

# Language Structure and Its Effects on Innovation

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## Introduction

Recent studies in a wide range of fields have related language to a number of characteristics including trust, cognition, perception, and sense-making. Language is a key aspect of international business, but thus far it has been studied mainly from a cross-cultural perspective (Brannen, Piekkari, & Tietze, 2014). In this paper, we argue that the effects of language run much deeper and can affect real aspects of national competitive advantage. In particular, we demonstrate that language structure affects a nation's innovation performance. This insight is novel and relevant for both theoretical and practical aspects of international business, with particular significance for enterprise-oriented global innovation strategies as well as for tailoring government policies and regulations.

Understanding the different levels of innovative output between countries has been a major issue of interest for academics, practitioners, and policymakers alike. What factors allow certain nations to attain and maintain competitive edge, positioning themselves as global innovation leaders? Responses to this question have led governments and agencies worldwide to adopt a wide range of policies as they seek to stimulate their domestic economies, enhance military strength, and attain global influence and independence. Similarly, multinational corporations and other global business actors continuously evaluate nations' relative capacity and positioning vis-à-vis innovation. These business players actively utilize this knowledge when they develop strategies to source and cultivate new technologies and ideas, locate research and development infrastructure, procure human capital and intellectual property assets, and optimize international networks of cooperative alliances and joint ventures. On a more conceptual level, academic researchers have evaluated a wide-range of innovation-related stimuli and developed a number of related constructs and theories. The complexity and multidimensionality of this research,

combined with its relevance for practitioners and policymakers, presents both challenges and prospects for academics. Innovation research continues to gain relevance and popularity among scholars in many disciplines related to management and international business, fostering and cultivating relevant new insights and propositions.

There is presently an established, well-documented association between innovation productivity and countries' institutional environment, political structure, geographic locus, and relative level of economic development. The empirical evidence clearly indicates that the worldwide output of knowledge-intensive technologies and processes is concentrated in specific regions, where it is reflected in the comparative levels of R&D investment and patenting, as well as how the global network of corporate alliances and other cross-border cooperative ventures is configured. General observation indicates that the most innovative countries tend to be wealthier and more economically-developed, such as the United States, Japan, or Germany. A closer look, however, reveals that there is substantial heterogeneity the innovative productivity of nations with comparable socioeconomic measures. For example, why has Malaysia generated 3.4 times more patenting activity than Poland in the past several years, despite its smaller population size and lower estimated GDP per capita? Similarly, why did Finland generate 3.6 times more patenting activity than Norway in the past several years, despite its generally comparable population size, location, and socio-economic structures but much lower estimated GDP per capita? Therefore, a close analysis indicates that countries' relative level of innovative productivity is much more complex than a mere reflection of differences in population size, institutional environment, political structure, geography, or economic development. What other factors contribute to the topology of global innovation, and is there a connection between concentration of knowledge-intensive development efforts and the cultural attributes derived from linguistic influence on cognition?

Language is one of the most important features that changes discontinuously at national borders (Beugelsdijk & Mudambi, 2013). Grammatically, languages differ widely in the way they separate genders, encode time, address hierarchies (age or status-related), and differentiate between individual and collective emphases. The role of languages in the formation of societies and in general societal behaviors has been evaluated over the past couple of centuries and documented in several fields of scholarly studies, and in practice (Whorf, 1956). However, only recently have scholars initiated efforts targeted at understanding the specific association between language structure and *managerially relevant* individual and societal behaviors. This stream of research evaluates how the cognition-related impact of linguistic structure leads to differentiated outcomes, thereby effecting global economic behavior and policies. For example, Chen (2013) finds that languages with a grammatical association of future and present influence future-oriented societal behaviors such as savings, retirement planning, smoking, safe sex, and avoiding obesity. Other recent empirical studies recognize that countries where the language's structure emphasizes gender have lower female participation in senior management occupations, and are more likely to regulate women's involvement in politics (Santacreu-Vasut et al., 2013, 2014). The formality of language structures has also been found to influence power dynamics in international teams (Tenzer & Pudenko, 2017).

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These findings highlight the importance of understanding the effects of language structure in cross-cultural and cross-national business communications and activities. Connecting linguistics and innovation, two major areas of research that are integral to international business, presents an opportunity that is both interesting and managerially relevant. In this essay, we specifically examine language structures that reflect (1) gender distinctions, (2) emphasis on individualism/collectivism, and (3) hierarchy differentiation, and evaluate the effect of these

linguistic differentiations on nations' patenting productivity and performance. Scholars in the fields of linguistic and anthropology have evaluated these three particular language categories in great detail. They have accumulated a comprehensive database of grammatical information that encompasses a very large number of global languages, thus enabling the feasibility of this study. Furthermore, in our opinion, prospective theoretical mechanisms that relate differences vis-à-vis these specific three grammatical categories and innovation-related behaviors can be formulated and understood in a more intuitive manner, when compared to available alternatives. Our findings demonstrate that there is a significant correlation between these variables, illustrating an association between language structure and innovation.

## Preliminary Analysis and Takeaways

To measure the effect of linguistic diversity on people's propensity and capacity to innovate, we created language indices that reflect gender distinctions, emphasis on individualism/collectivism, and hierarchy differentiation. We then evaluated the correlation between these indices and the aggregate country-specific per-capita patenting activity for a five-year period from 2008 to 2012.

### Gender Distinction

We expected higher level of gender discrimination within language structure to be negatively correlated with innovative output. We anticipated such association to be driven by the way such language structures cognition, thus effecting societal norms and behaviors in a manner that restricts female participation in various socio-economic activities, including those that contribute to innovation. Results of our study are consistent with these expectations. Specifically, correlation between the gender index and the per-capita distribution of patents is about -0.20, *indicating that innovative output is lower in countries where language structures are more gender discriminative.* Figure 1 displays this association. Notably, if we exclude Israel from analysis, the suggested association becomes meaningfully stronger with correlation between gender indices and the per-capita distribution of patents of about -0.3. Israel is a distant outlier with very high per capita patent output and highly discriminative language structure with respect to gender. These results suggest that a greater level of sex-based grammatical discrimination has a negative effect on the speakers' capacity for innovation. This finding complements previously referenced studies that identify the association between gender-based language structure and female participation in politics and in senior management occupations. If innovation productivity, is, in fact, among the effected behavioral variables, then understanding the nature and magnitude of this effect has an important strategic relevance to business disciplines and to a wide range of associated partakers.

### Emphasis on Individualism/Collectivism

We expected higher emphasis on individualism within language structure to be positively correlated with innovative output. We theorized that such linguistic emphasis influences cognition and asserts a favorable effect on creativity, thus affecting societal behaviors in a manner that stimulates knowledge-intensive development activities. Results of our study are consistent with these expectations. Specifically, analysis of patenting activity against the individualism/collectivism linguistic index indicates that *residents of countries with an individualistic language structure tend to innovate more than those from countries where language structure reflects a greater emphasis on collectivism*. The positive correlation of 0.34 shown in Figure 1 is significant and exemplifies this association. This finding provides further support to the view that language structure, in fact, influences economically important societal behaviors. Understanding of this relationship has relevance not only to organizations' global innovation strategies, but also to governmental efforts of developing policies and regulations aimed to enhance countries' economic and strategic positioning and performance.

### Hierarchy Differentiation

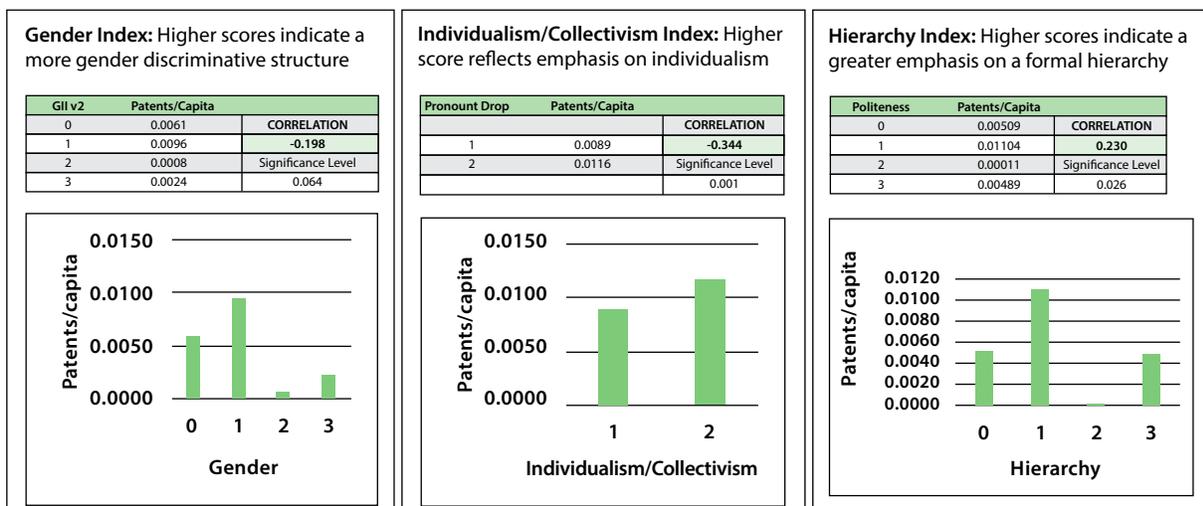
We expected higher level of hierarchy within language structure to be negatively correlated with innovative output. Our rationale was similar to that for the Individualism/Collectivism emphasis. We anticipated that a greater level of formal hierarchy within language structure influences cognition in a manner that inhibits creativity, thus inducing a negative effect on innovation productivity. The results of our study, however, contradict this hypothesis. Specifically, linguistic index of hierarchy has a positive 0.23 correlation with per-capita patent output, indicating that *countries with more hierarchical language structures are associated with a higher output of innovation*, as illustrated in Figure 1. This finding is puzzling, and we have not yet developed a sound theoretical mechanism for such potential

association. One possible explanation is that a greater level of formal hierarchy within language structure influences cognition in a manner that has a favorable effect on path-dependent thought processes, which, in turn, may have a favorable effect on innovation-related developmental behaviors. Another possibility is that our results are effected by the omitted variable bias, whereby the observed positive correlation is influenced by another variable that has a favorable effect on innovation productivity and that also correlates with our linguistic hierarchy differentiation index. We hope that a more comprehensive research on the topic will lead to a better understanding of this relationship.

### Relevance and Implications

The preliminary findings from our analysis indicate that there may indeed be an association between language structure and innovation. These insights have important relevance to the IB field, since identifying a source strategic advantage is a crucial first step for government agencies, multinational firms, and other global business stakeholders in their efforts to enhance strategic positioning and performance. If language structure, in fact, influences innovation output, then governments and businesses can utilize this knowledge to identify processes, develop strategies, and enact policies that either address or leverage the consequences of related effects. For example, government of a country where native language structure inhibits innovation potential of its population may be able to develop child education policies and programs that address the related cognitive consequence. Similarly, multinational corporations may be able to enhance their innovative productivity by incorporating native language-related knowledge into the process of designing their internal research and development teams, and/or implementing their global alliances and joint venture

Figure 1. Histograms of patents per capita for linguistic categories of gender, individualism, and hierarchy



strategies. Therefore, findings of our study are not only novel, but also relevant to both theoretical and practical aspects of international business, with particular significance for enterprise-oriented global innovation strategies as well as tailoring government policies and regulations. Although the insights from our study are informative, the complex relationship between linguistic and innovation productivity remains poorly understood. We hope that future investigators will continue to challenge this limitation by developing new constructs and implementing tailored and robust examinations that will not only enhance our understanding of the overall subject matter, but also enable a concrete evaluation of its relevance to global economy and to the development of national and firm-level competitive advantage.

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