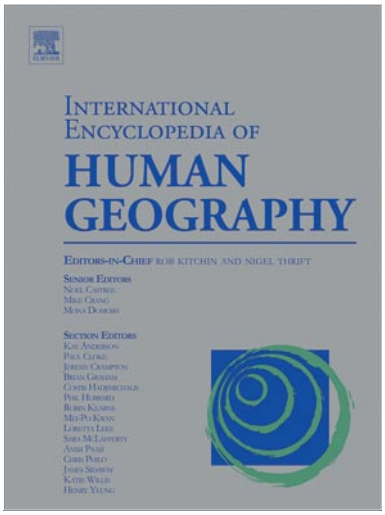

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Transnationalism and Technology Transfer

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Glossary

Industrial Upgrading As more and more developing country producers are integrated into global markets, there is downwards pressure on the prices of both agricultural and manufactured products. For producers to maintain or increase incomes in the face of this pressure, they must either increase the skills content of their activities or move into market niches which have entry barriers and are therefore insulated to some extent from these pressures. The shifts in activities which sustain higher incomes are taken as upgrading.

Knowledge Knowledge is viewed fundamentally as a heterogeneous resource that firms value in different manifestations. Mostly the main types of knowledge can be distinguished as codified knowledge versus tacit knowledge, and individual knowledge versus collective knowledge.

Overseas Diaspora It refers to ethnic groups whose sizable parts have lived outside their country of origin for at least several generations, while maintaining some ties to the homeland.

Structure Hole Burt defines it as "a gap between two individuals with complementary resources or information." When the two are connected through a third individual as entrepreneur, the gap is filled creating important advantages for the entrepreneur. Competitive advantage is, therefore, a matter of access to these 'structural holes'.

Technology Transfer Students of technology transfer make an important distinction, separating 'material transfers' and 'design transfers' from 'capacity transfers'. While technology transfer involves management and investment, it is difficult to rely exclusively on the transfer of machines and blueprints. Therefore, the migration of engineers must be considered an essential element in the effective transfer of technology.

Transnational Technical Community A community that spans borders and boasts as its key assets share technical knowledge and ethnic networks.

There has been a resurgence of interest in the implications of innovation and learning for the creation and maintenance of economic competitiveness since the new economy, or knowledge-based economy, became the buzzword in the past two decades. Two types of knowledge have been identified by the students of knowledge management: on the one hand, codified knowledge is necessarily explicit, formal, or systematic, and can be expressed in words and numbers, scientific procedures, or universal principles. The codified type of knowledge is easy to transfer, store, recall, and valorize. On the other hand, tacit knowledge is extremely difficult to transfer, and is gathered from the accumulation of practice, the ability to communicate, and wisdom. Johnson *et al.* raised a critical assessment of the dualism of codified/tacit knowledge used by Cowan *et al.* They argued the dichotomy was problematic since it was rare that a body of knowledge could be transformed into codified form without losing some of its original characteristics and that most forms of relevant knowledge were mixed in these respects.

Under the influence of new information technology and global knowledge economy, codified knowledge becomes ubiquitous, and the creation of unique capabilities and products hinges on the production and use of tacit knowledge. It is asserted that knowledge creation and diffusion should be taken as a situated practice embedded in distinctive communities and actor networks in which the powers of context, spatial and temporal, have to be placed at the center. Accordingly, the combination and composition of tacit and codified knowledge depend on the context within which agents or organizations manipulate knowledge. While codified knowledge can be disseminated through impersonal means, tacit knowledge is closely associated with meaning and understanding, and personal communication is indispensable for its transfer. In the times we now live, when communication technology is highly developed and information is widely available, interpersonal connections have become more, rather than less, important for the exchange of knowledge.

But we recognize that knowledge has the properties of being embedded in an individual, who is part of an organizational context. The consequence of combining personalized knowledge and organizational embeddedness is that knowledge can be at either end of the tacit-codified continuum and may therefore be straightforward or almost impossible to transfer.

In fact, the mobility of personnel as the most effective way to overcome the problem of tacit dimension of knowledge transfer has been well identified. One of the major goals of technology transfer is to cultivate local technological capabilities. (According to Bell and Pavitt (1993: 163), technological capabilities consist of the resources needed to generate and manage technical change, including skills, knowledge and experience, and institutional structures and linkages.) Students of technology

transfer make an important distinction, separating 'material transfers' and 'design transfers' from 'capacity transfers'. Material transfer is characterized by the import of new materials and techniques. Local adaptation is not conducted in an orderly and systematic fashion. The local adaptation of borrowed technology and the development of new machines tend to occur primarily as a result of trial and error, often termed 'learning by doing'. Design transfer is primarily carried out through the transfer of certain blueprints, formulas, books, etc. The knowledge contained in these design materials is coded and explicit, and must be adapted to local conditions. Capacity transfer means the transfer of scientific knowledge, which leads to the production of locally adaptable technology, based on technology prototypes existing abroad. A critical element in the process of capacity transfer is the migration of scientists and engineers, as most of the innovative knowledge is human embodied and diffuses through personal contact and association. While technology transfer involves management and investment, it is difficult to rely exclusively on the transfer of machines and blueprints. As Almeida and Kogut track the movements of over 400 engineers and show their patterns of mobility influence the inter- and intraregional patterns of knowledge flow.

It is particularly relevant to the knowledge economy in which the access to knowledge becomes the key for the construction of competitive advantage. According to Lundvall, the learning economy includes mastery over the know-what of facts and information, the know-why of principles and theorems, the know-how of competence and skills, and the know-who of knowledge in networks of collaboration and communication. Moreover, as Lundvall argued, the learning process involves more than purchasing technology, and includes social dimensions such as the absorption of tacit knowledge, which is embodied in technical staff. As a result, the know-who became the key job in identifying appropriate technologies to transfer.

The importance of the know-who illustrated a critical 'gatekeeper' role in technology transfer. Studies using a social network approach to innovation and product development determined that strategically positioned individuals facilitate information dissemination which in turn facilitates innovation. Individuals with more informal contacts outside the organization, or 'gatekeepers', were critical for importing novel information and linking the organization with its environment. These gatekeepers effectively serve as the primary link to external sources of information and technology.

The role of gatekeeper well epitomizes why some companies seem to be able to adopt technologies earlier than others. This could be related to their absorptive ability to screen their environment and identify new potential solutions from external sources. One way to achieve this is to have contacts in the supporting scientific community. These boundary-spanning individuals, or gatekeepers, are most likely well connected and informed. They have insight into the related technologies and underlying sciences.

The Rise of Transnational Technical Community and Technology Transfer

Based on a perspective of social network, a growing body of transnationalism, or globalization from below, tried to decode the technology diffusion and transfer which were usually engaged exclusively with the transnational corporations and nation-states. It contended that a transnational community of engineers has coordinated a decentralized process of reciprocal industrial upgrading by transferring capital, skill, and know-how to the source region and by facilitating collaborations between specialist producers in the two regions. The transnational community thus allows local companies from latecomer industrializing countries to avoid the problems that many corporations face when they establish operations in the technology hub such as Silicon Valley. Foreign firms need to be able to integrate into the region's social networks to gain access to up-to-date technology and market information, while simultaneously maintaining the ability to communicate quickly and effectively with decision makers in the headquarters. It argues that the multinational corporation may no longer be the advantaged or preferred organizational vehicle for transferring knowledge or personnel across national borders, but a transnational technical community provides an alternative and potentially more flexible and responsive mechanism for long-distance transfers of skill and know-how – particularly between very different business cultures or environments.

As demonstrated by Amin and Cohendet, two major advantages are exploited by the governance mode of community. The first is that communities 'freely' absorb the sunk costs associated with building the infrastructure needed to produce or accumulate knowledge, usually in a completely nondeliberate manner embedded in their daily practices which render the codification of tacit knowledge easy and costless. The second is that communities do not need a visible or explicit central authority to control the quality of work or enforce compliance with any standard procedure, as communities monitor the behavior of their members and render them accountable for their actions. By the same token, these advantages apply to the transnational technical communities in the current global economic system.

First, an increasing specialization of production and a deepening social division of labor generates entrepreneurial opportunities for innovation in formerly peripheral regions. By exploiting these opportunities in their

home countries, a transnational technical community can build independent centers of specialization and innovation, while simultaneously maintaining ties to the technology hubs such as Silicon Valley to monitor and respond to fast-changing and uncertain markets and technologies. The community was well positioned to establish cross-regional partnerships that facilitate the integration of their specialized components into end products. In the transnational community, ethnic ties and interpersonal relationships can facilitate collaborations and reduce the uncertainty of economic deals. The members of the transnational ethnic network are likely to be better informed on the capabilities and requirements of domestic labor and the sort of training local labor requires. In other words, such social ties fulfill the need of 'know-who' in the learning economy in which the social dimension is the key and often ignored issue in the constitution of competitiveness. These transnational relationships support technology transfer by supporting joint problem solving and complementary innovation. Close, trust-based relationships among the transnational community of engineers are thus an essential precondition for the flexible collaboration needed to adapt and survive in today's fast-paced competitive environment. The case study of the Silicon Valley–Hsinchu (Taiwan) connection vividly verifies the point. In addition, the development of the Indian software industry owes much of its growth to the Indian diaspora in the Silicon Valley, as shown by Kapur.

Second, accounting for technical upgrading in late-industrializing regions is a contested issue. In fact, as discovered by Saxenian, the links of the key technological latecomers such as Taiwan, India, and Ireland, with the Californian technology hub unfold in several ways: the latecomer companies recruit overseas engineers, they set up listening posts in Silicon Valley to tap into the brain power there, or successful overseas engineers return to the homelands to start up their own businesses. All of these possible links are established smoothly not only on an individualistic basis, but largely through the mediation of overseas organizations. In spite of ethnic ties that facilitate cross-regional technological cooperation, the technical community benefits more from integration with broader business networks. It is clear that the overseas diaspora helped transfer technology and business models back to the homelands. It is particularly true that while the latecomer firms in both regions had to rely on ethnic ties with mainstream businesses during their embryonic stages, ethnic ties could ease information collection across the globe. Trust and reciprocity incubated from primary ethnic bonds and informal personal relationships facilitate cooperation between these regions, and broaden the scope of network building. While some top-down accounts, such as that of Alice Amsden suggest that the developmental state and key big companies (national champion) should be put at center stage in the process of late industrialization, other accounts focus on global production networks (GPNs) and argue that late development benefits from its insertion into global value chains. Both are partially true, but fail to take seriously the embedded institutions in transborder connections between technologically leading and following regions. In fact, a new strand of GPNs perspective has more detailed and nuanced analysis of the social and developmental dynamics of contemporary capitalism at the global–local nexus, which becomes the mandate for the transnational corporations to survive and prosper in the interconnected economic system. The GPN perspective asserts that strategic coupling between GPNs and regional assets, or an interface mediated by a range of institutional activities across different geographical and organizational scales will be critical for the development of each region in the global economy. At the same time, the transnationalist discourses insist on the continuing significance of national borders, state policies, and national identities, while simultaneously crossing over them, and constituting a hybrid social space. Instead of maintaining a kind of zero-sum assumption of exclusiveness of nation-states and globalization, the transnationalist discourses take them as engaging in a process of mutual construction. In light of the GPN perspective, the transnational technical community plays a critical mediating role in the globalizing process of regional development.

The Limit of Transnationalism in Technology Innovation

As Amin and Cohendet warns, governance by community does not come without limits. One of the major causes of failure is the risk of parochialism, discrimination, or vengeance on other communities. A second limit is the risk of lack of variety. These cautious remarks apply to the mediating work of transnational technical community in technology innovation and transfer.

In fact, as shown by social network analysis, networks with an abundance of structural holes, a gap between two individuals with complementary resources or information, by situating people at the confluence of different social domains, create opportunities for the novel combination and recombination of ideas. These same networks, however, pose a problem for acting on such ideas. Structural holes pose an action problem because the dispersed, unconnected people found around structural holes are inherently more difficult to mobilize or coordinate, especially around novel ideas. Dense networks present the optimal conditions for the exchange of the complex information necessary for innovation in complex organizations but present an idea problem because of the redundancy of information circulating within the network.

Individuals who are active in introducing dissimilar others and facilitating action among previously tied alters (or people in one's social network) will be more involved in the combinative activity that leads to innovation. The information advantage Burt associated with networks with structural holes roughly corresponds to the advantageous position occupied by the gatekeepers in the earlier social networks/innovation literature to the extent that both imply boundary positions. Extensive social knowledge about the personnel and differing styles of critical departments across the organization resulting from informal ties and potentially shared design experience contribute critically to cross-boundary innovation efforts. In other words, knowledge heterogeneity was a significant predictor of both overall managerial performance and innovation performance.

As a result, a number of limits should be raised about the relations of transnationalism and technology transfer. First, the transnationalist argument risks oversocializing economic behavior that is rooted in business and technological considerations. This is the blind spot in the discourse on social constitution, which assumes that social relationships determine economic transactions and outcomes. The economy is not reducible to interpersonal relationships, but composed of multiple production worlds that are defined by product configuration, market principles, and technology and production process. In other words, dense social ties cannot substitute for the sophisticated managerial and technological learning that is required to compete in a particular sector in spite of the fact that the social dimension of learning is critical.

Second, close ties sometimes will become blind trust, and make firms unconscious of the exterior technological breakthroughs or new business opportunities. To make things worse, ethnicity-embedded system occasionally compels people to compete based more on the thickness of tie than the depth of capability. In other words, a socially overembedded industrial world without cautious monitoring might lead to unproductive situations, rather than a healthy and efficient production system. The peril of lock-in is usually put aside by the transnationalist (as well as networked firm) argument.

In light of the discussion above, two interesting threads, among others, could be elaborated in the future research. The one is a comparative study between the performances of transnational technical communities in divergent 'home countries' which demonstrate contradictory industrial structures and absorptive capabilities. Another thread lies in the combination of GPN perspective and transnationalist discourse by the use of social network analysis. By doing so, a number of typologies of global–local interface could be built up for the advanced study of transnational technology transfer.

See also: Transnationalism.

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