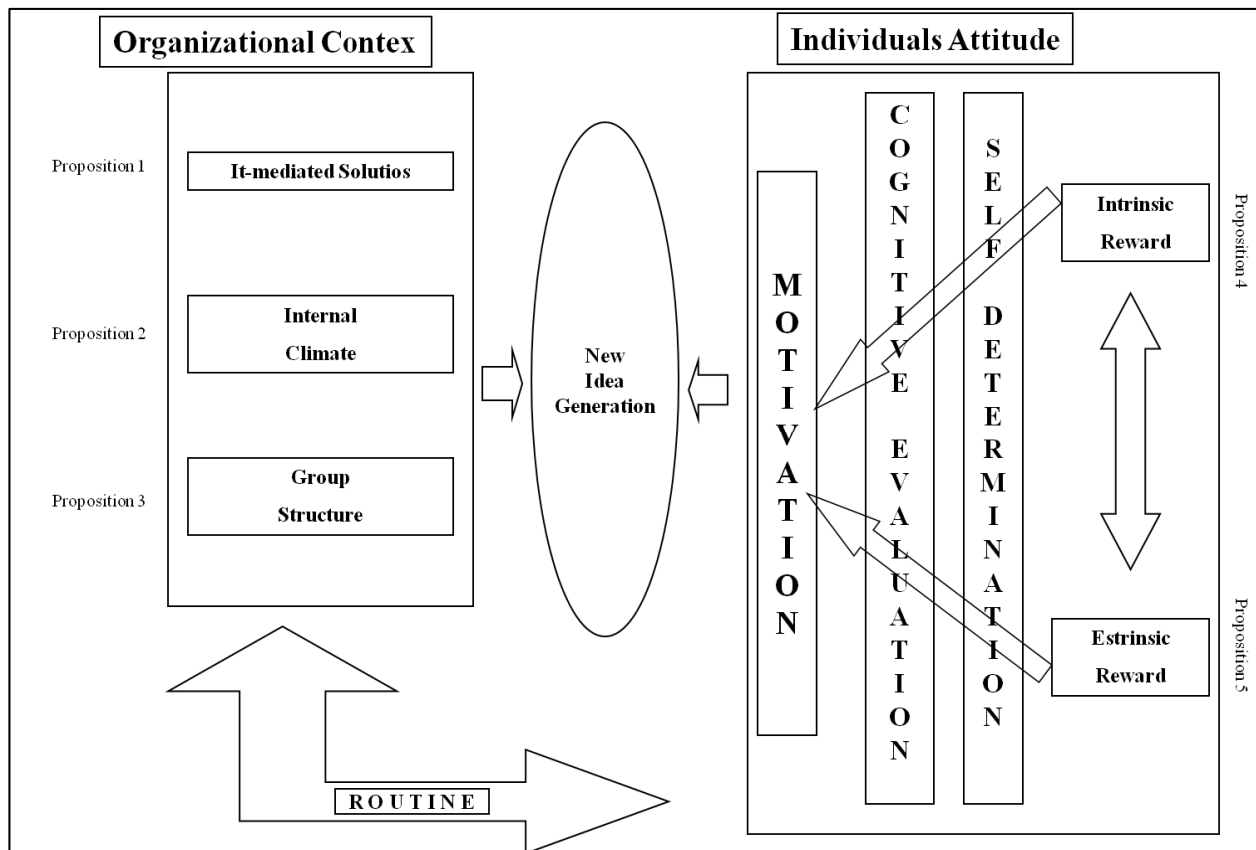


Figure 1. The conceptual framework.

What is new to the field is the recognition of the impact of the individual locus of control on creative performance. Following Gagné and Deci (2005), self-determination and cognitive evaluation could both moderate the impact on motivation to creativity. In particular, the consideration of the self-determination of individual behavior could be addressed, although not predicted, by considering the impact of the diverse forms of incentive alongside with the level of autonomy. By having that in mind, it is possible to consider how various creative tasks (and their specific organizational settings) could be designed and managed consistently with the expected organizational outcome in terms of new ideas generation. Such an approach preserves the consideration that ideas are products of mental activities which take place before their actual representation.

The translation of such mental activities (generate with specific loci of control) could be further mediated by the cognitive evaluation of the author (employees/contributor). In such sense, the usefulness of the idea itself could be considered as a pure and mere individual activity subject to the pressure exerted by the intrinsic and extrinsic rewards. Namely, the very same idea could generate different utilities over diverse individuals, or over the same individual over time, for example, the execution (implementation) of his/her own idea could be the main (and ultimate) source of motivation/satisfaction; in other cases, the fact that such an idea could be considered valuable by the external referent network (e.g., the relevant scientific or professional community) could be considered farther more important than any extrinsic rewards. The fact that some companies are creating internal discussion groups and knowledge groupware for idea sharing and filtering acknowledges that cognitive evolution does matter for the individual enactment. Finally, in such a setting, organizational routines

could represent a very powerful way by which manager could nurture creativity and link the organizational setting to the (expected) individual behaviors. The following paragraph will spoil on such idea.

Discussion

Some further discussion on the conceptual framework can be stimulated by considering the idea of human enactment. As many other practices related to human enactment, it is useful to recall the notion that the circular loop “(expected incentive)₀ → motivation₀ → performance (creativity)₀ → (actual) incentive₀ → motivation₁ ...” is not affected only by the “psychological contract” that ties a single individual (A) to the organization, but that the subjectivity of the evaluations calls for the concept of perceived equity (Adams & Freedman, 1976). It means that, both for individual and collective behaviors, each individual does not consider only what he/she receives from the enterprise (outcomes A), as a result of his commitment (input A), but tries instead to observe this relationship comparing it with other workers he considers equal/similar to himself (outcomes B/input B) (Adams & Freedman, 1976). In case of a perceived iniquity, whatever is the perceived incentive, the behavior of the individual (A) is not sure to reach the expected performance (creativity). Moreover, since the processes of goal reaching (Frey, Benz, & Stutzer, 2004) generate a further procedural utility, the organizational context (locus of causality, regulatory process, relationship with colleagues, available technologies, and relationship with superiors), and human resources management is a relevant part of the incentive. Particularly interesting is the fact that when the corporate context is considered positive by the workers, individual behaviors are not limited to the ones that Katz and Kahn (1978) have labeled as “productive” behaviors (result achievement), but on the contrary it is possible to start some “innovative” and “cooperative” behaviors that are summed to the previous ones. Such a consideration could solve the dilemma appearing between individual creativity and organizational compliance (culture, structure, and etc.). In this sense, the organizational context is potentially capable of generating internal relational economies based on shared procedures, knowledge, experiences, and solutions; in order to generate a organizational context capable of stimulating these kinds of intrinsic incentives and spontaneous behaviors, a relational leadership that enhances such a cognitive capital becomes indispensable.

Conclusions

This paper aimed at evaluating the impact of extrinsic and intrinsic motivation on idea generation both at an individual and team level. In order to do that, a conceptual framework was deduced from previous studies and present. The paper does not solve the paradoxes reported by the literature and without a systemic empiric research, few more speculations could be conducted on the subject. Notwithstanding its inner limits, the paper sheds some light on many grey areas and draws some propositions that could be helpful for both further research and managerial practice. The cornerstones for future research could be synthesized in the individual perception of such incentives and the general organizational setting in which creativity take place. In actual terms, some routines could be designed with the aim of stimulating the effective (and efficient) deployment of creativity. In such a sense, organizational routines could be meant as “regulatory processes” that complement the intrinsic motivation with some monetary incentives. Such incentives are meant to be used in order to amplify the positive effects of feedbacks on the employees’ morale. In short, creativity itself does not contradicts the evidence by which extrinsic incentives could boost performance; it is, on the contrary, the organizational context in which creativity takes place that calls for proper mechanisms (incentive structure)

(Alexy, Criscuolo, & Salter, 2012). Such an approach relies on synergic usage of extrinsic incentives as described in the Amabile's work (1996), and also tries to provide other implementation elements. Further, other unexplored areas rely on the links between intrinsic and extrinsic incentives in teamwork. On this point, Ancona and Caldwell (1992) noted that in organizational teams, subjective ratings sometimes determine promotions, future job assignments, and performance evaluations. It could be debatable, if the social "mutual" control taking place in creative context recalls somehow the idea of clan control introduced by Ouchi (1979). Further research in such vein could be useful to the task.

In conclusion, the paper suggests that, once considered motivational and behavioral implications analyzed, the creation of a whole and inner coherent system of routines that regulates the generation of new ideas could be more effective, if rooted in the wider practice of human resources management and policy, since it could amplify the effect of both intrinsic and extrinsic incentives. The theoretical contributions explored in this paper seem to confirm the paradox related to the impact of rewards on new idea generation which could not be solved straightforward, but only be mitigated by assuming a specific organizational and strategic direction: the alignment between the innovation practice and the human resources policy.

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Impact of the Jews and Polish-Jewish Relations on the Development of the Banking Sector in Poland

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The development of the Polish banking sector cannot be separated from the historical, cultural, and religious background. A key role in this area was played by the Jewish minority. Although the discussed subject matter relates to very remote times, due to the durability of cultural determinants, it has a large impact on the present shape of the Polish banking sector. The paper is dedicated mainly to the presentation of interrelations between Christianity and Judaism, the development of the historical Polish-Jewish relations and the role of the Jews in the development of the banking sector on Polish territory. In the light of the deliberations, the author refers to a deeply ingrained distance between a wide group of users of financial services and banks themselves, and to the relations resulting from the domination of foreign capital on the Polish banking market.

Keywords: Polish-Jewish relations, banking sector

Introduction

The relations of banking with the Jews, especially when perceived by the Polish society, but also worldwide, are very strong. In Poland, it is even more interesting, since, as a result of historical events (in particular World War Two, Anti-Semitic Movement in 1968), this minority is basically non-existent. However, this situation confirms importance of cultural aspects, developing over the centuries (Glinka, 2008). Banking belongs to these types of activity where the discussed determinants play an important and much bigger role than in other spheres of economic life. It is a consequence of a number of universal and national reasons: religion and active role of the Catholic Church in this matter until 19th century, historical and national aspects resulting from the turbulent Polish history, emotions related to money possession, and a particular position of banks as public trust institutions. The present attitude towards banking is nothing else but a result of many-century development of attitudes and cultural models, whose transformations are slow, even in spite of so fundamental system transitions and the total transformation of economy in the period of the past 25 years (Kurkliński, 2011). Therefore, when carrying out these analyses, the role of the Jews and Polish-Jewish relations cannot be ignored, even when it comes to very remote times. Moreover, the present times bring one more important aspect of banking activity in Poland—the domination of foreign capital. In cultural terms, it has serious consequences for current operations of banks. At this point, certain analogies appear. This paper is aimed to show these relations by going back to remote history of Poland and showing importance of religious factors.

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Judaism, Christianity, and Banking

Banking activity appeared in the ancient times, along with the popularization of standard money. It applied, first of all, to the phenomenon of lending and expecting relevant compensation in return, mainly in the form of interest. Nearly simultaneously moral attitude and then religious attitude to these dealings were formed. Already Aristotle was of the opinion that this way of making money is against nature, although his morally negative judgment concerned the situation when a borrower, in particular a minor borrower, was constrained to accept increased interest (Taeusch, 1973). However, the history of economy and the development of banking were (to a certain degree, are until the present day) determined largely by the perception of this phenomenon by great world religions: Christianity, Judaism, Buddhism, Hinduism, Confucianism, and Islam. This attitude was developing similarly, however, its evolution and intensification were different. An example can be the present Islamic banking, banning continuously and strictly charging interest on loans, which has created a different model of banks operation. At least at the beginning, all of the mentioned religions had basically negative attitude towards charging any interest on the lent money, which was diverging only in certain nuances (Kietliński, 2005). *The Old Testament* does not settle clearly whether the term “usury” applied to each case of demanding compensation for the lent money or it applied to charging excessive and exorbitant interest. *The New Testament* (Lucas 6.34: 35) clearly recommends the followers to lend money without interest (Wierzbicki, 2011). This attitude will become instilled in the Church and it will take a dozen or so centuries to change. Other mentioned nuances include inter alia—the issue of a person to whom loan would be granted. It is provisionally acceptable to grant interest-bearing loans to “strangers”, rather than “ones of us”—*The Book of Deuteronomy* (Jastrzab, 2013; Taeusch, 1973). This view, initially common for Christianity and Judaism, became established only in the Jewish community. In this way, in Europe, dominated by Christianity, the sphere of money turnover was mainly under the Jewish control (Botticini & Eckstein, 2012), although that control was not exclusive. Especially in the Middle Ages, lending money was reprehensible and strongly condemned by the Catholic Church. This attitude applied, first of all, to the Christians themselves, but many times also to infidels, including the Jews.

The needs of economic development, imposing the popularization of money-goods relationships, had their repercussion in the interpretation of both religions, with the difference that the Judaism followers were much more flexible in this area and were adapting more quickly to changing conditions. For instance, in Poland, the ban on interest-bearing loans between the Jews (namely between “ones of us”) was lifted by the Jewish self-government as early as in 1607.¹ It contributed to a further development of the credit and financial system this community was dealing with (Siewierski, 2010). Conducted by them, national and international goods turnover and accompanying operations involving bills of exchange were increasing. Bills of exchange were used to pay for goods, however, reliability of their issuers and frequent dishonesty were problematic. As a result, very stringent sanctions were adopted for issuing a worthless bill of exchange. The degree of standardization of this area is reflected also in a decision of the big town Poznań kahal on maximum interest rate in relationships between the Jews, determined at 25% (Jezierski & Leszczyńska, 1998).

The Christian world was also noticing the needs to increase money turnover. At the beginning, this process was taking place mainly in the region of central and northern Italy, starting from the 12th century. Demand for

¹ Waad Arba Aracot was the superior Jewish authority in Poland (XVI-XVIII century). The Jewish community was enjoying a large autonomy towards state legislative, executive, court, and religious institutions. Along with the crisis of the Polish state, independence of the Jewish community was decreasing and upon the partitions, it was nearly completely lifted.

credit was growing, including demand for investment credit which was involving greater risk and was accompanied by an expectation of compensation for lender. First quasi-banking institutions began to emerge. This situation was hardly acceptable for the Catholics that was strongly reprimanding usurers. However, with the passage of time, the church authorities changed gradually their attitude towards progressing economic transformations, especially in view of growing importance of financial transactions. In spite of the above, in official terms, the Catholic Church lifted the ban on usury no sooner than 1830 (Kracik, 2004).

With regard to reformatory movements, the attitude towards paid money lending was similar as of the Catholic Church. Martin Luther was strongly reprimanding those dealings. Anglican theologians were taking similar stands on the issue. An exception was John Calvin who reconciled religion and the world of money, contributing to the development of the Protestant mentality, which appreciates values, such as work and prosperity (Kracik, 2004). The emerging Protestant culture along with strongly developing money-goods economy was forming a good basis for developing banking activity. It was taking place largely beyond Jewish environments, since as a result of displacements, the Jews were not an important social group in Western European countries.

Regardless of the position of the Catholic Church, also secular authorities of most countries were trying to regulate the issue of granting loans. In Poland, starting from 1775, the principles of charging interest were standardized; they were applicable also for the Jews. Along with the partitions, regulations of the partitioners were implemented on Polish territory, providing for restrictions in interest. The second half of the 19th century brought about an unquestionable liberalization of regulations.

The discussion and legal attempts of eliminating or restricting usury re-emerged in public life in the Second Republic of Poland (1918-1939), inclusive of penalization of this phenomenon in the criminal code. Another development of this subject matter was its strong comeback in the recent history of Poland, in the form of a debate and final enactment in 2005 of an act banning excessive interest (Wierzbicki, 2011), remaining in force until the present day.

History of Polish-Jewish Relations

The Jewish settlement on Polish territory dates back to the early 10th century; it intensified over the period of crusades (1096-1270), which was a consequence of increasing hostility and even hatred towards the Jews in Western European cities and their frequent displacements. They were often seeking shelter in Poland, relatively highly tolerant² at those times (Weinryb, 1973; Weintraub, 1971). The foundations for formal position of the Jews in Poland were provided by *The Statute of Kalisz* issued by the Duke Boleslaus the Pious in 1264. It granted that, inter alia, Jewish courts guaranteed personal liberty and safety of the Jews, including, first of all, freedom of religion, travelling, and trade. Its provisions were confirmed by subsequent kings. However, the mere fact of the necessity to ensure freedoms for the Jewish community proves not fully equal position of this nationality representatives; an example may be a part of *The Warta Statute* issued by the King Władysław II Jagiełło, which restricted lending activity of the Jews. On the other hand, the Jews often enjoyed a privileged position (for instance, rights to operate taverns and inns and rights to run retail of alcoholic drinks). In the whole, living conditions were relatively good, which contributed to the boom of the Jewish population in Poland from approximate 10 thousand in 1340 to more than 750 thousand in 1772 (Pogonowski, 1998). Hence,

² In the later times, local strongly anti-Jews tendencies were emerging, inter alia, some towns were receiving rights to ban the Jews from residing in them—the privilege *De non tolerandis Judeas*.

in the late 18th century, the Jewish population living on the territory of Poland accounted for approximate half of the Jewish population worldwide (Siewierski, 2010).

The period of prosperity of the Polish state implied also good times for the Jews. However, at the time of emergence of serious social, economic, or political problems, they often had negative repercussions for the Jewish community, for instance, the Chmielnicki uprising (1648-1657) caused slaughter of approximate 100 thousand Jews and the difficult times of the Swedish Deluge (1655-1660) caused mass attacks and persecutions of the Jews (Attali, 2002). This tendency is even more noticeable in the period of the declining independency of Poland (18th century). In 1764, the Jewish parliament Waad was dissolved. In 1768, pogroms took place in following towns: Krakow, Poznań, Lvov, Vilnius, and Brest (more than 10 thousand victims) (Attali, 2002), whereas peasant revolts termed *koliszczyzna* (1768) in the eastern borderland of Poland caused another 50,000 Jewish victims. The problem of safety and living conditions of the Jews became so urgent that it was deliberated on by the *Great Parliament* (1788-1792) (Petelewicz, 2009). It concludes that the successive partitions of Poland put a stop to the era of relative tolerance and brought increasing and solidifying hostility in Polish-Jewish relations, stirred up more or less by the partitioners (Russia, Austria, and Prussia).

The partitioners were executing discriminatory policy against the Jews. No sooner than the second half of the 19th century was this attitude mitigated, mainly in Galicia (Austria) and partially in Russia. The number of the Jews on Polish territory kept increasing; in the late 19th century, it reached approximate 2.2 million, and in the early 20th century, as a result of the Jewish immigration from the interior of Russia, it grew by another 600 thousand (Petelewicz, 2009). The assimilation with the Polish society was running very slowly and mutual antagonisms were intensifying. Under these socio-economic and political conditions, due to administrative and legal actions, the attitude of the Catholic Church and the Jewish society tendency to cultivate cultural, language and religious distinctness, the Jews were largely isolated from the rest of the society. The Jews were and remained "strangers".

At the brink of the recovered independence of Poland, after World War One, the Jewish minority accounted for 10% of the Polish population. Its status was guaranteed by the *Minority Treaty* (equal civic rights and obligations, self-government, and religious autonomy, right to speak own language, and etc.). However, strong anti-Jewish tendencies in the society were preserved. They were upheld in the whole interwar period (for instance, boycotts of Jewish stores in the years 1929-1935); they were intensifying and supported with a certain form of state anti-Semitism (ghetto desks at universities). The Great Depression and anti-Jewish attitudes were reflected in worsening economic situation of the Jews. Nevertheless, in 1939, the Jewish population grew to 3.3 million (Petelewicz, 2009).

The outbreak of World War Two and the German occupation implied the extermination of the Polish Jews. Criminal actions of the Nazis resulted in deprivation of property, slave exploitation, and then physical extermination of nearly whole Jewish society. Under unimaginable occupation conditions, the attitude of the Poles towards the Holocaust was mostly a consequence of intimidation and terror. Certain Poles were helping the Jewish in spite of the danger, but certain were Gestapo informers, thieves, and blackmailers who wanted to make a fortune at expense of the Jews. The final balance is not clear. After the war, in Poland approximate 80-100 thousand Jews survived plus 140 thousand were repatriated from the Polish territory annexed by the Soviet Union. In spite of traumatic experiences of both nations during the occupation, the Polish society was not friendly towards the Jews. This attitude was partially a consequence of a relatively active role of the Jews in

the imposed pro-Soviet authority and of anti-Semitism that had solidified over the years (Jastrzab, 2013). The most rough event that exemplifies these attitudes was the Kielce Pogrom in 1946. Under these circumstances, until 1950, more than 130 thousand Jews emigrated from Poland. Next emigration waves were recorded after 1956, when the emigration policy was loosened, after the March anti-Semitic events in 1968. Presently, Poland has 12-15 Jewish inhabitants (Petelewicz, 2009), almost invisible as compared to the nationally monolithic Polish society.

Role of the JEWS in the Development of the Polish Banking

After considering the religious determinants of Judaism and Christianity and confronting them with the history of Polish-Jewish relations, the development of the Polish banking and the role played in it by the Jewish minority representatives are interesting.

Thanks to the religious and cultural distinctness of the Jews in relations to the Christians, they basically took over not only retail banking (the term would be used today), but also ducal and royal finance. It was giving them a kind of privileged position and protection granted to “the treasury servants”: a reason for intensified indignation of the catholic clergy, often inciting open hatred, which was gaining the ear mainly of lower social strata. In spite of the above, for instance, the King Casimir III the Great was appreciating the role of the Jews in Polish economy (many Jews were tax collectors). The religious and customary differences were preserving their cultural distinctness, solidifying the status of “strangers”. This situation was reinforced by usurious activity run by the Jews, often at a presently shocking level. As a result, representatives of this nationality were falling victims to many assaults and robberies. The reliability of financial transactions conducted by the Jews was reinforced by the principle of several liability of Jewish communes (kahals) for their members’ obligations. Therefore, investing money through the Jews was not that risky, and kahals were playing the role of quasi-banks; they were conducting financial transactions involving entrusted funds and paying out annual interest of 7% to 10% (Kietliński, 2005).

Taking into account the whole of socio-economic determinants, basically the lending-banking activity wasn’t developed in the Polish society, apart from the activity of the Jews. However, there were the examples of activity of Christian bankers, although some of them were foreigners. A more active role of non-Jewish banking houses emerged no sooner than the 18th century and was also largely determined by religious considerations. Apart from the Jews, the banking profession was dominated by the Protestants. In 1793, the first Polish banking crisis broke out. Then Polish banking turned into ruin (seven major banking houses went bankrupt); only few smaller ones survived the crisis. This event preceded the third partition of Poland and the loss of independence. The level of the development of banking on Polish territory regained a comparable condition no sooner than the mid-19th century (Morawski, 1998).

After the Napoleonic era, only few initiatives of founding banks were initiated. In 1825, Towarzystwo Kredytowe Ziemskie (Land Credit Society) and Bank Polski (Bank of Poland)—a state credit institution, were founded. With regard to private banks, they were treated very distrustfully on the territory under Russian rule until the 1870s. In Galicia, several dozens of small banking houses (mainly Jewish) were operating and a bigger institution of this type was founded no sooner than 1841: Galicyjski Stanowy Instytut Kredytowy (Galician State Credit Institute) in Lvov. Polish banking was the weakest in Prussia, where first banks were founded in the 1860s (Morawski, 1998). They were to be replaced by private lending activity, mostly usury, dealt with by the Jews, everywhere where official banking entities were missing.

The socio-economic transformations, related to the abolition of corvée labor, expansion of towns and industry, and liberalization of the regulations on loan interest, contributed to a stronger development of banking. Then, the financial entities can be divided into private banking houses, joint-stock banks, and credit societies. The first group operated already in the pre-partition period, but it was not numerous. The second group, also weak, did not have expanded branches. In both cases, the leading role was played by Jewish bankers, for instance, Kronenberg, the initiator of the biggest institution—Bank Handlowy in Warsaw. The situation was not differing from similar tendencies in a number of European countries, especially in Germany and in the Austro Hungarian Empire (Schijf, 2002).

Minor clients—borrowers—were served by local credit unions. These were mostly cooperatives following the models of Schulze or Raiffeisen, and savings unions in all three partitions (Leszczyńska & Lisiecka, 2004). Nevertheless, neither banks, nor other credit entities were able to rule out broadly-expanded private lending activity, run often on usurious terms, mainly on the part of the Jewish community representatives (Kracik, 2004).

Under these circumstances, a common cultural attitude towards banking was developing, with a very clear negative connotation, overlapped additionally with growing anti-Semitism. Dealing with finance was a task assigned to the Jewish community, therefore, this sphere of economic activity was assessed largely through the prism of attitude towards the Judaism followers.

A summary of the period before World War One may be the list of 10 biggest Polish banks with respective share of Jewish capital (Table 1).

Table 1

List of Polish banks at the Brink of World War One—Jewish Capital

Bank name	Year of founding	Seat	Jewish capital
1. Bank Handlowy w Warszawie SA	1870	Warsaw	YES
2. Wileński Bank Ziemski SA 1872	1872	Vilnius	YES
3. Bank Dyskontowy Warszawski SA	1871	Warsaw	YES
4. Bank Handlowy w Łodzi SA	1872	Łódź	YES
5. Gal. Akcyjny Bank Hipoteczny SA	1867	Lvov	NO
6. Bank Krajowy	1883	Lvov	NO
7. Bank Zachodni SA	1913	Warsaw	YES
8. Łódzki Bank Kupiecki SA	1897	Łódź	YES
9. Bank Handlowy W. Landau SA	1914	Warsaw	YES
10. Bank Przemysłowy dla Galicji SA	1910	Lvov	YES

Source: Morawski (2002).

A clear domination of the Jewish community in banking activity can be seen, both in terms of institutions (banks) and granting private loans.

After the recovery of independence in 1918, the situation started changing slowly. Relatively quickly enacted legal acts against usury prove social importance of this phenomenon and indirectly the perception of banking. It should be examined together with very strong Anti-Semitic Movement and related attitudes of the society. Trust in state banks was increasing; their position was growing, which was visible in particular during the Great Depression. The bankruptcy of several Polish private banks and the collapse of big institutions abroad stirred panic; clients started nervously transferring money to state banks. The post-depression picture is

illustrated by the following data; in 1926, private savings-credit institutions had 43% of total deposits; in 1936 this level fell below 20%. As a result of reformatory processes, large banks were nationalized, directly or indirectly; it applied, among others, to Bank Handlowy w Warszawie S.A.. Control of entities remaining in private hands was taken over largely by foreign capital (Landau, 2007). These tendencies could be noticed also among Jewish banks. From among bigger banks, only Dom Bankowy D. M. Szereszowski preserved its image of an institution perceived as belonging to and serving the Judaism followers (for instance, nearly all Jewish organizations were depositing their money in this bank).

During World War Two, occupation and a new soviet post-war system basically end the history of Jewish banking in Poland.

Conclusions

The history of banking in Poland is connected inseparably with the Jews and Polish-Jewish relations. Its tracing enables to understand better contemporary Polish banking, in particular the attitude of the society to this type of economic activity. It is beyond doubt that the distance separating the Polish population from the Judaism followers over the centuries was reflected in the attitude to banking (quasi-banking) institutions, including main activity—granting loans (credits). The above cultural determinants, though very remote in time, are ingrained in social awareness. Banks are perceived as entities with a special status, which results only partially from the position of a public trust institution. Attention is paid to their privilege and formal/informal power (domination) over a regular client. This phenomenon is widely spread worldwide, but noted especially in Poland. Additionally, it must be introduced an element of the dominance of foreign capital in the Polish banking sector. This aspect reinforces the abovementioned distance, which can be exemplified, for instance, by the semantic expression “strange capital” used in relation to foreign investors in Poland. The thesis can be confirmed that this “strangeness” reflects to a certain degree the cultural distance present over nearly 1,000 years between the Polish and Jewish communities. Therefore banks with foreign capital, in particular their owners, should pay special attention to cultural aspects when running activity in Poland. The manifestations of ethnocentrism can be observed in many cases on the part of international corporate groups are not favorable for success on the Polish market, which has been experienced by quite many banks.

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Technology-Transfer Through International Network Formation: Revisiting the Role of Cultural Variation

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This paper studies the factors affecting the technology-transfer within international research and development (R&D) networks. Specifically, this study examines the characteristics of ties, actors, and international network configuration to assess firm's accessibility to unique technologies. This study was conducted by research analysis in the aerospace industry. The total sample size used in this study is 125 cases of international R&D consortiums from January 1980 to December 2000. The result of this study supports the effects of "strength of tie" and "characteristic of actors" on the technology transfer explained by network theory. It also demonstrates that the international network structure that would facilitate the technology transfer is shaped by dual type of tie; the apparent type of tie is general, usual, and functional tie, and the hidden one is the national culture.

Keywords: the aerospace industry, international research and development (R&D) network, strength of ties, national culture, technology transfer

Introduction

On one hand, the study of international technology transfer process is still in its primary stage (Kotabe, Dunlap-Hinkler, Parente, & Mishra, 2007). In reviewing the traditional literature on technology transfer (Amesse & Cohendet, 2001; Daghfous, 2004; Sunaoshi, Kotabe, & Murray, 2005), the general context of the knowledge-based view or learning theory was identified. In this context, the authors focused more on the technology itself, such as demonstrability (Sunaoshi et al., 2005), rather than the process of actual transfer. In the field of international business, however, the transfer process should be theoretically and empirically discussed as the main character of the technology transfer, because the definition of the technology transfer states interaction between two or more social entities (Albors, Sweeney, & Hidalgo, 2005). Transfer process is also a problem to be solved with different organizational arrangements (Amesse & Cohendet, 2001). Therefore, it is necessary to fill the gap of the previous researches by focusing more on the transfer process.

On the other hand, most literatures on international technology transfer are based on high-tech industry, such as software (Patibandla & Petersen, 2002), semiconductors (Hemmert, 2004), pharmaceuticals industry (Kotabe et al., 2007), and etc.. However, existing empirical findings of transferring technology seem to have

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some limitations for industry-specific reasons. The cases of high-tech industry used by prior researches indirectly relate to the issue of the “transfer”, because they do not depend on transferring technology to survive.

Also, they excluded the aspect of the international business. The technology transfer among firms in software, semiconductors, and pharmaceuticals industries in the same country or region only revealed the limited relationship. In order to search determinants of technology transfer in the international context, diverse nationalities are needed, because nationality or national culture is a crucial variable in the field of the international business (Hofstede, 1980). Although national culture has been used in many studies in international business, the empirical finding of influences of cultural distance on network outcomes, such as technology transfer, is still scarce in the studies of network theory. Prior researches suggest that national culture is associated with attitudes which affect activities between firms (Sirmon & Lane, 2004) and knowledge sharing among alliance partners (Parkhe, 1991). These studies, however, have some limitations in creating broader view, because each case focused on the narrow context with researchers’ interests, such as difference of national wealth and quality of technology. Then, it is not clear that such findings would be supported under all conditions, including when networks face cultural variance, especially in the global context.

In this study, international research and development (R&D) consortiums conceptualized as a global network arrangement and examine firm’s accessibility to unique technology by analyzing the characteristics of the industry’s overall network arrangement and cultural variation. By understanding the pattern of international R&D network in the aerospace industry, researchers may be able to understand the international network characteristics of the high-tech industry and the peculiarity of international ties affecting the technology transfer. In addition, this study will look into the aspect of international network structure.

Literature Review and Hypothesis

Technology Transfer in the International R&D Network

From the network theory, actors are embedded within a network of interconnected relationships (Brass, Galaskiewicz, Greve, & Tsai, 2004). Burt (1992) already applied this approach to an extended domain of social phenomena, including relationship beyond the firm. Therefore, a firm’s activity as an actor within organizational network can be understood as a process adjusting dyadic ties among firms. Organizational ties among firms function as channels for technology and resource flows, and a firm may gain access to other firms’ unique resource through social ties (Tsai, 2001; Hansen, 1999).

Granovetter’s study (1992) on social capital classified social ties into weak and strong ties. According to that, the strength of a tie is a combination of the amount of time spent together and the reciprocal services, and these features also characterize the tie. Several studies have sought to identify the characteristics of social ties that lead to technology transfer, for example, according to Hansen (1999), weak ties contribute to the search for sources of information or transfer of non-codified knowledge, but hinder the process of transferring complex technology. Lin, Ensel, and Vaughn (1981) supported the ceiling effect of social networks, arguing that the advantage of weak ties may be restricted by the network’s ability to reach useful resources. Moreover, transferring complex technology requires multiplexity of ties (Hansen, Mors, & Lovas, 2005), because recipients may not acquire the technology completely, during the first interaction with a partner. As partner firms spend more time together, their social tie is likely to be strengthened by their relationship. However, frequent contact among firms could become the source of discord. Because firm’s separation from a network

happens in relation to an organizational network configuration, firms must maintain good relationship without being satisfied with other firms. If durability of network is damaged, firm's ability to acquire unique technology becomes limited (Powell, 1990). In this regard, firm's activity as an actor within an organizational network is a cumulative process in which strength and durability of ties are secured to guarantee short-term and long-term profit (Johanson & Mattson, 1987). These ties have a variety of purposes, and depending on its purpose, the degree of strength and importance differs (Granovetter, 1973). In some cases, a new tie is neatly integrated into one's previously formed cliques (Gulati, 1998). In others, the tie is kept completely separated from others or introduced only to a limited number of ties. By controlling who knows whom, the firm is able to manage explicitly the network among firms, creating additional connections. When firm's network like the R&D consortium is sequentially constructed, individual firms act as a bridge through dyadic ties among the firms (Burt, 1992).

The role of international R&D consortium is becoming increasingly important in high-tech industries, such as aerospace industry. More and more firms are putting pressure on developing unique technology and managing R&D consortium (Medcop, 2001). If an efficient network can be defined as a cumulative process of forming a relation among firms (Johanson & Mattson, 1987), firms can acquire valuable technology or skills through strong dyadic ties without own investment (Orru, 1991). In the analysis of new-product development projects of multidivisional and multinational electronics company, Hansen (1999) found that strong interunit ties provide the highest positive effect on completion time, when the knowledge is highly complex, whereas weak interunit ties have the strongest positive effect on completion time when the knowledge is not complex. Moreover, Weimann's study (1982) proves that information via strong ties, as opposed to weak ties, is likely to transfer at higher speed and is attributed with greater credibility. Thus, strong ties serve as better disseminating channels of high-technology for firms in the international business network.

Hypothesis 1: The strength of dyadic tie within network is positively related to technology transfer through international network structure.

Characteristic of Actors Within Organizational Network

R&D consortium has been broadly defined as an agreement under which firms jointly acquire unique technology (Link & Bauer, 1989). Several studies have revealed a positive correlation between R&D activity and alliance formation intensity, especially in technology intensive industries (Hagedoorn, 1993). A firm may greatly advance its innovative capacity by acquiring the skills through transfer of technology from other firms (Pennings & Harianto, 1992; Gilbert & Cordey-Hayes, 1996; Szulanski, 1996). Accordingly, as the role of international R&D network is becoming more important, firms in high-tech industry like the aerospace industry are putting pressure to develop unique technology (Medcop, 2001). However, in this industry, it is not always easy to transfer technology to create new or improved products, because the industry fully depends on high-technology. In addition, it is very difficult for firms to simply apply the new technology to create advanced products (Hagedoorn, 1993), because in order to do so, firms generally need the know how to synthesize the existing resources in a new way (Tsai & Ghoshal, 1998). Furthermore, in order to achieve new productive possibilities, the newly transferred and existing technology must be combined appropriately (Henderson & Cockburn, 1994). The recipient firm must distinguish needed technology and reject irrelevant technology for an effective flow of technology to occur (Henderson & Clark, 1990). Closely related technology is likely to be more compatible with the firm's existing system than with an unrelated technology, the former

will be incorporated with more efficiency (Sapienza, Parhankangas, & Autio, 2004). Most technologies that share similar traits with existing technology domains are found to be transferring more effectively.

From a network perspective, because almost all firms are linked to one another via direct or indirect ties (Duysters, De Man, & Wildeman, 1999), similarity among firms is thought to ease communication, increase the predictability of behaviour, and foster trust and reciprocity (Brass et al., 2004). Interaction is influenced by the degree to which an individual actor is similar to other individuals (Mehra, Kilduff, & Brass, 1998). Empirical evidence shows that a greater tendency for interaction can influence technology transfer (Carley, 1991; McPherson, Smith-Lovin, & Cook, 2001; Monge & Contractor, 2003). When actors of a network frequently interact, increased knowledge sharing is a natural product of the interaction (Makela, Kalla, & Piekkari, 2007). In the organizational context, Brass et al. (2004) concluded that actor similarity is an antecedent for interpersonal network formation. In other words, similarity can breed informal business-related connections among firms over and above formal structures (Makela et al., 2007). As a result, because it is difficult to transfer complex technologies (Kogut & Zander, 1993), such process requires frequent interaction (Hansen et al., 2005) among firms with similar characteristic of firms.

Hypothesis 2: The similarity of firms within network is positively related to technology transfer through international network structure.

National Culture in the International Network

Recently, the issue of cultural context emerges again from the network theory. Xiao and Tsui (2007) insisted that the control and information benefits of central actor (structural holes) in the network structure cannot materialize, due to cultural variance in some organizations. Also, they argued that an important insight of social network perspective is that actions and outcomes can be predictive by the relational character and the national culture is contingent factor affecting outcomes from network, such as network effectiveness and learning (Provan, Fish, & Sydow, 2007). In the international business network, however, the national culture is a type of “conduit” or “tie” rather than contingent factor, because cultural variations across nations among firms that are involved in the international business network can directly affect the outcomes from the success of business work (Kedia & Bhagat, 1988).

Inside the network perspective, the conduit or tie of the firms is difficult to imitate and has distinctive characteristics, which are the information sharing (Sharma & Blomstermo, 2003), and referral (Burt, 1992) etc.. Firstly, the technology would be transferred through the same national culture as firms’ ties. A tie facilitates technology or knowledge transfer by firm’s decision making process (Palmer, Friedland, & Singh, 1986). The cultural bond of each firm’s managers or board members context may be considered in the firm’s decision, making process for technology transfer because of reducing transfer cost from different social contexts, for example, reciprocity has long been recognized as the principle in exchange networks (Gouldner, 1960). It has, however, greater importance in Asian countries where there is a stronger emphasis on trusting and mutual obligation than western countries (Lincoln, Gerlach, & Takahashi, 1992). Secondly, referrals imply the right time and the right place of firm’s interests (Sharma & Blomstermo, 2003). Center firms in a network may receive more technology compared to their competitors (Burt, 1992). However, the advantage of brokering position in the network cannot be realized by culture (Xiao & Tsui, 2007). It means that an apparent tie of firms would be affected by another type of ties such as “guanxi” in China. The present study demonstrates that various types of interorganizational ties have different effects on network outcomes (Gulati & Higgins, 2003).

Accordingly, from the finding of Xiao and Tsui (2007), the national culture is a type of ties affecting the network outcomes in the international business.

Meanwhile, one of the most important characteristics of network structure is the density of ties. Density describes the overall level of interaction of various kinds reported by network member (Sparrowe, Liden, Wayne, & Kraimer, 2001). The density of ties in a network tends to increase or decrease over time (Venkatraman & Lee, 2004), because time may modify the flow through the change of network features and the form of network structure (Soda, Usai, & Zaheer, 2004). The cultural context is also influenced by time just like the dimension of the network. Needless to say, the national culture changes slowly but absolutely. Although cultural boundaries among nations gradually become ambiguous with increasing economic integration (Fukuyama, 1995), the unique national culture encompasses every aspect of a firm's activity, for example, because the national culture or corporate culture can dissuade actors from exercising the maximum degree of opportunism (Koford & Miller, 2006), the culture is one of the most important criteria of partner selection of the international alliance (Dong & Glaister, 2006). Then, the national culture may play a role of tie on the international business network.

The other characteristic of the national culture as international network tie is embeddedness. The relational embeddedness describes the kind of personal relationships. Actors have developed with each other through a history of interaction (Granovetter, 1992) and have focused on the particular relations that influence actor's behavior (Nahapiet & Ghoshal, 1998). Also, the concept of embeddedness has been adapted for a number of different dimensions. One of the adaptations is the cultural embeddedness (James, 2007). The cultural embeddedness is treated only as the effects of national cultures with current conceptions of culture as rules and practices (Whittington, 1992). The national culture provides the categories and understandings that enable actors to engage in economic and social action, and culture provides shared norms that constrain action (DiMaggio, 1994). Accordingly, the national culture is not only shared values that reinforce the belief, intention, and collective activity but also as complex rule-like structures that constitute resources to realize strategic purpose (DiMaggio, 1997). In this regard, the national culture is one of the essential elements affecting the formation, maintenance, and outcomes of international business network, and the technology transfer occurs in a shared culture in which different units are linked to one another (Tsai, 2001). As a result, the national culture has the features of both the node and conduit or tie of firms within same culture.

Hypothesis 3: The distance of national culture within network is negatively related to technology transfer through international network structure.

Analyses and Methods

This study was conducted by research analysis in the aerospace industry. The aerospace industry is not only a high technology-based industry (Jorge & Jhegu, 2005), but it also is an industry where the firms cannot ensure successful survival without technology transfer (Stuart, 2000). Accordingly, the technology transfer is extremely critical issue in the aerospace industry, compared to other industries.

Secondary data from the securities data company (SDC) database in Thomson financial is used for this study. The sample size is 125 cases from January 1980 to December 2000. All cases involved international R&D consortium in the aerospace industry, classified at the international alliance category of Thomson financial criteria. Given the data structure, the study employed binomial logistic regression analysis to test the relationship between the various independent variables and technology transfer.

To compute network measure, matrices of the relationships among the firms representing “strength of tie” were constructed. The matrices were input into UCINET VI, a software package that allows the computation of network measures (Borgatti, Everett, & Freeman, 1992). The multidimensional scaling was used and it referred to a set of methods used to obtain inside representations of the cultural proximity (national culture) among firms in the international R&D network. The network in this research was cumulative and encompassed all international R&D consortiums that have been formed between 1980 and 2000.

Definition and Measurement of Variables

The dependent variable, “technology transfer”, was coded as “1”, if the technology is transferred among firms through R&D consortium and as “0” if otherwise. Although the item of technology transfer is indicated as either “yes” or “no” in the SDC database, direct coding was used to identify all deals made via R&D consortiums, for example, the following illustrates two brief deals in text regarding technology transfer (Tsai, 2005; Simonin, 2004): ... A company agreed to share data, computer programs, and design methods..., or ... B company received technical support from C company...

The strength of dyadic tie. A multiplex tie or multiplexity is assumed to be an indicator of the strength and durability of an organization’s links, because it enables an organization and its partner to maintain a relationship, even if one type of link dissolves (Provan et al., 2007). In this research, the multiplexity is measured as the sum of closeness centrality score and experience of R&D consortium for each firm across all its partners (Hansen, 1999). Closeness centrality captures how closely a firm is connected to the rest of the firms in the interfirm network (Gulati, 1998). It is computed by counting the number of firms that a focal firm must go through to reach other firms in the network (Freeman, 1979). Experience captures the number of R&D consortiums a firm has formed. All the prior R&D consortiums a firm has entered with any partner is counted. The multiplex tie of the focal firm is then revealed by the score of the sum of two variables, because the ties are based on the number of types of link (Provan et al., 2007).

Firm’s similarity. Firm similarity is defined by the industries of the participants of R&D consortium (Morosini, Shane, & Singh, 1998), and a recent research has found SIC-based (Standard Industrial Classification) measures of business similarity to be closely associated with them (Flanagan, 1996). All four-digit SIC codes among participants in the aerospace industry were classified into six categories by the criteria found in the World Wide business directory. Firm similarity is identified as the deal where the participants operate in the same three-digit SIC code.

Cultural distance. Leading research about dimensions of national culture was achieved by Hofstede (1980). In his pioneer work, although national cultures are different in every country, the similarities and differences of some national culture were indicated. Following his research, Kogut and Singh (1988) developed that a cultural distance is an important factor affecting the success on the international business. Also, cultural differences between the knowledge transferor and the transferee act as one of organizational communication barriers (Lin & Berg, 2001). In this research, cultural distance is defined measurement by Morosini et al. (1998).

Based on prior research, two control variables are distinguished for model. First, firm’s size is operationalized as the number of employee (Prater & Ghosh, 2006) to capture any effect of firm’s size on alliance activity (Gulati, 1998). National relationship is also included and measured by national agreement in the aerospace industry—as the second control variable, because, according to Lawrence (1998), breaking the

link between aerospace industry and the state is unlikely to happen. Currently, there exist two global agreements in the aerospace industry: GATT (General Agreement on Trade and Tariffs) and ESA (European Space Agency).¹¹ The variable was coded as “1” if parent nation of firm is part of the GATT or ESA, and “0” if otherwise.

Results

Prior to the assessment of the hypotheses of this study, a correlation analysis of the variables is performed. Table 1 shows the mean values, standard deviations, and correlations for all the measured variables. The all correlation coefficients show the threshold of 0.7 below which is used as a rule of thumb for collinear relationship and multicollinearity (Anderson, Sweeney, & Williams, 1996), and the results of the regression model show no sign of the bias.

Table 1

Means, Standard Deviations, and Correlation

	Mean	s.d.	1	2	3	4	5	6
1. Firm's size	127,631	100,249	1					
2. National relation	0.63	0.48	-0.273**	1				
3. Strength of tie	4.16	6.11	-0.372**	0.239**	1			
4. Similarity	0.36	0.48	0.199*	0.158	0.149	1		
5. Cultural distance	30.25	26.33	-0.158	-0.382**	-0.221	-0.061	1	
6. Technology transfer	0.60	0.49	-0.031	0.223*	0.240**	0.204*	-0.251**	1

Notes. * Correlation is significant at the 0.05 level (2-tailed); ** correlation is significant at the 0.01 level (2-tailed).

Figure 1 demonstrates the pattern of cultural similarities among the firms which join in the international R&D network. The goodness of fit in this two dimensional model is excellent (stress value -0.0001). According to the Figure 1, there are two different ties in the aerospace industry. One is the tie of national culture by dimension 2 and the other is the strength of ties by dimension 1. U.S. firms, such as Boieng, General Dynamics, and etc., are located to center of international R&D network from dimension 1, and they can play the role as broker with transferring technology in the international R&D network. Future studies should examine the difference between dimension 1 and apparent network structure.

The result of the logistic regression analysis supports the hypotheses. The result of the model is presented in Table 2. Firstly, firm's size and national relationship were shown as not significant. Although the national relationship is an important factor, especially, in the aerospace industry, technology cannot transfer through the national relationship.

Hypothesis 1 states that the strength of dyadic ties is positively related to technology transfer. As shown in Table 2, the logistic coefficient is positive and significant ($p < 0.05$), which indicates that the strength of ties among firms in the aerospace industry contributes to the transfer of technology. Hence, hypothesis 1 is supported.

Hypothesis 2 assumes a positive correlation between firm similarity as the characteristic of nodes and transfer technology. The logistic coefficient of firm similarity is positive and weakly significant ($p < 0.1$),

¹ GATT (General Agreement on Trade and Tariffs) includes the following countries: Austria, Belgium, Canada, Denmark, EEC, Germany, France, Ireland, Italy, Japan, Luxembourg, Netherlands, Norway, Romania, Sweden, Switzerland, U.K., and U.S.; ESA (European Space Agency) includes the following countries: Austria, Belgium, Denmark, Finland, Germany, France, Ireland, Italy, Netherlands, Norway, Sweden, Switzerland, U.K., Portugal, and Spain.

which indicates that firm similarity as the characteristic of nodes in the international network may be related to transfer technology. As a result, hypothesis 2 is also supported. Consistent with previous research, this implies that strong ties and similarity of actors can effectively improve the network outcomes such as technology transfer.

Hypothesis 3 states that the distance of national culture is negatively related to technology transfer. The logistic coefficient of cultural distance is negative and significant ($p < 0.01$), and the national culture would strongly play the role of conduit or tie among firms to achieve network outcomes, such as technology transfer and network effectiveness in the international network.

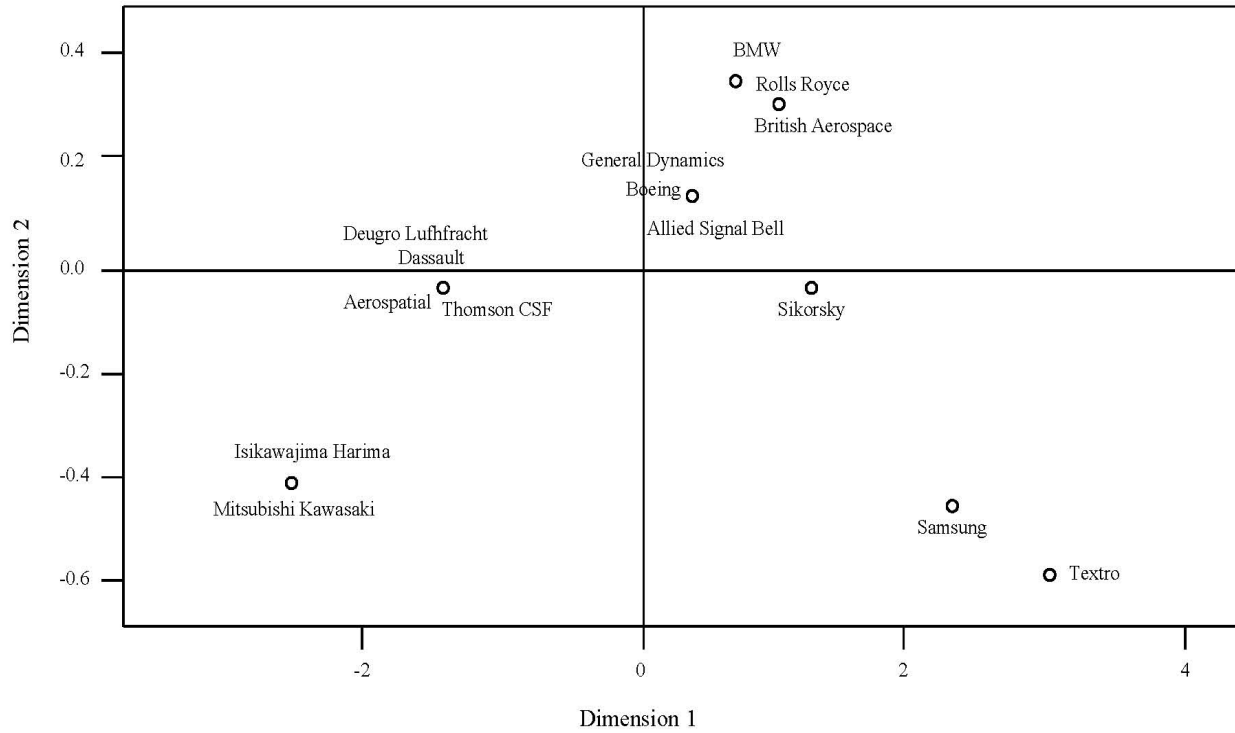


Figure 1. The pattern of cultural similarities in the international R&D network.

Table 2

Regression Results for Technology Transfer Through International Network

		Technology transfer through R&D consortium	
		Model 1	Model 2
Control variables	Firm's size	-0.015 (0.876)	-0.148 (0.186)
	National relation	0.724 (0.100)*	0.128 (0.800)
	Strength of tie		0.096 (0.025)**
Independent variables	Firm Similarity		0.832 (0.083)†
	Cultural distance		-0.023 (0.017)**
Constant		0.100 (0.814)	0.943 (0.129)
Chi-Square		2.660 (0.264)	16.868 (0.005)**
N		125	125
Correct Classification (%)		63.6	74.8

Notes. ** 0.01 level; *0.05 level; †0.1 level (2-tailed).

Conclusions

How can a firm in the international business network acquire useful technology from other firms to make new or better products? This study suggests that strong ties, firm similarity, and national culture are critical factors in answering this question. Technology is a major source of competitive advantage and a critical strategic asset in the aerospace industry (Stuart, 2000). However, because successful technology transfer is difficult in international network and high technology-based industry, transfer mechanism is required for smooth transactions (Sunaoshi et al., 2005). Consequently, this study analyzed various factors affecting technology transfer via international business network.

The result suggests that the strength of ties is positively associated with greater chance of successful technology transfer. Several studies have shown that technology transfer is facilitated by the extent to which two parties strongly establish their relations (Hansen, 1999; Szulanski, 1996). The hypotheses in this research support the positive relationship between the strength of tie and transfer. This result is significant, because it addresses some critical problems in international R&D strategy. Internationalization of R&D is achieved by creating technologies via access to overseas technology (Belderbos, 2002), however, merely participating in R&D consortium cannot ensure technology transfer. It is interesting to observe that successful technology transfer takes place through strong tie among firms with repeated R&D consortium. In 2002, Sakakibara (2002) called attention to the network effect on R&D consortia, though it received limited attention in managerial literature. In this light, adopting a relational approach to study transfer technology in R&D consortium can be a basis for further research.

This study also notes the significance in the relation between firm similarity and technology transfer. Monteiro, Arvidsson, and Birkinshaw (2004) purported that firms have the tendency to communicate more intensively with similar others, leading to uneven patterns of technology flows. In this regard, Von Hippel (1994) has presented the concept of “stickiness” of knowledge to refer to the additional costs to transfer technology from one practice to another (Szulanski, 2003). Therefore, stickiness of knowledge becomes an obstacle in technology transfer (Von Hippel, 1994). The transfer costs will increase, when the technology provider and the recipient operate in different contexts are engaged in different practices. However, when the technology provider and the recipient share the same context and are engaged in the same practice, the costs of stickiness will be relatively reduced (Van Baalen, Bloemhof-Ruwaard, & Van Heck, 2005). Accordingly, the further studies with network theory should never overlook at the characteristics of nodes or actors itself.

Finally, the national culture is a conduit and tie of international firms. The firms which reside in the same regional sector, such as Asia, North America, Europe, and etc. have cultural capital, like social capital, compared to other firms in the different regional sector. Moreover, cultural capital is seen as a resource that inheres in a focal firms' international network to give the firm some advantages in competitive rivalries. Compared to social capital, cultural capital may be the most important variable in the research of international business network. Furthermore, despite the lack of recent attention in the international business field, the national culture deserves a better treatment as an important issue in the field. The focus of study was on the transfer of technology via international network. Based on the findings, the structure of international business network would be built with superficial or external ties and fundamental or internal ties. Then, both ties in the international business network can play a significant role in achieving the network outcomes.

Although this research focuses on the technology transfer through international network, it is necessary to study the unique international network structure itself. Also, other types of national connections, such as political and military connection, may affect the firm's network outcomes. Further study pursuing this line of questions has great potential to make significant contributions to the research of the international business network.

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Some Recommendations for Improving Renewable Energy Policies in China*

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Renewable energy is the one of the most promising solutions for environmental protection and energy deficiency. Since 2005, the Chinese government has put forward a number of measures in promoting renewable energy. This paper presents those renewable energy policies in China and illustrates their achievements and limits. Comparing the renewable energy policies in Europe and US, feed-in-tariffs and quotas are two main measures that are adopted by western countries. A detailed performance review of feed-in-tariffs and quotas is examined by using effectiveness and efficiency as criteria. The enlightenments to improve renewable policies in China include strengthening compliance with quotas, developing priority dispatch and technical standards for interconnection, putting forward a more advanced feed-in-tariff system, and ultimately guaranteeing the electricity consumer's right of choice.

Keywords: feed-in-tariffs, renewable power quotas, priority dispatch, distributed generation

Introduction

Since 2006, China has experienced a rapid growth in its renewable energy resources, particularly wind power, placing it among the world's leading countries, in terms of renewable energy installation and generation. This growth was greatly enabled by the renewable energy policy framework created by its landmark *Renewable Energy Law*, passed in 2005 and amended in 2009, which established key policies including: national renewable energy targets; a mandatory connection and purchase policy; a national feed-in tariff (FIT) system; and arrangements for cost-sharing and funding of renewable energy incentives.

This paper describes the mechanisms established by the *Renewable Energy Law* and its implementing regulations, as well as the challenges China continues to face in improving its renewable energy policy framework to improve integration and utilization of renewable energy sources. It also provides a comparison of the Chinese renewable energy policy framework with those in the European Union (EU) and United States and examines the effectiveness and efficiency of FITs and quotas by using Europe as an example. Later, the paper provides recommendations for improving implementation of the *Renewable Energy Law*, with regard to implementing a renewable power quota system and priority dispatch policy, developing technical standards for

* Project Supported: Ningbo-Chinese Academy of Social Sciences Strategic Collaboration Research Fund.

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connection of renewable resources with the grid, development of a more advanced FIT system, and central-local coordination of renewable energy development.

Renewable Energy Policies in China

Establishment of a National Level Renewable Energy Target

On February 28, 2005, the Standing Committee of the National People's Congress promulgated the *Renewable Energy Law*, which became effective on January 1, 2006 (National People's Congress, 2005). As stated in the law, the purpose of the *Renewable Energy Law* is to promote the development and utilization of renewable energy, increase energy supplies, improve the energy structure, guarantee energy security, protect the environment, and realize economically and socially sustainable development. The law stated that renewable energy development and utilization would be treated as a priority area for energy development and defined renewable energy to include wind, solar, hydro, biomass, geothermal, ocean, and other non-fossil energy. Subsequent regulations have clarified that biomass power includes agricultural and forest waste-generated power, as well as waste-to-energy power and sludge gas power projects (Ministry of Finance [MOF], National Development and Reform Commission [NDRC], & National Energy Agency, 2012).

In 2007, the State Council released the mid- and long-term development plan for renewable energy, which set targets for meeting 10% of China's primary energy consumption from renewable energy sources, including hydropower, wind, and solar by 2010 and 15% by 2020. The mid- and long-term development plan for renewable energy also sets specific installed capacity targets for 2010 and 2020 for various renewable power technologies, including hydropower, wind, and solar (see Table 1). The 2020 installed capacity target for wind power, 30 GW, was already met by 2010, highlighting the challenges in setting targets for rapidly expanding renewable technologies.

Table 1

Installed Capacity Targets for Renewable and Other Power in the 2007 Mid- and Long-term Development Plan for Renewable Energy

	2010 Targets	2020 Targets
Hydropower	190 GW	300 GW
Wind power	5 GW	30 GW
Solar electricity	300 MW	1.8 GW
Biomass power	4 GW	24 GW
Power from livestock and industrial methane	1 GW	3 GW
Waste-to-power	500 MW	3 GW

Source: NDRC (2008).

In 2008, NDRC released the renewable energy plan for the eleventh five-year period, which reiterated the target of reaching 10% of energy consumption from renewable sources by 2010, the final year of the *Eleventh Five-year Plan* (NDRC, 2008). The *Eleventh Five-year Renewable Energy Plan* also sets out target indicators for the installed capacity and generation to be met by various technologies, including hydro, wind, photo voltaic, and biomass power (NDRC, 2008).

Use of a Renewable Power Quota System to Address Challenges in the Implementing Renewable Power Targets

However, gaps in implementation and in the clarity of the targets remained, for example, by 2010, only

seven out of 14 power companies and two of the grid companies have met their 2010 targets of obtaining 3% of installed capacity and 1% of generation, respectively, from non-hydro renewables. The government has sought to address these challenges by setting out more specific generation-based renewable power quotas, akin to renewable portfolio standards (RPS), for grid companies, power generators, and provincial-level governments in draft *Regulations for Management of Renewable Power Quotas* issued by the National Energy Administration (NEA) on May 2, 2012.

The draft *Renewable Power Quota Regulations* has renewable power targets for 2015 for three types of entities:

(1) The largest 14 generators, which accounted for 66% of China's annual power generation (2786 TWh) and had 28 GW of renewable capacity installed in 2010, will be required to generate an average of 6.5% of their total electricity generation from non-hydro renewable sources by 2015. At the end of 2010, the 14 power companies generated an average of just 1.34% (37.3 TWh) of their power generation from renewables, so this will mean increasing generation from renewable sources to 276 TWh of their forecasted total 4,235 TWh total generation in 2015. Although the NEA has not defined a 2020 target, Bloomberg New Energy Finance has calculated that it could be as high as 10% based on an extrapolation of the current level of generation and the 2015 target;

(2) The four grid companies will be required to purchase a certain percentage of their total generation from non-hydro renewable generators in their area. The targets are 4.8% for State Grid, 3.2% for Southern Grid, 14.9% for Inner Mongolia Power Grid (covering Inner Mongolia West), and 9.9% for Shaanxi Provincial Power Grid (covering 30% of Shaanxi);

(3) All provinces and the four provincial-level municipalities will have their own non-hydro renewable electricity consumption targets in order to ensure that generators and grid companies in their jurisdictions implement the quotas. These targets are to be included in local government plans for energy development and power generation. There are four tiers of targets, ranging from a low of 1% of total energy consumption for Zhejiang, Hubei, Guangxi, Chongqing, and Hainan, to 15% of total energy consumption for Inner Mongolia West and East (wind resource rich provinces). The average renewable energy consumption target across all of the provinces is 5%.

The draft *Renewable Power Quota Regulations* requires generators and grid companies to meet their compliance targets in 2015 and 2020, not on an annual basis. However, they are required to report their progress in meeting these targets to the local branch of the NEA on a monthly basis. The local branch of the NEA reports progress in their jurisdiction to the NEA, which evaluates the progress of each generator, grid company and provincial/municipal government. After a six-month evaluation period, the NEA will publish a report on the performance in meeting the quota targets. No penalty for non-compliance has been set in the regulations, but progress in meeting the renewable power quota targets will be used by the central government in their performance evaluations of state-owned generators, grid companies, and provincial/municipal governments.

The Mandatory Connection and Purchase Policy

Article 14 of the original *Renewable Energy Law* required grid companies to connect and purchase all of the renewable power generated within their coverage area. This mandatory connection and purchase policy was a landmark provision, because it ensured that there would be a market for the electricity generated by

renewable sources and helped foster the clear long-term market demand that is needed for investment in large-scale energy infrastructure projects.

In 2007, the State Electricity Regulatory Commission (SERC) issued the *Measures on Grid Company Full Purchase of Electricity from Renewable Energy (Full Purchase Measures)*:

- require grid companies to promptly provide connection services to the renewable generator;
- establish a “priority dispatch” system, in which renewable generators are given priority in the electricity dispatching sequence to guarantee the requirements of the mandatory connection and purchase policy;
- allow the power dispatcher to manage the renewable power generator in cases where grid stability is threatened. If this occurs, the grid company must promptly notify the renewable generator in writing with an explanation and include an estimation of the non-purchased volume. The grid operator must also report the incident including the reasons for taking action and the corrective measures taken to SERC, which will supervise these measures;
- include a penalty provision in the event of grid company non-compliance with the mandatory connection and purchase policy.

Despite the provisions and the 2005 *Renewable Energy Law*, it became clear that grid companies were not complying fully with their obligations to connect and purchase all renewable power. However, there have been no reported cases of SERC exercising its discretion to impose penalties on grid companies for non-compliance, possibly because of a reluctance to enforce penalties in instances where the grid company did not purchase wind electricity, because of concerns over the possible destabilization that doing so could have on the grid.

Require Renewable Generators to Meet Technical Standards

The 2009 amendments sought to improve the implementation of the mandatory connection and purchase policy by balancing the responsibility that renewable power generators have to meet technical standards for on-grid electricity with the grid companies’ obligation to connect and purchase all renewable power. The original 2005 law simply required grid companies to purchase without condition all renewable power available for purchase; the 2009 amendments limit grid companies’ responsibility to purchase renewable power only from those renewable power generators that meet certain technical requirements for connection. By including technical standards for connection, the generators and the grid companies are now mutually responsible for ensuring grid stability. Article 11 of the *Renewable Energy Law* states that the State Council standardization body shall establish and issue renewable power grid connection technical standards and other national renewable energy technical product standards.

However, as the SERC noted in a 2011 report, wind power technical standards have been delayed, including national wind power grid connection technical standards and associated standards for collection, connection, and monitoring of wind power (SERC, 2011). The lack of these standards has threatened the safe operation of the grid. In particular, the 2011 SERC report examined the increasing number of major incidents of wind turbines suddenly and unexpectedly going off-line on the grid, causing grid disturbances, noting that there were 80 such incidents in 2010, rising to 193 in the first eight months of 2011 (54 of which involved 100-500 MW going off-line and 12 of which involved over 500 MW going off-line).

Priority Dispatch of Renewable Power

Article 14 of the 2009 *Renewable Energy Law* requires the NEA, SERC, and MOF to set priority dispatch regulations that will give priority to renewable power generators in the electricity dispatch sequence. This

meets the requirement in the 2007 *Full Purchase Measures* that electricity dispatchers give priority to renewable generators in accordance with the relevant national regulations regarding dispatch. Although national regulations regarding dispatch have not yet been issued, a trial “efficiency dispatch” policy was announced in late 2007 pursuant to the *Energy Conservation Law* (State Council, 2007a). Under this policy, the loading order of power-generating units was set based on the level of pollution emitted from the generating unit, with zero-emissions units being dispatched first and the highest emission units being dispatched last. The efficiency dispatch policy is an innovative policy that departs from the general practice in China and most of the rest of the world, in which the dispatch sequence is based on dispatching the units generating electricity at the lowest average cost first.

The trial efficiency dispatch policy started with five provincial pilot projects in Jiangsu, Henan, Sichuan, Guangdong, and Guizhou. These pilot projects were relatively successful and provided provincial and central government officials with priority dispatch experience, paving the way for its inclusion in the amendments to the *Renewable Energy Law*. In Guizhou, for example, a total of 1.35 million tons of standard coal equivalent were saved from January 2008 to September 2008, as a result of the trial dispatch policy (International Energy Network, 2008). Nevertheless, a number of technical and financial issues still exist, for example, one problem is that combined heat and power (CHP) coal-fired power plants are the primary source of heating used in Northern China during the winter months and are considered “must-dispatch” resources to provide heating to citizens. Thus, in practice, CHP power plants are given priority in the dispatch sequence, although wind and other renewable resources would otherwise be given that priority because of their lower emissions. Coal-fired power and hydropower are limited in their ability to match the variable generation patterns of renewable power. Increasing the dispatch of renewable power sources will require the construction of more flexible and active generation sources that can be quickly increased or slowed down to meet peak load or frequency needs, such as natural gas power plants or pumped hydro-electricity storage systems.

FITs and Cost Sharing Measures

FITs guarantee a price that the grid company will pay to the renewable generator, in order to ensure that developers of more expensive renewable generation sources can recover their costs and earn an appropriate profit. Concession programs provide the government with valuable experience in setting an appropriate FIT that is neither too high and thus an inefficient use of public funds, nor too low and thus insufficient to create adequate incentives for investments in renewable technologies. Once a FIT has been set, any further projects permitted through concession bidding cannot exceed the national FIT. The additional cost of the FIT over and above the price of conventional coal-fired power is paid with funds collected through a national electricity surcharge for renewable energy.

In 2006, the NDRC issued the *Interim Measures on Renewable Energy Electricity Prices and Cost Sharing Management (Cost Sharing Measures)*, which directed NDRC’s pricing department to set a nationwide renewable surcharge levied on electricity users at a uniform rate based on the users’ consumption of electricity (NDRC, 2006). The surcharge was set at an initial rate of 0.001 RMB /kWh in May 2006, but with the increase in wind, solar, and biomass power projects and the associated costs of FIT subsidies, the surcharge has had to be increased to 0.002 RMB/kWh for industrial/commercial customers in July 2008 (staying at 0.004 RMB/kWh for residential customers), 0.004RMB/kWh for industrial/commercial customers in November 2009, and most recently, 0.008 RMB for both industrial/commercial and residential customers in December 2011.

Renewable Energy Development Fund

Under the 2009 amendments, the new renewable energy development fund includes both the renewable energy surcharges collected from grid companies and it specified in the original *Renewable Energy Law*, which is funded through central government budget allocations and supports the following activities:

- (1) science and technology research, standard setting and demonstration projects supporting renewables development;
- (2) renewable energy programs for use in agricultural and herding areas;
- (3) construction of independent renewable electricity systems in remote areas and islands;
- (4) renewable energy resource exploration, evaluation, and related information systems;
- (5) promoting the localization of manufacturing for renewable energy equipment (MOF & Finance and Construction Department, 2006).

Projects seeking funding for research and development are required to apply through the national “863” and “973” high-technology development research programs under the Ministry of Science and Technology, which have a long history of funding advanced scientific research in a variety of areas (Osnos, 2009).

In July 2010, MOF appropriated special funds of 200,000,000 CNY to foster the development of ocean energy development for the first time. The funds were issued by the State Oceanic Administration (SOA) to several large scale projects led by some large state-owned enterprise such as CNOOC, Huaneng, Datang, Longyuan, etc. and dozens of research projects in ocean renewable energy development. Participation of enterprises is considered the most significant step to the road of commercialization of ocean renewable energy. This event is considered to be a milestone for China’s ocean energy development and the funds will be evaluated every year thereafter.

Challenges China Continues to Face in Improving its Renewable Energy Policy Framework

Integration Problem of Renewable Power Into the Grid

About 25% to 30% of China’s erected wind turbines are not connected to the grid at any one time, although most eventually will be connected. The lower performance of Chinese wind farms is the reflection of a number of challenges that renewables development has faced in China in recent years, including:

- long delays in connecting wind farms to the grid, due to a lack of coordination between wind farm and grid development planning, as well as a lack of incentives for grid companies to connect to renewables generators;
- lower conversion efficiency of domestic turbines compared to international manufacturers;
- poor integration of wind farms with the grid and grid company curtailment of wind-generated electricity, due to concerns that wind-generated electricity might destabilize the grid.

Low Operating Efficiency

Wind power doubled in capacity each year during the four year period from 2006 to 2009, and wind has grown from a mere 1.3 GW at the end of 2005 to 62.4 GW (grid and non-grid connected turbines) by the end of 2011, which helps China to surpass the US as the country with the most installed wind capacity in the world. However, China’s rapid growth in wind power has been accompanied by significant growing pains, which have exposed areas in which the renewable policy framework can be improved, for example, although China’s installed wind capacity has grown at a rapid rate, the actual amount of electricity generated from the installed

wind turbines has been less impressive. Both China and the US had about 47 GW of grid-connected wind power at the end of 2011, but the US generated 120 terawatt hours (TWh) from its 47 GW of wind farms, while China generated only 74 TWh with the same grid-connected capacity. The difference in performance between US and Chinese wind farms was reflected in the differences between the average capacity factors of US and Chinese wind farms, with US wind farms achieving a 29% capacity factor and Chinese wind farms reaching just 22% in 2011 (Romankiewicz, 2012).

Weakness and Incompleteness in Incentive System

When it comes to China's subsidy to renewable energy investment projects, small scope and little amount are the very foremost problems. Except the project of Delivering Power to Village, most subsidies are symbolic and are less than 10% of the total investment; besides, these subsidies tend to be jammed in their transmission to the lower level of units, making it difficult to reach the lower level of units smoothly. China's force in supporting renewable energy through taxation methods is fairly weak the actual taxation of most renewable energy projects is quite close to that of conventional energy, some even higher than that of conventional energy. This could not present the favorable conditions and policies for renewable energy.

Even as the surcharge rose from 0.001/kW in 2006 to 0.008/kW in 2011, there was a short fall of RMB 1.4 billion in 2010 and RMB 22 billion in 2011. Even with the most recent 0.008 RMB rate, an analysis of the forecasted wind, biomass power, and solar PV FIT payments through 2020 has found that accumulative RMB 710 billion of renewables subsidies will be required from 2011 to 2020 at current subsidy levels, and that the RMB 0.008/kWh surcharge is not sufficient to cover these costs. This suggests that the government will need to raise the surcharge (e.g., to 0.01 RMB/kWh in 2013) or reduce the level of the FITs for certain technologies.

Inadequate Investment in the Technical Research and Development for Renewable Energy

Renewable energy is a technology-intensive and fund-intensive industry. Currently, China has ranked top in terms of investment on renewable energy; the investment reached 0.6 bn USD in 2005, but very small proportion were applied in technical research and development. As statistics shows, China's investment on the research and development of renewable energy took up only 0.045% of the total GDP (gross domestic product), while EU member countries' investment accounted for 2% of the GDP, which is about 44 times higher than that of China. China's technical research and development in renewable energy lack adequate investment, leading to the fact the some advanced techniques and equipment depend much upon importation, for instance, 70% of the wind energy power generation machinery group came from importation in 2005, which is the most important reason why the cost remained high; spathic-silicon materials and raw materials for photovoltaic cell must depend upon importation, leaving the industrial development at a slow pace and its future not so promising.

Comparisons With the EU and US Renewable Energy Policy Frameworks

EU's Renewable Energy Legal and Policy Framework

Based on the roadmap and a public consultation, the EU in 2009 adopted a new comprehensive renewable energy directive (the 2009 renewable energy directive), covering renewable energy in the electricity, transportation, and heating and cooling sectors, and setting mandatory targets for EU member states based on the overall targets of obtaining 20% of gross final energy consumption from renewables and 10% of transportation fuels from renewable fuels by 2020 (European Parliament and European Council, 2009). The

directive requires member states to implement measures to support the development of renewable energy to meet their renewable energy targets. The 20% renewables target is a part of a larger “20 to 20 to 20” energy and climate package adopted by the European Commission in December 2008 which aims to reduce EU greenhouse gas emissions by 20% from 1990 levels, increase renewables to 20% of final energy consumption, and reduce primary energy consumption by 20% of projected 2020 levels through energy efficiency, all by 2020 (European Commission, 2010).

In allocating the 20% mandatory renewable energy target to individual EU member states, the 2009 renewable energy directive notes that the starting point, the renewable energy potential, and the energy mix of each member state vary, and that it is thus appropriate to share the required total increase in the use of energy from renewable sources on the basis of an equal increase in each member state’s share weighted by their GDP, modulated to reflect their starting points, and by accounting in terms of gross final consumption of energy, with account being taken of member states’ past efforts with regard to the use of energy from renewable sources. The targets set for each of the 27 member states range from 10% (Malta) to 49% (Sweden)

With regard to grid connection, the 2009 renewable energy directive states that, subject to requirements relating to maintaining the reliability and safety of the grid, member states shall provide renewable energy sources with priority or guaranteed access to the grid and also provide them with priority dispatch. Member states are to take measures to minimize the curtailment of renewable electricity generators; if significant measures are taken to curtail renewable generators in order to protect the security of the system, member states are to ensure that the responsible system operators report the curtailment measures to the relevant competent authority and the corrective measures they intend to take to prevent inappropriate curtailments.

In Germany, the *Renewable Energy Sources Act* (Erneuerbare Energien Gesetz or EEG) provides for differential FITs based on the cost of generation of various renewable energy sources (solar, offshore and onshore wind, geothermal, hydro, biomass and landfill gas, sewage gas, and mine gas (Retrieved from www.erneuerbare-energien.de/files/pdfs/allgemein/application/pdf/eeg_2009_en.pdf). The level of FIT payments are also differentiated by project size, with lower payments made to larger projects to account for their greater profitability, due to economies of scale and to encourage smaller distributed generation as well as larger utility-scale projects. The German system also provides for tariff degression in most cases, whereby the amount of the FIT available for a particular renewable energy source is lowered over time based on expected cost reductions in the technology; FITs for rapidly developing technologies, such as solar and offshore wind, have a greater decreasing rate, since their costs are expected to drop more quickly than more mature renewable technologies such as wind and hydro (Couture, Cory, & Williams, 2010).

United States’ Renewable Energy Legal and Policy Framework

Compared to the EU and China, the United States presently has relatively less national guidance and policy support to promote the deployment of renewable energy, with no mandatory national targets for renewable energy and no national FITs or renewable energy standards (RES), although national RES legislation has been proposed in congress several times in the last decade.

Instead, at the federal level, the primary means for promoting the deployment of renewable energy has been through federal production and ITC, and more recently under the *American Recovery and Reinvestment Act*, through a direct cash grant program known as the “1603 Treasury Grant” program. The Production Tax Credit (PTC) program was first established under the *Energy Policy Act* of 1992 and in 2010 provided

qualifying renewable energy project owners with a tax credit of \$22 per MWh of electricity generated for wind, closed-loop biomass, and geothermal, or \$11 per MWh for open-loop biomass, qualified hydroelectric, landfill gas, municipal solid waste, marine, and hydrokinetic power. The incentive is production-based, such that the more electricity that is generated, the greater the tax credit gained. The PTC generally lasts for a period of 10 years, with the value of the tax credit provided rising for inflation (Bolinger, Wiser, Cory, & James, 2009). The investment tax credit (ITC), created in the *Energy Policy Act* of 2005, reduces federal income taxes for qualified renewable energy project owners based on the capital investment value of the project, and in 2010 provided a 30% tax credit for solar, small wind, and fuel cells, and 10% for geothermal, CHP, and micro turbines, subject to certain maximum incentives.

With the economic downturn in 2008, banks which had previously used their investments in renewables projects to take advantage of the PTC found their future profitability uncertain, making investments using the PTC less attractive and leading to a sharp downturn in the availability of tax equity capital. In order to avoid a sudden downturn in investments in renewable energy, the *American Recovery and Reinvestment Act* of 2009 created a new “1603 Treasury Grant” program, providing qualified project developers with cash grants equivalent to 30% of the capital expenditure of a project in lieu of production or ITC. The first cash grants were issued in September 2009 and the program has managed to provide an incentive for project investors sufficient to avoid a serious reduction in renewable energy investment. The “1603 Treasury Grant” was extended in December 2010 for an additional year.

As a result of the relative lack of a consistent renewable energy policy framework at the federal level, much of the policy support for renewable energy in the United States has taken place at the state level, through RPS and, to a lesser extent and more recently, state FITs. As of May 2010, 29 states plus the District of Columbia have established RPS, which set a mandatory target for a utility to obtain a certain percentage of its retail electricity sales (or generating capacity) from renewable energy sources or purchasing renewable energy credits. In addition, six states have non-binding renewable energy goals (Database of State Incentives for Renewables & Efficiency, 2010). California has been one of the most ambitious RES in the nation: Investor owned utilities are required to reach an additional 1% of retail sales per year from renewable sources, with a target of 20% by 2010, and all utilities are required to achieve 33% of their electricity from renewables by 2020 (Retrieved from www.lw.com/Resources.aspx?page=FirmPublicationDetail&publication=3769).

Effectiveness and Efficiency of FITs and Quotas in the Europe

FITs are generation-based and price-driven incentives. The price per unit of electricity that a utility, supplier, or grid operator is legally obligated to pay for electricity from renewable energy sources in the electricity (RES-E) producers is determined by the system. Thus, a federal (or provincial) government regulates the tariff rate. It usually takes the form of either a fixed amount of money paid for RES-E production, or an additional premium on top of the electricity market price paid to RES-E producers. Besides the level of the tariff, its guaranteed duration represents an important parameter for an appraisal of the actual financial incentive. FITs allow technology-specific promotion as well as an acknowledgement of future cost-reductions by applying dynamic decreasing tariffs.

Figure 1 gives an overview on the economic level of FITs for electricity from onshore wind between 2003 and 2005. It can be seen at a glance that the range is rather broad. In 2005, it varied between about 60 and 90 EUR/MWh which is mainly due to differences in wind conditions in different countries.

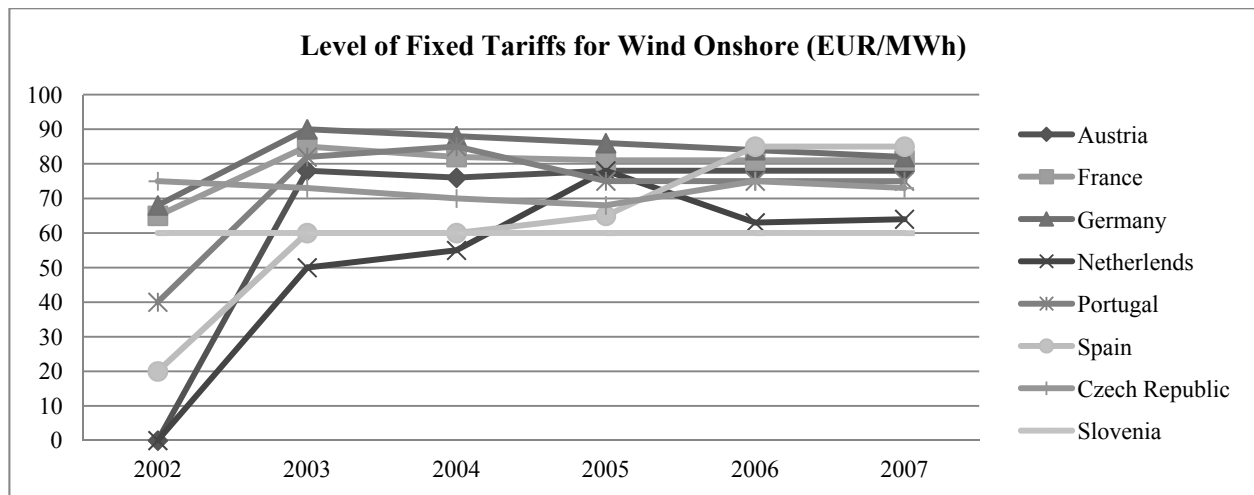


Figure 1. Example: Level of fixed FITs for electricity from wind onshore in some European countries. Source: Held, Haas, and Ragwitz (2006).

Quota obligations based on tradable green certificates (TGCs) are generation-based and quantity-driven instruments. The government defines targets for RES-E deployment and obliges a particular party of the electricity supply-chain (e.g. generator, wholesaler, and consumer) with their fulfillment. Once defined, a parallel market for renewable energy certificates is established and their price is set following demand and supply conditions (forced by the obligation). Hence, for RES-E producers, financial support may arise from selling certificates in addition to the revenues from selling electricity on the power market. With respect to technology-specific promotion in TGC systems, this is also possible in principle.

Quota-based systems are now in place in six EU countries, in the U.S. as RPS in about 20 states (and the District of Columbia) and also in Japan. Figure 2 gives a comparative overview on the prices of TGC in the last years. The most important perception is that with the exception of UK, no recognizable decrease took place.

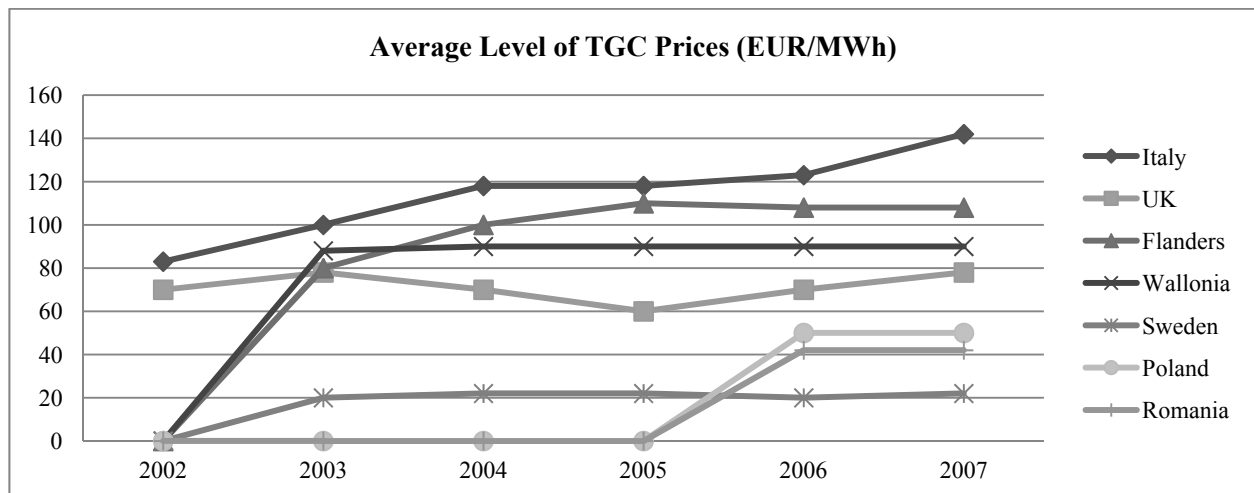


Figure 2. Comparison of premium support level: Value of TGCs. Source: Ragwitz et al. (2007).

Reviewing the two renewable policies described above, the core question is whether these policies have been successful or not. To assess the success, the most important criteria are:

- effectiveness: Did the policies lead to a significant increase in deployment of capacities from renewable energy resources in the electricity (RES-E) in relation to the additional potential? The effectiveness indicator measures the relation of the new generated electricity within a certain time period compared to the corresponding potential of the technologies;
- economic efficiency: What was the absolute support level compared to the actual generation costs of RES-E generators and what was the trend in support over time? How is the net support level of RES-E generation consistent with the corresponding effectiveness indicator?

Effectiveness of Policy Instruments

Firstly, the effectiveness of policy instruments is analyzed by looking at the quantities installed. Figure 3 depicts the policy effectiveness for electricity generation from all “new” RES from 1998 to 2005 measured in the incremental amount of RES-E per year and capita. Clearly, it was highest in Denmark with about twice as high renewable electricity deployed than the next ranked countries Finland, Sweden, Spain, and Germany. It should be noticed, however, that since 2003, the net increase in wind power capacity has been close to zero in Denmark. It is of interest that among these countries, quite different promotion schemes exist: a quota-based TGC system in Sweden, investment incentives in Finland, and FITs in the other countries.

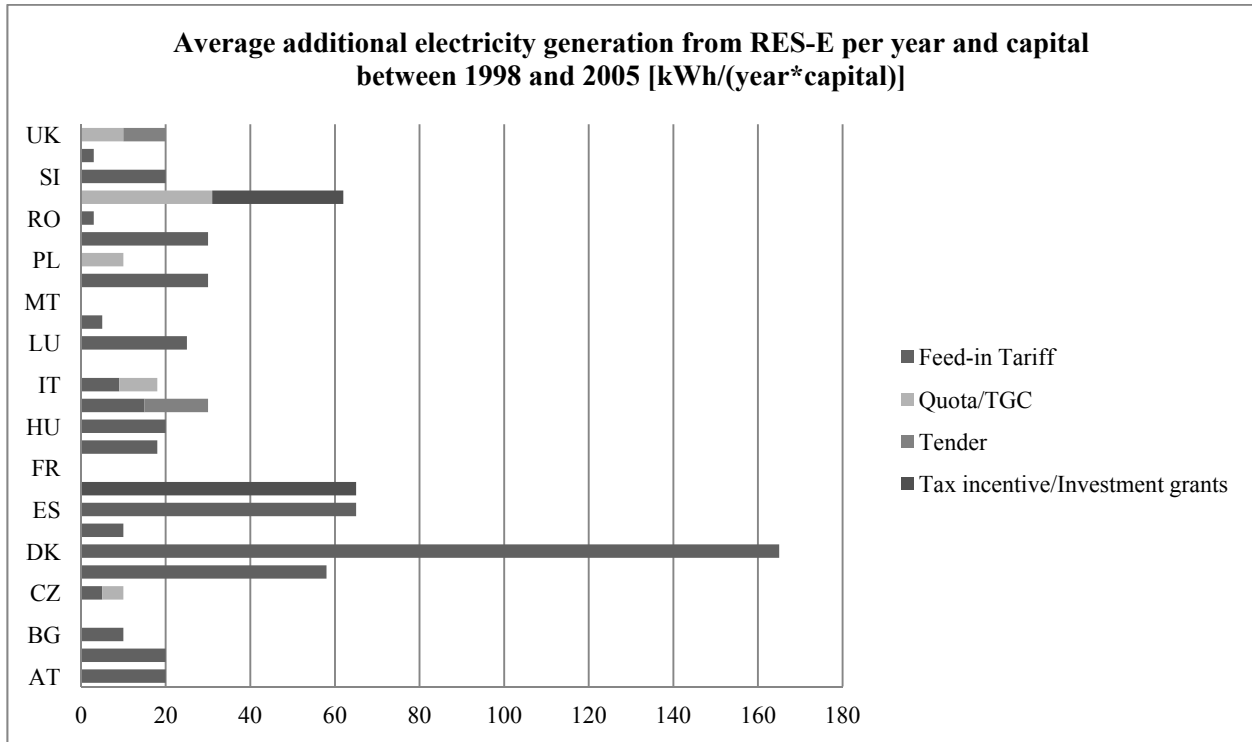


Figure 3. Policy effectiveness of support measures for electricity from “new” RES (excl. hydro) measured in additional kWh per year and capita for the period from 1998 to 2005 in the EU. Sources: Harmelink, Voogt, and Cremer (2006).

It is clearly noted that countries with FITs as support scheme achieved higher effectiveness compared to countries with a quota/TGC system or other incentives. Denmark achieved the highest effectiveness among all member states, but again it has to be mentioned that hardly any new generation plants have been installed in recent years, whereas the opposite happened in Germany and Portugal, with a strong increase in the recent past.

Among the new member states, Hungary and Poland have implemented the most efficient strategies in order to promote “new” renewable energy sources. Since Figure 4 depicts the effectiveness indicator for the total renewable electricity, the following figures demonstrate the effectiveness by technology.

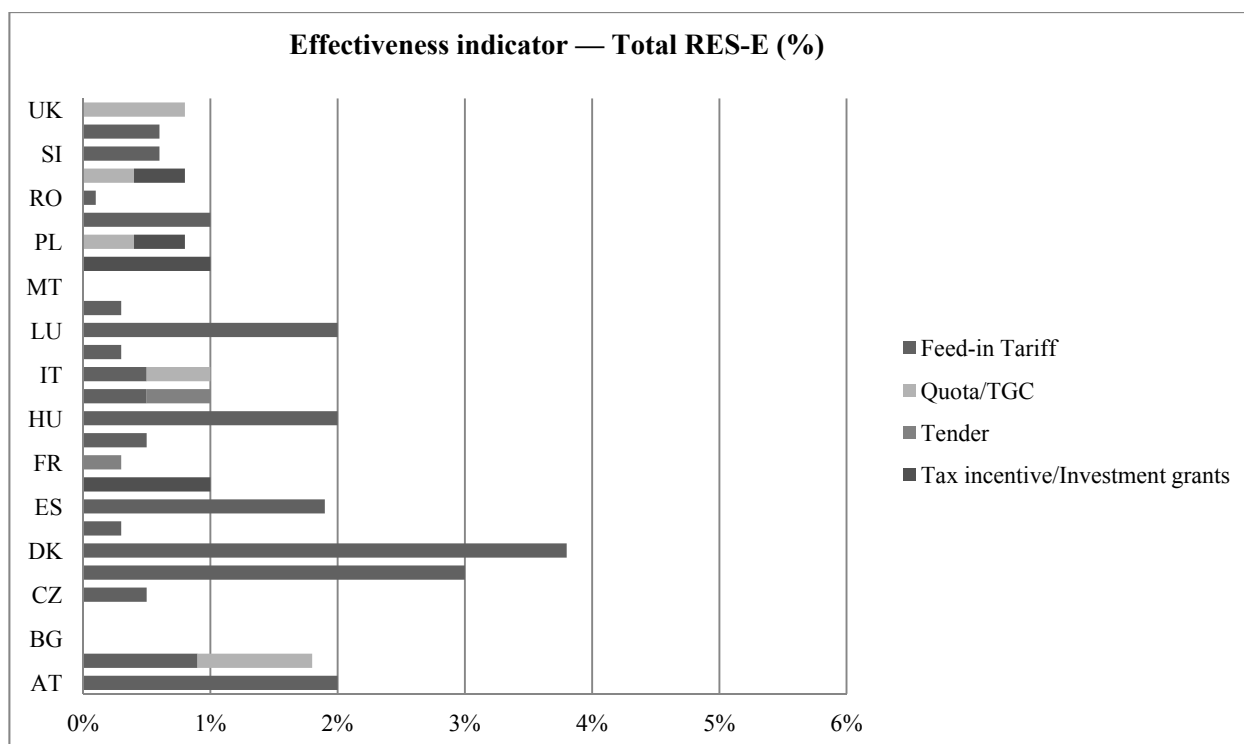


Figure 4. Policy effectiveness of total RES-E support for the period from 1998 to 2005 measured in yearly additional electricity generation in comparison to the remaining additional available potential for each EU-27 member state. Sources: Harmelink et al. (2006).

Economic Efficiency

In this context, three aspects are of interest: absolute support levels, total costs to society, and dynamics of the technology. As an indicator in the following, the support levels are compared for wind power in the EU-27 specifically.

Figure 5 shows that the support level and the generation costs are mostly very close. Countries with rather high average generation costs frequently show a higher support level. A clear deviation from this rule can be found in the three quota systems in Belgium, Italy, and the UK, for which the support is presently significantly higher than the generation costs. The reasons for the higher support level expressed by the current green certificate prices may differ. Main reasons are risk premiums, immature TGC markets, and too short validity times of certificates (Italy and Belgium). For Finland, the level of support for wind onshore is too low to initiate any steady growth in capacity.

Figure 6 and 7 illustrate a comparatively overview of the ranges of TGC prices and premium FITs in selected EU-27 countries. With the exception of Sweden, the TGC prices are much higher than the premium received by the investors, if guaranteed FITs are eligible, explaining also the high level of support in these countries as it is demonstrated in Figure 6. Additionally, a trend towards more efficient designs in FITs in the recent past becomes obvious. However, this trend has not yet been noticed in quota markets based on TGCs.

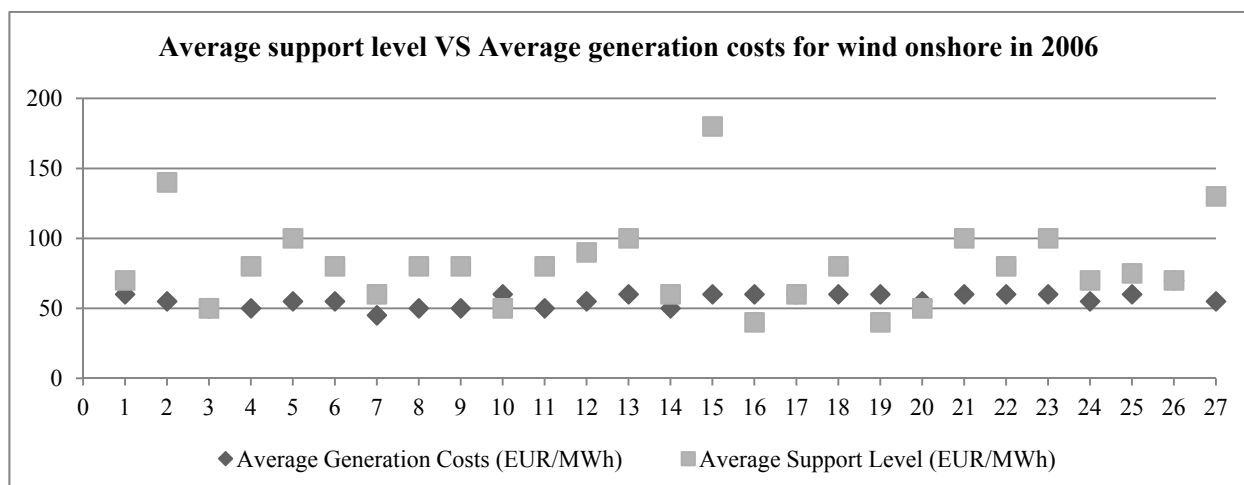


Figure 5. Wind onshore: Support level ranges (average to maximum support) in EU countries in 2006 (average tariffs are indicative) compared to the long-term marginal generation costs (minimum to average costs)—Support level is normalized to 15 years. Source: Ragwitz et al. (2007).

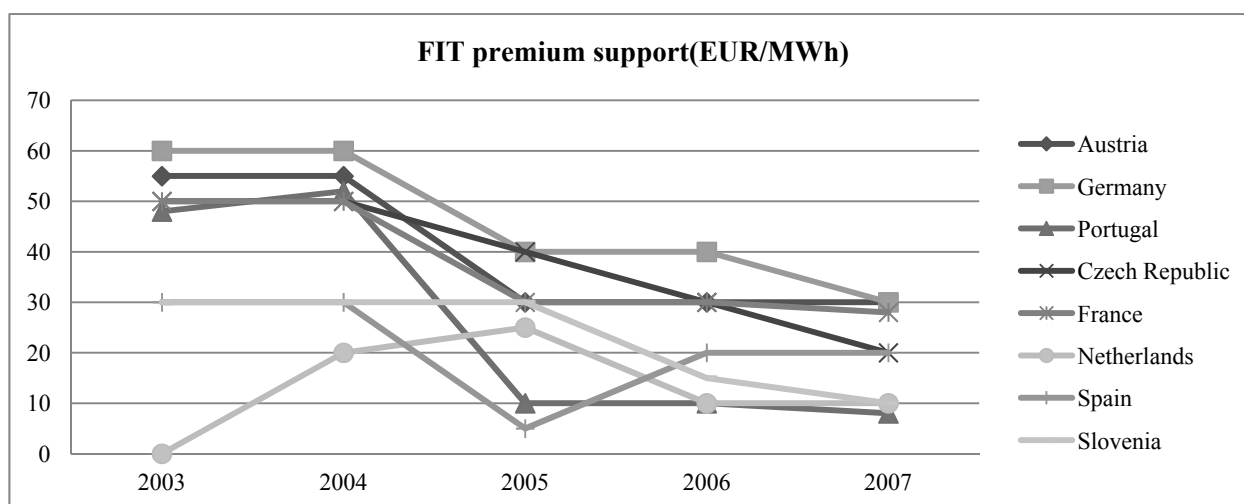


Figure 6. Comparison of premium support level: FIT-premium support. Source: Van Der Linden et al. (2006).

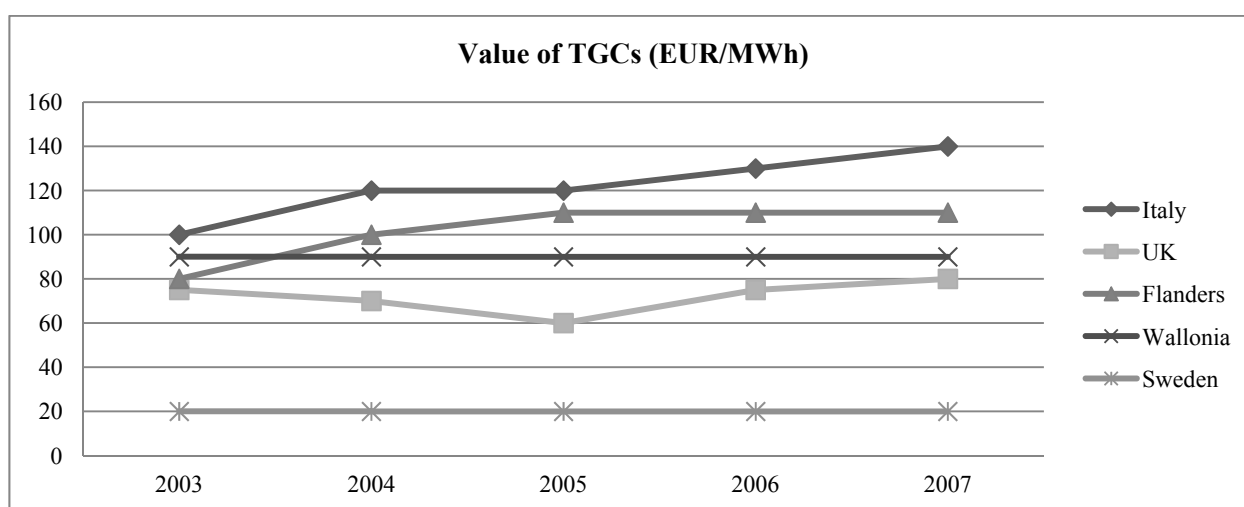


Figure 7. Comparison of premium support level Value of TGCs. Source: van der Linden et al. (2006).

Comparison of Effectiveness and Financial Indicators

It is often argued that the reason for higher capacities installed is a higher support level. Although it should be noted that the resource endowments of RES vary depending on each country, as can be seen from Figure 7, actually the opposite is true. The countries with highest support levels—Belgium and Italy—are among those with the lowest specific deployment. Meanwhile, high FITs especially in Germany are often named as the main driver for investments especially in wind energy. However, the support level in Spain and Germany is not particularly high compared with other countries analysed here.

Figure 8 compares the effectiveness indicator, defined as new generated electricity within one year to the additional potential of RES-E, to the net support level of total RES-E technologies, excluding hydro plants between 2005 and 2006. Notable are that higher efficient countries as Austria, Germany, Portugal, or Spain have introduced FITs, whereas countries with less effectiveness and high support, as Italy, Belgium, and UK operate a quota system.

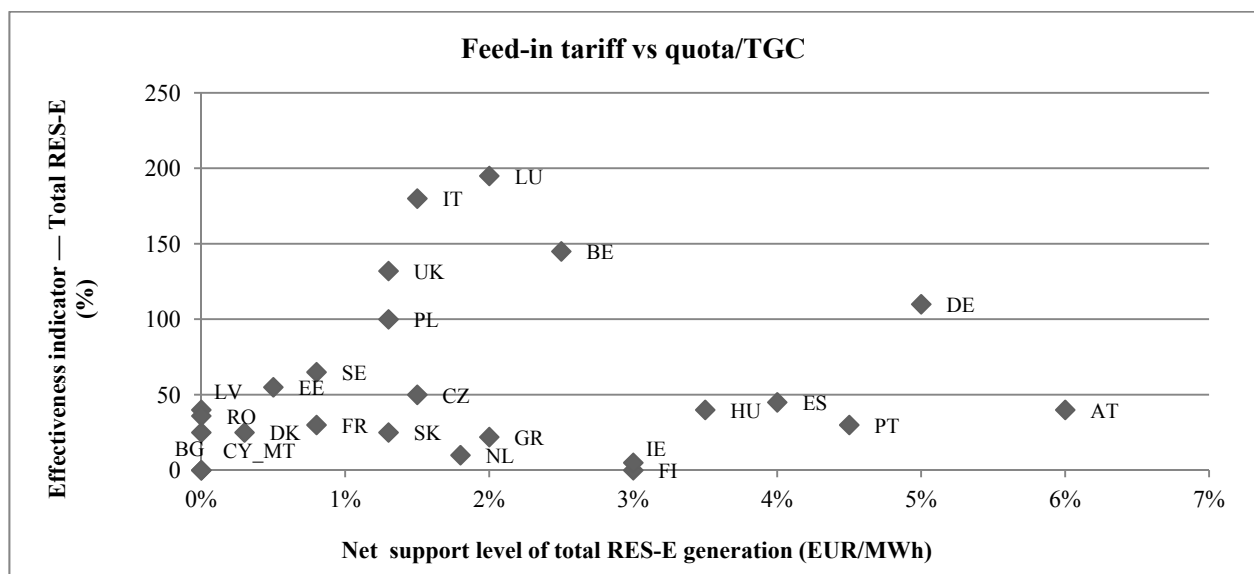


Figure 8. Effectiveness vs. net costs of promotion programs for electricity from RES in EU-27 countries (2005–2006). Source: Ragwitz et al. (2007).

As a general conclusion, it can be stated that the investigated feed-in systems are effective at a relatively low producer profit. In contrast, it can be observed that the present quota systems only achieve rather low effectiveness at comparably high profit margins. It is important to know that these quota systems are relatively new instruments in all the countries currently using them. Therefore, the observed behavior might still be characterised by significant transient effects.

Recommendations for Enforcement of the Renewable Energy Law

Implementation of the Renewable Power Quota System

Interactions between the renewable power quotas and FITs. Given that the quotas will be implemented in a policy framework which already uses FITs to promote the development of renewable power sources, Chinese policymakers will need to consider how the new renewable power quotas will interact with the FIT system. Although countries around the world have tended to rely on one or the other policy to incentivize

renewables growth, i.e., either requiring utilities to meet a quantitative target for renewables as a share of total energy or electricity consumption or guaranteeing a price for electricity from renewable, the policies can complement and support each other (Cory, Couture, & Kreycik, 2009; Azuela & Barroso, 2011), for example, the level at which China's various FITs are set may incentivize some forms of renewables development over others; developers, for example, based on the higher value of the FIT and other reasons, may prefer to develop solar PV over biomass power. This may affect the costs for the government in paying for FIT payments as developers, grid companies, and provinces seek to meet their renewable power quotas.

Tracking compliance with the renewable power quotas and piloting REC trading programs. The draft *Renewable Power Quota Regulations* does not provide for trading of renewable energy certificates. This makes sense, given that China will need to gain experience with tracking progress in meeting the quotas by generators, grid companies, and provincial-level governments. The draft requires generators and grid companies to report their progress on a monthly basis and requires the NEA to publish a report on the performance in meeting the quota targets. To ensure timely and accurate filing, the NEA's report should be made public and that generators, grid companies, and provincial-level governments will be subject to substantial penalties for submitting false or misleading information. Cross-checking the data submitted by each of the entities within a jurisdiction will also help to ensure the integrity of generation data for both the renewable power quota system and the FIT payments system.

In the future, a REC trading system could allow grid companies and generators to trade renewable energy credits depending on the excess or shortfall in meeting their quotas. A trading mechanism could increase economic efficiency in meeting renewable generation targets by increasing the flexibility of grid companies and generators to meet their targets. It would allow grid companies and generators in areas with less renewable resources, such as Beijing and Shanghai, to meet their target obligations by purchasing RECs from areas with rich renewable resources, such as Inner Mongolia. However, an adequate legal and regulatory infrastructure must be in place and reliable generation data must be available for such a trading scheme to be successful and to prevent gaming of the system. While it may be premature to institute a nationwide REC trading scheme in the near-term, a pilot trading scheme could be developed to help lay the groundwork for implementing a national trading system in the mid to long term.

Strengthening compliance with the quotas through sufficiently strong penalties. The draft *Renewable Power Quota Regulations* does not specify a penalty for non-compliance in meeting renewable power quotas, but progress in meeting the renewable power quota targets will be used by the central government in their performance evaluations of state-owned generators, grid companies, and provincial/municipal governments. Performance evaluations of government officials—which determine whether officials are rewarded or penalized, based on their performance in meeting economic, social, and environmental targets—have proven to be one of the most effective tools for implementing China's centrally determined targets at the provincial and local level. Beginning in the *Eleventh Five-year Plan*, the target responsibility and evaluation system has been used to effectively motivate government officials and state-owned enterprises to meet the energy intensity and pollution reduction targets assigned to them (State Council, 2007b). This system will be helpful in motivating generators, grid companies, and provincial officials to meet their renewable power quota targets. However, the target responsibility and evaluation system alone may not be sufficient to ensure compliance with the renewable power quotas.

Priority Dispatch, Defining Conditions for Permissible Curtailment, and Development of Technical Standards

Grid operation issues raised by priority dispatch. China has experimented with priority dispatch in five provinces since 2007. The implementation of priority dispatch can be technically difficult, because of the general non-storability of electricity and the intermittent nature of renewable energy resources. Since electricity generated by a wind farm typically cannot be stored for future use, it must be dispatched entirely at the moment it is produced, even if this occurs during a period of low demand. The dispatcher must meet energy demand with a sufficient amount of energy supply even as demand fluctuates throughout a single day. If, for example, a wind farm is the first power generator in the dispatch sequence, the dispatcher will need to know the exact amount of wind power being produced as soon as possible in order to successfully match power supply and demand; otherwise, priority dispatch could lead to power outages and compromise the stability of the entire grid network.

Defining permissible curtailment conditions and appropriate compensation to generators. Germany's priority dispatch experience could be useful for China in considering how to set its own policy. Under the 2008 amendments to the *German Renewable Energy Sources Act*, grid system operators must immediately and as a priority purchase, transmit and distribute the entire available quantity of electricity from renewable energy sources (Retrieved from www.erneuerbare-energien.de/files/pdfs/allgemein/application/pdf/eeg_2009_en.pdf). However, as a result of these amendments, the priority connection and purchase system was changed from an unconditional system to a conditional one, in which there are exceptions in certain defined circumstances by which the grid is permitted to take technical control over installations connected to the grid. As a result of these changes, grid companies are now permitted to force the curtailment of power generated from renewable facilities with a capacity of over 100 kW, if all of the following conditions are met:

- (1) The grid would otherwise be overloaded, if curtailment were not to take place;
- (2) The grid has ensured that the largest possible quantity of electricity from renewable sources and CHP is already being purchased;
- (3) The grid has reported the current situation to the relevant region of the grid system.

Notably, the German law includes a hardship clause which states that even if the grid is permitted to curtail generation in situations that meet the above three requirements, the grid is still required to compensate the renewable generator for the curtailment, on the basis of either a negotiated price or, in the event an agreement cannot be reached, the FIT price minus the expenses saved by the generator as a result of the curtailment.

Developing technical standards for interconnection. Developing compulsory national standards for wind, solar, and other renewable interconnection can help improve grid stability as well as promote the development of renewable technologies. The development of national grid codes in the United States has helped to advance wind turbine technologies that ultimately make it easier to integrate wind projects into the grid (Federal Energy Regulatory Commission, 2005). Although grid standards around the world vary in many respects, there are certain common features of successful grid standards for wind power in the United States and Europe. In addition to low voltage ride through (LVRT) capability, which is mandatory in China at the end of 2011, other grid codes around the world require that wind turbines have certain technical capabilities to maximize grid stability, such as the capability to (1) maintain a particular power factor and (2) remote supervisory control and data acquisition (SCADA) capability.

Developing a More Advanced FIT System and Distributed Generation Policies

Besides using FITs to support renewables development, China should consider developing more advanced FIT schedules, for example, China could consider including tariff degression in its FIT schedules for various technologies, similar to Germany, based on the best available estimate of the declining costs of renewable technologies. Current FIT schedules do not provide any detail on how the on-grid price may be adjusted in the future: China's solar photovoltaic FIT set in July 2011, for example, simply states that the government will adjust the tariff in the future based on changes in investment capital and technological improvements. Providing a tariff degression schedule would provide generators, grid companies, and manufacturers with a better idea of future subsidy support and allow them to better plan for future renewables development. It would also help the government to control the costs associated with FIT subsidies for renewable power development. China could also consider setting a reasonable cap on the total payments made for FITs for particular technologies on an annual basis, in order to avoid overly rapid development and promote a more sustainable development model. This could help China to avoid the recent boom-bust growth patterns seen in some EU countries, which provided generous FITs for solar photovoltaic, but then greatly reduced the subsidies following the economic downturn.

China could also differentiate FIT payments based on project size, with higher payments made to smaller projects to encourage the development of distributed generation. China is in fact developing draft distributed generation regulations, which could expand the use of renewable technologies, particularly solar photovoltaic, in cities, including industrial, commercial, and residential rooftop appliances. The draft distributed generation regulations foresee the implementation of net metering as well as FIT and installation incentives for distributed generation sources. Developing distributed renewable electricity sources would help to complement China's focus on larger, utility scale renewables projects, and could reduce the need to build transmission capacity from China's wind and solar resource rich western areas to its eastern electricity demand centers by developing models favoring localized production and consumption of renewable electricity.

Guarantee the Electricity Consumer's Right of Choice

China's existing renewable policy focuses on the supply side and ignores the other side of the market: consumers. Currently, as a result of heightened environmental consciousness, more and more consumers, including industrial and commercial users, are willing to pay a higher price for renewable electricity.

Currently, consumers' green purchasing power has not been effectively tapped in China. The *Renewable Energy Law* encourages electricity consumers to purchase renewable electricity at a higher price. However, again, no administrative orders or guidelines have been issued to make sure that electricity consumers can get renewable electricity when they ask for it. That is to say, utilities have no obligation to offer their customers the choice of buying green electricity—a situation quite different from that in the US, where a mandatory green power option has been implemented in several states. The mandatory green power option has proven to be a powerful tool for encouraging renewable development. With this policy, all utilities in the state are required by law to offer its customers the choice of opting to buy green power. If Chinese electricity companies were required to offer renewable, the purchasing power of millions of green consumers would create additional market incentives and pressure for electricity companies to development renewable energy.

Conclusions

China has achieved remarkable improvement for its renewable energy resources, since it firstly enacted *Renewable Energy Law* in 2005. About seven relevant policies have been put forward, which include

feed-in-tariffs, quotas, priority dispatch, technical standards, mandatory connection and purchase, and etc.. However, the government also faces a few challenges such as the integration problem of renewable power into the grid, and low operating efficiency during implementation. The motivation of this paper is to provide insightful recommendations for improving the current renewable energy policies in China. By comparing renewable energy policy frameworks in the EU and United States, feed-in-tariffs and quotas are two main measures that are adopted by western countries. After a detailed performance review of those two policies in effectiveness and efficiency, the significance of policy interactions between feed-in-tariffs and quotas is straightforward. More specifically, the government is advised to strengthen compliance with quotas and pilot renewable energy certificates, develop priority dispatch and technical standards for interconnection, put forward a more advanced feed-in-tariff system and distributed generation policy, and ultimately guarantee the electricity consumer's right of choice.

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Management Studies

Volume 3, Number 3-4, April 2015

David Publishing Company

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ISSN 2328-2185



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