
The export of Germany's "secret of success" dual technical VET: MNCs and multiscale stakeholders changing the skill formation system in Mexico

Judith Wiemann and Martina Fuchs

Department of Economic and Social Geography, Faculty of Management, Economics and Social Sciences, University of Cologne, Albertus-Magnus-Platz, 50923 Cologne, Germany, wiemann@wiso.uni-koeln.de, fuchs@wiso.uni-koeln.de

Received on August 29, 2017; editorial decision on February 21, 2018; accepted on March 14, 2018

Technical dual vocational education and training (VET) is deemed to be one of Germany's export hits. The study explains how dual VET is transforming the skill formation system in Mexico. The study is based on qualitative studies in metropolitan regions of the Mexican central highland. Results show the Mexican skill formation system under transformation by providing companies with intermediary skilled workers, and thus Mexico's change towards more knowledge-based production. The study contributes to closing a research gap on skills in manufacturing, which are relevant in practice, but still under-researched in regional studies and economic geography.

Keywords: vocational education and training, skills, manufacturing, Mexico, regional change, international transfer

JEL classification: R11 (Regional Economic Activity: Growth, Development, Environmental Issues, and Changes)

Introduction

Schuler not only exports presses to Mexico, but with Cedual also Germany's dual education and training system, the envy of many countries around the world. (Schuler's CEO Stefan Klebert 2013 at the opening of a new dual education and training centre in Puebla, Mexico)¹

For many industrialised regions, Changing Industrial Organisation in Space—the title of this Special Issue—translates into being shaped by networks of multinational companies (MNCs). Globalisation research in regional

studies and economic geography has long since addressed subsidiaries of MNCs as drivers of regional change (Dicken, 1986; Taylor and Thrift, 1983). This contribution confirms the importance of MNCs as a relevant driving force, but emphasises the presence of various stakeholders with an interest in changing the region, thereby closely interacting with MNCs and supporting the international transfer of practices from abroad to the region concerned. This is suggesting a multiscale perspective, combining various stakeholders from the international to the local level (Ward, 2006, 54).

Rather than being an elaborated theoretical framework, such a multiscalar perspective implies addressing the region not as an isolated set of local actors, but understanding the region as also being involved in national and international actor networks (Herod, 2003; Phelps and Wood, 2006; Pike et al., 2016). Swyngedouw (1997) addresses this with the notion of “globalisation”. The region is no longer “pale background scenery” (Jones, 2008, 72) but a specific “action arena” of various (economic, political, social) stakeholders of different spatial levels and with some particular powerful change agents (Rafiqi, 2009, 343).

The implementation of German-style dual vocational education and training (VET) in countries of the Global South, and particularly emerging economies, is an excellent example of such view. Dual VET is considered Germany’s “secret of success” (Zimmermann, 2017). Secret of success signifies that the way of training young people leaving school and entering the labour market is seen as a key issue for Germany’s international competitiveness. From an international point of view, the German crisis-proof performance during the last years, resulting from its strong manufacturing base and technically skilled workers, is a good reference for dual VET in the context of structural change (Gessler, 2017). The claimed “secret of success” is based on a corporatist skill formation system (Busemeyer and Trampusch, 2012). Dual apprentices usually attend both vocational schools (*Berufsschulen*) and companies for 3–4 years. The apprentices learn generic skills as well as practically oriented competencies with up-to-date equipment. The *Berufsbildungsgesetz* (Vocational Education Legislation) is the legal basis for dual VET, with the federal state ministers of education specifying framework curricula (Pilz, 2009). Companies, employers’ federations, industry chambers, trade unions, the German state and the federal state authorities provide for up-to-date and practice-oriented content. The chambers ensure the final certification;

the certificate is state approved. Dual VET graduates enjoy a good social reputation and are often part of middle-income groups (Pilz, 2009). For German young people, dual VET is a common professional path; about half of all German school graduates do not choose a university or polytechnic, but a vocational school.

The movement of labour from a company that has paid for its training to another, which did not invest in it, is generally low, as dual VET graduates are a broadly available workforce on the German labour market. Besides, the apprentices usually develop an affinity to their training companies during dual VET. Moreover, industry-wide wage agreements make it less profitable for employees to change their jobs frequently (Barabasch and Wolf, 2009).

Given the complex actor arrangement in Germany, evidently it seems difficult to export dual VET to different skill formation systems and to implement it successfully. Still, there are many efforts to transfer and adapt dual VET, particularly to emerging economies such as China, India, Brazil and Russia (Jürgens and Krzywdzinski, 2016; Pilz and Li, 2014; Pilz and Wiemann, 2017) and Vietnam (Wrana and Revilla Diez, 2016).

The key question addressed by this contribution is how technical dual VET coming from Germany is implemented in Mexico. In particular, by taking a multi-actor and multiscalar perspective, the article asks how VET implementation induces local cooperation between the actors, and how dual VET even transforms the Mexican skill formation system.

While Germany has a corporatist skill formation system as described above, the Mexican system is shaped by individualised government-company arrangements with a low degree of formalisation, and a strong role of the state (Graf et al., 2014; Pilz, 2017). Such differences between the skill formation systems suggest difficulties in dual VET transfer. At the same time, there are good reasons for closer cooperation in VET between Germany and Mexico. Mexico is Germany’s most

important trade partner in Latin America, and Germany is the fourth most important trade partner of Mexico, behind the USA, Canada and China (in 2016; [Destatis, 2017](#)). Besides large MNCs, such as Volkswagen, Audi, Siemens and Bosch, more and more German medium-sized high-tech firms have invested in Mexico, particularly since the early 2000s ([Parnreiter, 2012](#)). Most of the subsidiaries require skilled labour. The Mexican government and regional policies support this trend to overcome the competition with Asia and Latin America in the low-cost sector and to orient the region towards knowledge-intensive production ([Villareal Gonzalez et al., 2017](#)). Remarkably, the Mexican government adopted the Mexican Model of Dual Education (MMFD by its Spanish initials), following the German role model.

The article starts with conceptual deliberations on potentials and restrictions of transforming skill formation systems in emerging economies by international VET transfer. The subsequent part explains the research design and methods. The empirical part shows the implementation of dual VET in the Mexican skill formation system by local companies' cooperation and by the MMFD. The remainder of the article is a conclusion, synthesising and reflecting on the findings related to the performance of a multiscalar and multi-stakeholder view and to the relevance of intermediary skills in the discourse of regional studies and economic geography.

Conceptual deliberations: potentials and limits of transforming skill formation systems by international VET transfer

Transformation is systemic change, that is, new dominant practices and new institutional arrangements, understood as rules guiding action ([Hodgson, 2006](#)) appear on the scene. Particular local dynamics can be precursors

of a systemic transformation, offering new responses to a pending problem. [Fortwengel and Jackson \(2016\)](#) call this situation "proto-institutionalisation".

The transformation of skill formation systems is not a new issue. Historically, various skill formation systems evolved during the process of industrialisation, when craft-trade-based vocational methods were challenged by various new variants of training workers ([Greinert, 2002](#)). Today, there is elaborated research about skill formation systems in change, and how they compare to each other ([Bosch, 2017](#); [Busemeyer and Trampusch, 2012](#); [Busemeyer and Vossiek, 2016](#)). Many studies analyse flagship projects of VET transfer as drivers and role models and often reveal that they remain standalone solutions within the country ([Stockmann, 1999](#); [Wrana and Revilla Diez, 2016](#)). Still, some of the institutional entrepreneurs start to change the skill formation system in place ([Fortwengel and Jackson, 2016](#); [Wrana and Revilla Diez, 2016](#)). Such studies indicate that transfer of VET does not only comprise dual practices in unrelated lighthouse projects, but also induce local cooperation in the host regions ([Fortwengel and Jackson, 2016](#); [Gessler, 2017](#); [Jürgens and Krzywdzinski, 2016](#); [Wiemann, 2017](#)). Such research is in-depth case studies, given the complexity of the issue. Still, they need a further validation on a broader empirical basis (see the part of this contribution about research design and methods).

There are some indications for transformation, or at least change of skill formation systems, in the host countries, given general insights about the internationalisation of MNCs. International business (IB) shows that MNCs can follow dedicated strategies to transfer organisational practices on international levels ([Pudelko and Harzing, 2007](#)), and thereby react to, and actively shape, different local environments (for example [Cantwell et al., 2010](#); [Fortwengel, 2017](#); [Meyer et al., 2011](#)). Economic geography early adapted this

view (Dicken, 1986; Taylor and Thrift, 1983) and recently has emphasised the diversity of multiscalar stakeholder shaping regions (Herod, 2003; Phelps and Wood, 2006; Pike et al., 2016; Swyngedouw, 1997).

With regard to international VET transfer from Germany to emerging economies, the multiscalar actor network comprises particularly German MNCs, political actors and governmental bodies of vocational education, embassies, employers' federations and industry chambers. They support the transfer of dual VET to emerging economies to strengthen their worldwide trading partners and to support institution-building as a tool of development policy (Fuchs et al. 2017). On the side of emerging economies, politicians, employers' federations, industry chambers and other stakeholder pursuing regional growth in particular see dual VET as modernisation of the local economy, claiming that it strengthens the local competitiveness and at the same time reduces youth unemployment and underemployment in informal activities (Wolf, 2009).

Empirical studies report some main barriers to dual VET implementation abroad, implying particular ways of local adaptation, which are different to the German role model. For example, companies have to balance the pros of productivity increases triggered by well-trained employees and the cons of high training costs (Rauner, 2007; Wolter et al., 2003). Often labour turnover and poaching is a problem in emerging economies, with their contested labour markets (Pilz and Wiemann, 2017). In consequence, in emerging economies, the companies often reduce the length of VET and only adopt the innovative core of German dual VET, particularly practice-oriented training and apprentices' handling of modern technologies (Wolf, 2009).

This is also due to the fact that in many emerging economies there are no vocational education programmes, which are interwoven with comprehensive practical training in the

companies. Technical schools or colleges usually teach technological procedures in a rather abstract fashion in the classroom and do not train practical skills using real modern machinery. Teachers are not used to up-to-date technologies, and vocational schools prepare their students for working life in a general manner rather than training them for a specific occupational profile. Thus, vocational schools in emerging economies are often difficult counterparts for foreign MNC subsidiaries (Pilz and Li, 2014). Recent literature frequently illustrates in-house solutions of VET in large MNC (Jürgens and Krzywdzinski, 2016; Pilz and Li, 2014; Wrana and Revilla Diez, 2016).

Furthermore, in emerging economies, the population does not usually have a high esteem for non-academic education. This is due to the fact, for example, that loans for blue-collar workers are low, and work is often hard, dirty and dangerous (Pilz and Li, 2014). There is a further issue usually neglected in the recent literature. The legal frameworks in many emerging economies do not include collective or company agreements that guarantee enforceable rights to the apprentices—like in Germany—which would give them contractually agreed protection and thus a certain bargaining position within the company. Instead, workers' and apprentices' concerns are often subject to bilateral bargaining between worker and management, or not enforced at all (see Jürgens and Krzywdzinski, 2016).

In sum, research indicates MNCs', politicians' and further stakeholders' interest (both in the home and in the host country) to implement dual VET in emerging economies. At the same time, there are obvious limits to transfer dual VET as it is practised in Germany, in particular with regard to the duration of VET (rentability), fit to the given institutional setting (in particular vocational schools and their abstract training methods), and formal rights of the apprentice in the emerging economies.

Research design and methods

To overcome Eurocentric views on MNCs as drivers of change in emerging economies, it is necessary to perform extensive fieldwork abroad. Given the research effort of such fieldwork, only few comprehensive analyses of technical training have been conducted worldwide (see [Barabasch and Wolf, 2009](#)). This article reports on a section of a larger research project, which apart from Mexico also includes China and India as VET-importing countries, and which is not only about dual VET but also more generally about the transfer of skills for blue-collar workers within German MNCs. The research team consists of two senior and two junior researchers, who combine the perspective of economic geography with business education. Analysis of the Mexican case was composed of a pre-test, which was carried out in 2015 by the whole team. The main fieldwork was carried out in 2016, with the junior researchers spending several months in Mexico. Further research in Germany involving the MNC headquarters of the subsidiaries and experts of organisations promoting international dual VET transfer in 2017 completes the research design. The view

is on Germany as a country of origin for dual VET, without Austria and Switzerland (which have similar dual VET systems), as German MNCs are prevailing in Mexico. Another reason is to keep the (already complex) research design overseeable.

Given the explorative character of this study, qualitative research was the method of choice. Semi-structured expert interviews with Human Resource managers and training personnel in MNC subsidiaries were at the centre of the study (see [Table 1](#)). In particular, automotive industries, machine engineering and chemical industries, that is the most important German foreign direct investments in Mexico, were researched. Documented plant and training centre visits completed the empirical insights, as well as participatory research at workshops of the MMFD and further interviews with workers and apprentices. Within Mexico, the focus was on the industrial belt (Guadalajara, Querétaro, Estado de México, the capital Mexico City and Puebla), that is, the central highland.

All interviews were completely transcribed and analysed with a software tool for qualitative research. The analysis followed [Mayring \(2007\)](#)

Table 1. Overview over the study conducted in Mexico.

Type of interview partner organisations	Number of organisations	Number of persons interviewed
Production plants	39	49
In-plant training centres	7	12
Apprentices	10	11
Workers (former apprentices)	2	3
Schools (principals, teachers, school administrative staff, school system representatives)	6	18
Training providers	2	3
National experts (COPARMEX, local government representatives)	3	4
Experts of German institutions based in Mexico (GIZ, AHK)	2	3
Total	71	103

Further documented fieldwork activities	Number
Training centre visits	15
Plant visits	22
Participation in MMFD-related events	2

Source: Authors' research.

but was critically adapted to the empirical data (Soeffner, 2004), allowing triangulation of the methods of investigation. The insights were discussed in the research team during the field studies and later on during the interpretation stage.

Empirical evidence

New variants within the skill formation system: cooperations on local level

While large MNC subsidiaries are often discussed as lighthouse projects and attract a lot of attention, as discussed in the conceptual section, in our study, only few large companies could afford pure internal solutions (with classroom and practical training within the company); mostly, these are subsidiaries that had been established some decades ago and had not been able to draw on existing structures in their neighbouring firms, for example, Volkswagen in Puebla and Siemens in Guadalajara from the 1960s to 1980s (see Cáceres-Reebs and Schneider, 2013). The following quotation illustrates a more recent example:

Well, we have sent around 6 to [subsidiary of same MNC] in the beginning, then up to 12 people. We got to have up to 24 apprentices over there [...]. In Volkswagen we had around 6 more. The only difference: they were studying for maintenance at Volkswagen. [...] So, [the reason to start our own programme] were the costs. (Interview M40a, HR Manager at German automotive supplier, all interviews translated by the authors)

Many of the subsidiaries in our sample, however, seek out cooperations, as the subsidiary in the previous quote in the early stage of production. For such young (small and medium-sized) subsidiaries, an own dual VET programme would be expensive, for example incurring high costs for classrooms and instructors.

The subsidiaries entered into different forms of cooperation for their dual VET programmes, as shown in the following. First, the subsidiaries *cooperate with educational bodies*. In Mexico, non-academic technical vocational education consists of 3-year schooling at upper secondary level and roughly corresponds to a high-school diploma. Unlike Germany, where half of the school graduates opt for dual VET, in Mexico, only every tenth school graduate starts technical vocational education (Cáceres-Reebs and Schneider, 2013). In line with the conceptual deliberations above, such a relatively small pool of candidates reduces the probability of MNCs receiving adequately skilled candidates from such vocational schools. Additionally, also in line with the conceptual deliberations, practical education is insufficient from the view of MNCs, as in Mexico vocational training only comprises short practical company internships (see Cáceres-Reebs and Schneider, 2013). For example, an HR manager of a German subsidiary complains:

We are really not satisfied [with the vocational education in Mexico]; in reality the people learn once they enter the company. [...] They teach you a career that gives you a title but no experience or cleverness. [...] School and reality are a little separated in Mexico. (Interview M27)

Some MNC subsidiaries, in particular those of larger German automotive industries, gradually overcame such restrictions by interacting and bargaining with vocational schools, or they prefer to cooperate with universities. Such cooperation can generate some intense give-and-take between MNCs, regional politics and the Mexican educational facility, in particular if large and renowned companies are involved. One example is the automotive brand manufacturer Audi, which established a greenfield investment and has been producing one of its premium car models in Mexico since 2016. The

new subsidiary is located near the small village of San José Chiapa, that is, in a peripheral, rural area in the Estado de Puebla; there is no nearby urban labour market with workers experienced in manufacturing. Thus, Audi started to cooperate with the Technical University of Puebla (UTP, by its Spanish initials). Even before the production of cars started, Audi established a centre for technical training on an area of more than 7700 m². The Estado de Puebla financed the construction of the training centre and agreed to pay for the training personnel stemming from the UTP for the first 10 years. Audi provides the machines for the training activities and trains the trainers at its headquarters in Ingolstadt, Germany. The training is for mechatronic technicians and toolmakers (Comunicación Audi México, 2014). The successful graduates receive the grade "técnico superior universitario", which roughly corresponds to a bachelor's degree. The students can add 2 years of study to receive the renowned degree of "licenciado" in engineering. Early cooperation between public bodies and prominent car producers before the production launch is not an isolated case. The German car producer BMW plans to produce a premium car in San Luis Potosí from 2019; it began cooperating with the Technical University of San Luis Potosí to train apprentices in dual VET in 2015 (Scholz, 2015).

Second, MNC subsidiaries cooperate with each other. Particularly, the smaller subsidiaries of German medium-sized MNCs only need a few experts with intermediary skills in their production. If possible, they send their apprentices to another subsidiary of the same MNC in Mexico, which has already established a dual VET programme. Other subsidiaries send their apprentices to the subsidiary of another, often neighbouring, MNC. One such dual VET offers is the "Volkswagen Group Academy Mexico" (today's name), which was founded in 1996 to support apprentices of Volkswagen's supply

companies, beyond the (already existing) internal dual VET programme.

Third, some MNC subsidiaries send their apprentices to private VET providers. There are two vendors offering dual technical VET, both shaped by German influence. Cedual in Puebla is a spin-off of Schuler, a German machine engineering company, which also produces in Puebla. The other, Altratec in the Estado de México, has its roots in a German–Mexican dual VET alliance (see Cáceres-Reebs and Schneider, 2013), and today is the start-up of a German expert. Altratec works with a vocational school for the preparation and certification of the apprentices, while Cedual only sells dual VET conforming to the German training regulations, with certification offered by the German Chamber of Commerce.

The forms of cooperation shown above are not strictly related to a particular subsidiary in our sample; rather, they often appear mixed and change over time in response to different demands. For example, if a new subsidiary is founded, or if it grows, there is more need for dual VET, so the subsidiary seeks out new kinds of cooperation. The same is true for important innovations of products or production technology. Still, if subsidiaries reach a mature stage, they sometimes reduce their in-house dual VET and cooperate with their neighbouring bodies to reduce costs. Besides, the dual technical VET is sometimes slightly tightened compared to the German role model; however, the problem of time- and cost-related reduction emphasised in the studies above in the conceptual part is not as relevant, since as German training regulations, and certifications do provide a clear framework.

With regard to the often negative image of blue-collar work as mentioned above, a noticeable effect is that dual VET practices offer revenue for the apprentices, which is otherwise unusual in Mexico (see Graf et al., 2014). This improves its attractiveness, as the following quotation shows:

I would say that we develop ourselves into a direction of higher value. Given the quality and the recognition by industry, and that they earn the double of the sum they earn normally. And today, they [graduates] earn more as if they would work as an [academic] engineer. (Interview M9, training instructor in dual apprenticeship programme)

With respect to the question of transformation, it is apparent that such cooperative interactions represent new variants within the Mexican skill formation system. Such new variants particularly come into being in regions with a long tradition of German MNC subsidiaries, in our case especially concentrated in Puebla and the Estado de México. Such cooperation can be seen as a precursor of systemic transformation: the older subsidiaries, long-standing practitioners of dual technical VET, have shown a way of skilling young people, offering a role model for other regional actors. They are also exemplary for the MMFD.

Systemic transformation

While in the previous section MNC subsidiaries were characterised as relevant drivers of change, the MMFD evidently shows the Mexican government as a noticeable change agent, within the multiscalar actor constellation. The MMFD is an almost countrywide new mode of VET in Mexico. In 2015, a decree by the Mexican Ministry of Education (SEP, by its Spanish initials) declared the MMFD an officially approved option within the Mexican educational system. Prior to this, agreements had been reached on the MMFD by the relevant Mexican bodies, that is the SEP, the Mexican National College of Technical Professional Education (CONALEP) and the employers' federation (COPARMEX). Also, international agents play a role, supplementing the multiscalar actor network: German organisations had participated in the negotiations from the beginning. The development and activities of the dual

VET provider Altratec played an important role in shaping the MMFD, acting as a role model in the Estado de México (see Cáceres-Reeb and Schneider, 2013). The German–Mexican Chamber of Industry and Commerce was an important actor in the development of training regulations and supported the practical implementation of the MMFD. Germany's Federal Institute for Vocational Training (BIBB, by its German initials) continuously supported the process over time. The German embassy had an ongoing role in facilitating communication between Mexican and German bodies. Also, the German Corporation for International Cooperation (GIZ) supported the implementation of the MMFD.

There are particular mechanisms institutionalised by the MMFD. The MMFD is mainly financed by the Mexican Government; the state provides the schools for the classroom parts of the dual VET and funds a scholarship of 2000 Mexican pesos (about \$100) for each apprentice per month. There is no apprenticeship pay by the companies involved, as is the case in Germany. The MMFD curricula and certification standards are developed by Mexican companies, MNC subsidiaries from Germany and other countries and the Mexican authority of technical training (CONOCER). They are inspired by the German dual VET training regulations but based on Mexican certificates and study courses. The objective of the MMFD is to provide the apprentices with the standard Mexican vocational school certificate, which the non-MMFD students of the respective vocational schools also receive, but there is an additional second certificate proving the technical competencies of the apprentice. To the graduate, possession of two certificates promises a good position on the labour market (SEP, 2017). CAMEXA, COPARMEX and CONOCER take part in the coordination of such certificates and related programmes.

The MMFD study programme takes 3 years. In Germany, apprentices apply directly to the

companies that train them. In the MMFD, an employers' federation, mostly COPARMEX, or one of the vocational schools allocates the apprentices to the companies. Similarly to Germany, where the apprentices pass through different departments to learn the respective tasks and to understand the overall organisation of the company, the MMFD has a plan of rotation that guides the apprentice through the company. If the company cannot deliver all the necessary learning units itself, the apprentice learns the relevant steps in practical training units, or in other companies. Such procedures ensure a training with generic and practical skills.

Considering the MMFD only came into being in 2013, the MMFD has spread significantly throughout Mexico. Companies of different sizes, sectors and origins participate in the MMFD. Apart from Mexican companies, foreign companies also participate, such as General Motors, General Electric and Caterpillar, that is, companies from the USA as the most important Mexican trade partner. Japanese companies, well known for their sophisticated training at headquarters (Pilz and Alexander, 2011), also joined the MMFD, for example Bridgestone. German MNCs also joined, with some of the large MNCs, such as Siemens. The following quote illustrates the rather optimistic view of the Mexican government and its educational bodies:

At this moment there are 300 companies implementing the MMFD. This means that they [i.e. the companies involved] get employees with [comprehensive] human capital and competencies: team work, problem solving, work discipline and [...] also loyalty for and knowledge about the company. (Interview M69, employee of the Secretary of Education)

Still, in the Mexican institutional setting, there is no formal representation of interest for the

apprentices in Mexico. By contrast, Germany has strong apprentice representation; such bodies are linked to works councils and trade unions. There, apprentices can find legal support in case their training company does not provide them with an adequate learning experience. Such deficits of co-determination in Mexico generated some cases of misuse of the MMFD by companies: they did not take their role as teaching and training units seriously, using the apprentices instead as helpers subsidised by the state.

The spatial distribution of companies participating in the MMFD shows predominance in the Estado de México, where the MMFD was largely developed and implemented (Figure 1). There, the commercial dual VET provider Altratec has been a key driver behind the development of the dual VET with local vocational schools and the local vocational government, years before it became an official educational option for the whole country. Still, we also find the MMFD in other relevant manufacturing regions of Mexico, as the map (Figure 1) illustrates. The MMFD is less prominent in Puebla, which is a dynamic location of German automotive MNCs. There, German MNC subsidiaries are hesitant with respect to the MMFD format, as dual VET is already strong locally with many dual VET cooperations between German MNCs. This also makes further local stakeholders reluctant to introduce the MMFD into local companies of other industrial sectors (Figure 1).

At the time of writing, the MMFD has not been fully established; nevertheless, the stage of institution building has reached a level that goes beyond proto-institutionalisation (see Fortwengel and Jackson, 2016). Although the curricula, certification and concrete training programmes are yet to be fully implemented, by now there are about 1500–2000² MMFD apprentices (August 2017). This represents a considerable contribution with regard to the various companies' need for technical experts

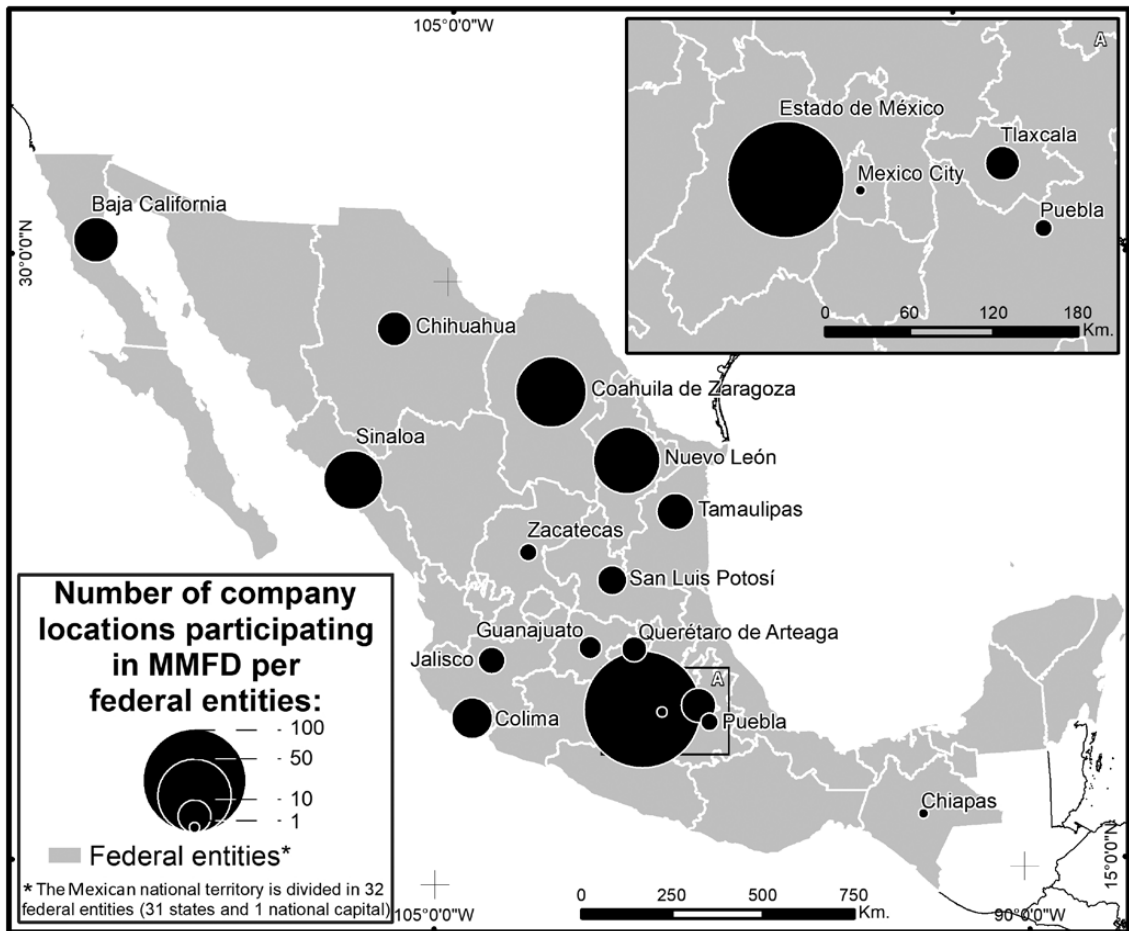


Figure 1. Companies participating in the MMFD.

Source: Data calculated individually by COPARMEX, own investigation in 2017; elaboration the authors and Daniel Rodríguez.

at the intermediary level. Moreover, a systemic transformation of the skill formation system appears to be in progress, particularly since today the MMFD is expanding from manufacturing to the service sector in Mexico.

Still, at least until now, systemic transformation of the MMFD does not imply a measurable deep change of local labour markets or local firms' competitiveness. Quantifiable effects for developmental objectives are limited. Dual VET in Mexico has not been able to reduce the large-scale underemployment and unemployment

of young people in Mexico, as originally had been claimed by politicians. Such limitations are proved by further studies in emerging economies, where dual VET is relevant only for the relatively small segment of skilled labour in key positions on the shop floor (see [Avis, 2012](#); [Pilz and Li, 2014](#); [Pilz and Wiemann, 2017](#)). Possible effects of dual VET for regional competitiveness can also hardly be measured, given that even on company level the economic efficiency of VET and productivity increases generated by well-trained employees are hard to estimate. As

such, dual technical VET is rather a prerequisite and driving force of regional change; in general, it supports (but not solely produces) the "second life" (Doussard and Schrock, 2015, 149) of the metropolitan areas in the Mexican central highland with orientation towards knowledge-based industries.

Conclusion

With regard to the key question of this contribution, to what extent technical dual VET coming from Germany is transforming the skill formation system in Mexico, we find two relevant issues: first, there are diverse cooperations between MNC subsidiaries and other actors. MNCs' in-house solutions of dual VET are an exception. Rather, MNCs are drivers of change within the actor network at place. By now, MNC subsidiaries have developed different modes of cooperation: among themselves, with schools and universities, as well as private VET providers all getting involved. Such cooperations represent new variants of VET within the Mexican skill formation system. Second, there is the MMFD, which proves the relevance of the Mexican government within the local "action arena" (Rafiqi, 2009, 343). The MMFD can be said to represent an early transformation stage with respect to the governmentally established institutional arrangement and public offer of technical vocational training. Still, at least until now, there are hardly tangible developmental effects, as originally claimed by government.

With regard to the conceptual discussion in regional studies and economic geography, the contribution has shown that the perception of MNC subsidiaries as drivers of local change is correct but limited, as various actors take part in transforming the local setting on site (see Uzzi, 1997). MNC subsidiaries are actively embedding themselves in the local environment and interact with various foreign and domestic actors in the region that originate at different spatial scales (see Pike et al., 2015). Within such settings, governments represent important players,

too. Both MNCs and governments are involved in multi-actor and multiscale settings of stakeholders driving forward regional transformation (Clarke et al., 2016; Dawley et al., 2015).

Until now, the transformation of VET in Mexico is a "process of mutation and flux" (Martin et al., 2015, 141). Still, the apprentices are left in a rather weak position (see Rutherford and Holmes, 2014). As this study has shown, this could hollow out the transformation. Political-economic issues such as these seem particularly relevant for further research, not least as governmentally based approaches of dual VET have also begun to be introduced elsewhere, for example in Spain, Peru, Egypt and South Korea.

Another implication for the conceptual debate in economic geography and regional studies is that the issue of skills of workers at an intermediary level, including dual VET, has attracted little attention until now. While some studies address the general importance of technically skilled employees for regional growth and development (for example Boschma et al., 2013; Clark, 2014; Pike et al., 2015; Rutherford and Holmes, 2014; Schamp and Stamm 2012), space-related academic disciplines in general rather focus on academics as drivers of innovation (Florida et al., 2008; Harrison and Turok, 2017). At the same time, the international transfer of dual VET is highly important for practitioners in management and politics. Our contribution argues to further develop this current issue from a spatially informed perspective.

Endnotes

¹ https://www.schulergroup.com/major/us/unternehmen/presse/pressemeldungen/archiv/2013/2013_06_21_mexiko/index.html (accessed 7 July 2017).

² Estimation by (rather different) data of SEP, COPARMEX, CAMEXA and interviews.

Acknowledgements

The authors thank the anonymous reviewers for their valuable comments and suggestions. We gratefully

acknowledge financial support for this study as part of the research project “Global strategies and local forms of technical vocational education and training in German multinational companies: A regional comparison in Emerging Economies” by the German Scientific Foundation (Grant No. FU 424/16-1). We thank our project partners from economics and business education, Matthias Pilz and Kristina Wiemann, and especially the numerous practitioners who have discussed their insights with us. We also thankfully acknowledge Kira Gee for linguistic editing and Daniel Rodríguez for cartography support.

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