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High-speed rail in developing countries and potential inequalities of use: the case of Morocco

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Abstract

The 21st century is characterized by the extension of the high-speed rail network in developing or emerging countries. While lines are already in operation in China and Turkey, others are under construction in Morocco and Iran, and projects exist in numerous other countries (Brazil, Malaysia, Egypt, etc.) in very different socio-economic contexts and characterized by significant inequalities. What are the effects of high-speed lines in these countries? By improving territories' accessibility, high-speed lines can foster population mobility and exchanges within a given country or between two or more countries in the case of international lines. But, especially in developing countries, one key issue is knowing for whom and for what use they are built. The aim of this article is to show that the creation of a high-speed line could reinforce the existing inequalities that are widespread in this type of country because the uses of such a line are spatially, economically and socially quite different. Our analysis will be illustrated by the case of Morocco.

Keywords: High-speed rail, inequalities, developing countries, Morocco

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1. Introduction

In January 2017, there were 37,343 km of high-speed lines (HSLs) in the world, with a further 15,884 km under construction; almost 36,000 km were planned worldwide for completion by 2050 (UIC, 2017). By favouring mobility, these lines are used to develop exchanges between cities and sometimes with other countries, in the case of transnational lines, and more broadly to foster economic development. But forecasts for high-speed rail projects tend to overestimate traffic levels and underestimate their financial cost (Bonnafous, 2014). Moreover, the potential indirect effects (or wider impacts) of high-speed rail (HSR) on the local economy are difficult to assess and not automatic (Bazin et al., 2006; Delaplace and Dobruszkes, 2013; Vickerman, 2015). There is no structuring effect of high-speed rail on local development (Offner, 1993 and more recently, in 2014, in the controversial debate in the French journal *L'Espace géographique*). But this is an issue that needs to be re-examined, as 21st-century rail has so far been characterized by network extensions in developing or emerging[1] countries (China, Turkey) and by projects in many others (India, Brazil, Morocco, Malaysia, Egypt, etc.). These high-speed lines take shape in very different socio-economic contexts from those of developed countries. Can the issue of potential increases in mobility be addressed in the same way in both sets of countries? In developing countries in particular, one key issue is knowing for whom and for what use these lines are built. Does everybody have access to high-speed rail in developing countries? Are its uses and clients the same as in developed countries? Do factors such as low income and greater inequalities, which characterize these developing countries, influence the way transport infrastructure is used? The aim of this article is to show that high-speed rail could induce more inequalities in terms of access and use in developing countries than in developed ones, not least because its uses differ spatially, economically and socially. This article suggests analysing a less-developed issue concerning the effects of high-speed rail, namely the issue of spatial, social and economic inequalities linked to high-speed lines. Section 2 will consider network extensions in developing countries that are characterized by great inequalities, while Section 3 will address the issue of high-speed rail effects on these inequalities. In Section 4, we will illustrate our analysis using a case study in Morocco that will be in operation by June 2018; and Section 5 contains some concluding remarks.

2. High-speed rail in developing countries

High-speed rail developed during the 20th century, first in Japan, from 1964, and then in European countries (France and Italy in 1981, Germany in 1988, Spain in 1992, Belgium in 1997, etc.), i.e. in developed countries that were designated as such[2]. But since the beginning of the 21st century, highspeed rail has spread to and/or is planned for emerging or developing countries, i.e. in countries characterized by greater inequalities.

2.1 The spread of HSR in the developing world

The first high-speed line in a developing country was launched in China in 2003. This line, some 405 km in length, links Qinhuangdao and Shenyang. Since 2003, the network in China has been expanding: in April 2017, a total of 23,914 km of high-speed lines were in operation in China (Table 1), which is more than the 22,551 km of existing lines in Europe.

1 In this article, we consider that this term encompasses all countries that are not considered to be developed. These might be emerging countries, lower-middle-income countries or upper-middle-income countries according to the classification of the World Bank.

2 Except Japan, which was considered an emerging country in 1964 when the first Shinkansen was introduced.

Table 1. High speed lines in developing countries			
Country	Km of line		
	In operation	Under construction	Long term planning
China	23,914	10,730	1,525
India			4,630
Turkey	688	469	1,134
Morocco		183	480
Malaysia (to Singapore)			350
Egypt			1,210
Brazil			511
Russia			2,978
Kazakhstan			1,011
Iran		425	870
Thaïland			2,877
Mexico			210
Indonesia			712
South Africa			2,390
Vietnam			1,600
Total in developing countries	**24,602**	**11,807**	**22,506**
Total in the world	**37,964**	**14,973**	**35,640**

Source: based on data from UIC (July 2017)

After China, HSLs were inaugurated in Turkey in 2009, with the 232 km line between Ankara and Eskisehir. The network has subsequently been expanded towards Konya, as well as towards Istanbul.

In all, 469 km of lines are currently under construction. Iran and Morocco have also built lines, which will soon be operational. At the beginning of April 2017, there were more than 24,602 km of lines in operation in developing countries, representing 65% of the world total. Moreover, numerous developing countries are characterized by high-speed rail projects. Some 11,807 km of lines are under construction in developing countries, accounting for 79% of the worldwide total, and a further 22,506 km are currently in the planning stages, representing 63,1% of all planned lines worldwide. These lines are improving, or are set to improve, the accessibility of the cities served to varying degrees[3]. These lines and projects are or will be taking shape in very different socio-economic contexts characterized by significant inequalities.

2.2 Socio-economic contexts in developing countries characterized by significant inequalities

Developing countries are characterized by lower levels of income per capita (Table 2).

3 This improvement depends on numerous factors (Delaplace, 2017): speed, the existing service, the topography of territories crossed, geographical characteristics (Campos, Rus de, 2009), the degree of urbanization, etc., or the management of interchange, access and egress times in stations (Givoni and Banister, 2011).

Table 2. Gross domestic product (GDP) per capita (current and constant $), gross national income (GNI) per capita and Human Development Index (HDI) in developing countries with HSLs or HSR projects				
Country	**GDP per capita in current $ (2016)**	**GDP per capita (PPP constant $ of 2011) (2016)**	**Gross national income (GNI) per capita in $ PPP (2015)**	**GNI per capita rank minus HDI rank**
Countries with lower-middle income				
India	1,709	6,092	5,663	-4
Vietnam	2,185	5,955	10,053	18
Morocco	2,832	7,266	7,195	-4
Egypt	3,514	10,319	10,064	-7
Indonesia	3,570	10,764	10,053	-8
South Africa	5,273	12,260	12,087	-30
Countries with upper-middle income				
Thailand	5,907	15,681	14,519	-11
Iran	6,530*	16,010*	16,395	-2
Kazakhstan	7,510	23,419	22,093	-3
China	8,123	14,400	13,345	-7
Mexico	8,201	16,831	16,383	-9
Brazil	8,649	14,023	14,145	-19
Russia	8,748	24,026	23,286	1
Malaysia	9,502	25,660	24,620	-13
Turkey	10,787	23,679	18,705	-7

Source: based on data from the Human Development Report, 2016 (GNI per capita and HDI); OECD 2017 (GDP per capita in $ PPP); World Bank 2017 (current GDP per capita/inhab.).

* 2014 data

But they are also characterized by significant inequalities – although these vary from one country to another – especially in terms of education and health, as reflected by their Human Development Indices. With the exception of Russia and Vietnam, taking into account education and life expectancy induces a lower ranking for these countries compared with the ranking obtained by taking into account GNI per capita only[4].

Moreover, income inequalities are also higher than they are in developed countries: "Developing countries tend to exhibit wider within-country inequality relative to developed countries" (World Bank, 2016, p. 10). Indeed, as shown by Kuznets in 1955, during the take-off period, growth is highly unequal because only a small percentage of the population benefits from the growth of national income[5] induced by this industrialization.

4 Luxembourg is the only developed country with a high-speed rail service characterized by such a low ranking.

5 Then, after a peak, inequalities diminish to form an inverted U. The existence of this inverted U-curve has been demonstrated econometrically very recently (Lessmann, 2014).

The value of their Inequality-Adjusted HDI (IHDI)[6], which is below the value of their HDI, shows the magnitude of these internal inequalities (Table 3).

In these countries, the Gini coefficient, which measures the deviation of the distribution of income among individuals or households within a country from a perfectly equal distribution, tends to be high or very high (Brazil, Mexico, South Africa), and in all cases[7] is greater than the Gini coefficients for developed countries with high-speed lines[8].

Moreover, in developing countries, income inequalities are linked to spatial inequalities that increase with growth and development. "Rapid economic growth is often associated with uneven regional and urban development" (Kim, 2009, p. 1).These spatial inequalities exist between regions, within regions, between cities and between cities and rural areas (Kim, 2009, Kanbur and Venables, 2005). In many countries, inequalities within regions seem to be as significant as inequalities between regions (Kim, 2009, p. 145).

Table 3. A selection of indices of internal inequalities in developing countries with operational or planned HSLs

Country	HDI	Inequality-adjusted HDI (IHDI)	Gini coefficient (Coefficient de Gini (revenu national brut par hab.)
Countries with lower-middle income			
India	0.624	0.454	35.2
Vietnam	0.683	0.562	37.6
Morocco	0.647	0.456	40.7
Egypt	0.691	0.491	N/K
Indonesia	0.689	0.563	39.5
South Africa	0.666	0.435	63.4
Countries with upper-middle income			
Thailand	0.740	0.586	37.9
Iran	0.774	0.518	37.4
Kazakhstan	0.794	0.714	26.3
China	0.738	N/K	42.2
Mexico	0.762	0.587	48.2
Brazil	0.754	0.561	51.5
Russia	0.804	0.725	41.6
Malaysia	0.789	N/K	46.3
Turkey	0.767	0.645	40.2
Developing countries	0.668	0.499	-
High HDI countries	0.892	0.793	-

Based on data from Human development report, 2016

6 The inequality-adjusted HDI (IHDI) value takes into account the inequalities in the three basic dimensions of human development, i.e. the way the country performs in terms of education, health and the distribution of GNI among the population. It reduces the HDI according the degree of inequality in the country in question.

7 Except Kazakhstan.

8 It is between 28 for the Netherlands and 35.9 for Spain.

There are also inequalities between the rural world and the urban world because, within a given country, wages in urban areas are higher than those that prevail in a rural environment. As underlined by Perroux (1955, p. 309) “growth doesn’t appear everywhere at the same time; rather, it appears in different areas or growth clusters with variable intensity”. For example, in China in 2006, the incomes of the urban population were on average 3.55 times higher than those of rural populations (Boquet, 2009) and this gap has grown as the country has developed (1.7 times in 1984, 2.3 in 1992, 2.8 in 2000, 3.2 in 2004). Similarly, in Morocco, while 19% of the Moroccan population lives below the national poverty line, 70% of these individuals live in rural areas (Boutayeb, 2006). So what is the impact of high-speed rail in the developing world, given the levels of economic, social and spatial inequalities that characterize it?

3. High-speed rail and the issue of inequalities in developing countries

Mobility has become necessary in developed countries. Since 1982 in France, the national law on domestic transport (known as LOTI, or Loi d’orientation des transports intérieurs) has institutionalized a right to transport, and mobility has become a right (Orfeuil, 2011, Urry, 2000, quoted by Cass et al., 2005). Indeed, this “rising value of contemporary societies is at the same time a factor in the reinforcement of social inequalities” (Bacqué and Fol, 2007; see also Cass, 2005 for the case of Great Britain), since without this right an individual cannot access a whole series of activities and, increasingly, employment (Orfeuil, 2004, Bacqué and Fol, 2007). The mobile processes and infrastructures of travel and transport can generate and reinforce social exclusion (Cass et al., 2005). While the issue of inequalities associated with transport and mobility is not new, it has to date mainly been addressed from the point of view of daily urban mobility. However, high-speed rail is also likely to reinforce inequalities. This is the case in developed countries, but more particularly in developing countries, in part because high-speed rail does not serve all areas within these countries, but also because it can lead to economic exclusion and exclusion in terms of access and use.

3.1 High-speed rail and inequalities: an analytical framework

People do not always have the opportunity, income and/or skills to be mobile. The literature defines social exclusion as the inability of individuals to access activities in which they need to participate (Kenyon et al., 2002, Preston and Rajé, 2007 and Church et al., 2000, for an analysis of social exclusion linked to transport, and Banister, 1994, on equity issues in transport). An improvement in the transport offer associated with a high-speed line can lead to inequalities and be spatially inequitable in the sense that not everyone has access to it.

The issue of inequalities associated with high-speed rail has recently been studied in developed countries. In the case of Spain, Monzon et al. (2013) show that extensions of high-speed rail in periurban areas have led to an increase in spatial imbalances and contribute to a more polarized spatial development. Bouf and Desmaris (2015) consider that high-speed rail lines are spatially unfair in France, first because they promote growth in an unfair way, secondly because the pricing system is unfair (ticket prices per kilometre vary according to the line and are not proportional to the distance travelled), and lastly because the way in which they are funded (amounts, types of contributors) vary significantly from one line to another. Kim and Sultana (2015) point out that in South Korea spatial equity was diminished when the network was extended in 2010/2011, as accessibility improvement was concentrated in cities located on the first high-speed corridor near the capital. Pagliara et al. (2016) show that in Italy people are very sensitive to the cost of accessing high-speed rail and the cost of high-speed train tickets. These costs have a strong impact on spatial equity.

In developing countries, this issue has been analysed by Shi and Zhou (2015) in China. They show that investments in high-speed lines have not significantly changed transport equity. While the accessibility of cities has been improved by high-speed services, the price of a ticket is unaffordable for a large part of the population.

In the literature, we can find three types of inequalities linked to high-speed rail:

- spatial inequalities linked to the fact that the infrastructure is not uniformly distributed in spatial terms;
- spatial inequalities related to differences in service between the territories served;
- economic inequalities linked to pricing.

3.2 Inequalities in access related to infrastructure and service

As Kim pointed out in 2009 (Kim, 2009, p. 137), "infrastructure investments that increase the mobility of goods, labour, and capital may have significant impacts on spatial inequality because of the self-forcing nature of increasing returns". In both developed and developing countries, highspeed rail networks do not serve all cities and are generally concentrated on routes between the largest urban centres. Indeed, while in France many intermediate and even small towns are served by TGV (the French high-speed train), most often on a conventional line, in other countries such as Japan, where high-speed trains do not operate on the conventional network, fewer cities are served (see Campos and de Rus, 2009, for a presentation of the different types of networks). In China, the network serves the largest cities in the country, mainly on the east coast, except for the line linking Xuzhou to Lanzhou in the centre of the country . In Turkey, Ankara, Istanbul and Konya are among the seven largest cities in the country [9]. The other smaller cities served by high-speed rail are located on the Ankara–Istanbul line. Thus, the inequalities of access linked to the existence of a line are close to those existing in some developed countries.

Moreover, the level of the service (frequency, during the week, at weekends) is variable between cities. For example, the frequency is often correlated to the size of the urban areas in question. In 2010 in France, there were on average 3.3 direct round trips to Paris for cities with 20,000 to 100,000 inhabitants and 10 for cities with more than 200,000 inhabitants (Delaplace, 2012).

There are inequalities in the service provided. These inequalities depend on the size of the cities served. In China, given the large size of most cities, service inequalities are likely to be lower. The magnitude of improvements resulting from new high-speed services also depends on the existence and quality of conventional rail services in a given city (Delaplace, 2017, Garmendia et al., 2008). If the quality of the previous classic rail service was very low, the improvements linked to HSTs will appear to be more significant. In these circumstances, the increase in accessibility will represent only a marginal improvement. In developing countries, rail service is generally of lower quality or nonexistent. The inequalities of accessibility between territories served by high-speed rail and those that are not are thus much more significant.

This differentiated spatial impact of HSR may be linked to economic inequalities.

3.3 Access inequalities related to pricing and differentiated income

High-speed rail services can generate economic exclusion because of ticket prices. Indeed, these tickets are often more expensive than conventional train tickets. High-speed rail services are thus not merit goods accessible to all.

9 There is another line towards the north-western part of China linking Lanzhou and Urumqi, but its operating speed is below 250 km/h, the minimum for a rail line to be considered a high-speed line.

When prices are high, they are used more extensively by the socio-professional categories that have the highest income and are most mobile (senior managers, consultants, etc.). This was long the case in France (Klein and Claisse, 1997, Klein, 1998, Mannone, 1995), before the development of discounted fares ("Prem's" tickets and Ouigo services) (Delaplace and Dobruszkes, 2015). According to Szynkier (2012), more than 70% of TGV trips are made by the five wealthiest deciles (Szynkier, 2012). For example, a second-class ticket for a Paris–Marseille round trip in July 2017 can cost up to EUR 223 – that is, 13% of the net median per-capita wage in 2016. While the literature shows that daily mobility varies relatively little according to income level (Paulo, 2007), this is not the case for professional mobility or weekend mobility. Rates of weekend travel are two-thirds higher for the fifth quintile than for the first quintile. The distance travelled by the former group is also 2.4 times higher than for the latter. Rouquette shows that, in France, 58% of people belonging to the first decile of standard of living do not go on holiday, whereas this proportion drops to 15% for the tenth decile (Rouquette, 2001). Long-distance mobility (over 100 km) is even more highly correlated with income. Similarly, the modal shift from air to rail travel is a priority for high-income travellers. Income levels influence the potential for leisure mobility and long-distance mobility. Low-income populations might therefore be excluded from the possibility of using these high-speed rail services. For example, in France in 2013, national rail operator SNCF estimated the number of users who would not have travelled at all without the Ouigo offer (Delaplace and Dobruszkes, 2015) to be 25% of the total number of Ouigo users, reflecting a possible economic exclusion.

These income levels vary from country to country and, by definition, are lower in developing countries. In these countries, the level of exclusion can be significant if the cost of a ticket is high and income inequality higher. As highlighted by Shi and Zhou (2015), high-speed rail is inaccessible to a large part of the Chinese population in a country characterized by very high growth in income inequality: "The top 10% income share rose from 27% to 41% of national income between 1978 and 2015, while the bottom 50% share dropped from 27% to 15%" (Piketty et al., 2017). For example, a Beijing–Shanghai ticket was priced at about EUR 142 in July 2017, which represents about EUR 621 in purchasing-power parity (PPP). In these conditions – and, as some have argued, given public spending on HSR – taxpayers pay for the mobility of the richest (Delaplace and Dobruszkes, 2016). Nevertheless, the price of a high-speed train ticket is not always so high in developing countries. For example, in Turkey, the train fare is equivalent to the bus fare on the Ankara–Konya route and only slightly higher for the Ankara–Istanbul and Ankara–Eskisehir routes. It is even lower for the Eskisehir– Konya link (Celikkol-Kocak et al., 2017). For example, the price of a Konya–Istanbul ticket in PPP is just EUR 41.30. In the case of Morocco, if our calculations (see below) are correct, the cost of a Casablanca–Tangier ticket will be MAD 150 – or, in PPP[10], approximately EUR 45 – for 350 km[11].

The economic inequalities of access to high-speed rail are thus variable in developing countries. They depend on fare policy and income inequality: the greater the income inequality and the more selective the pricing policy, the greater the inequality of access.

But beyond these types of inequalities, there may also be inequalities in terms of possible uses. Indeed, the range of possibilities in terms of economic activity and mobility for the population is differentiated not just according to individuals' status but also to the society to which they belong.

3.4 Inequalities in terms of possible uses of high-speed rail

A high-speed line can be used for business trips, for tourist trips and sometimes for commuting. But it is only relevant for distances between 150 km and 800 km. Below 150 km it competes with car travel and beyond 800 km it competes with air travel (Klein, 1997, 1998, EC, 2010).

10 OECD (2017) Purchasing-Power Parity (PPP) (index). doi: 10.1787/c0bc06ba-fr (accessed July, 18 2017).

11 For comparison, a ticket for travel between Paris and Nancy (i.e. for an almost equal distance) can cost up to EUR 89.

High-speed rail transport therefore only concerns long-distance mobility. It should be noted that, at the international level, these mobilities in developing countries currently lag behind those in industrialized countries. According to Doyle and Nathan (2001), the richest 20% travel 3.5 times farther than the poorest 20%. On the other hand, while in Western societies one may consider that "individuals live in one place, work in another, and distract themselves in a third" (Paulo, 2007), it is in all probability less marked in developing countries. Mobilities are therefore linked to levels of development.

For example, tourism-related mobility depends on working time and holiday allowance, which varies between countries. A reduction in working time, as has been the case in France since the beginning of the 2000s, has increased the potential for mobility and has led to an increase in short-term tourist stays (notably city breaks) as a result of TGV services. The very idea of tourist mobility also differs between countries. In South Korea, due to the low annual holiday allowance (15 days), travel is most often devoted to family events. Consequently, mobility potential is more restricted for leisure and tourism. More generally in developing countries, tourism has long been either international or the preserve of a local minority. It grows among the middle classes only with increases in the standard of living (Cazes, 1983, quoted by Berriane, 1989), as evidenced by the current development of domestic tourism in China, estimated at 300 million tourists (Taunay, 2010). It is therefore initially the wealthiest populations who are able to travel for tourism purposes, and in particular long-distance tourism-related travel. But developing countries can also be countries that play host to international tourists. By reducing journey times, high-speed rail could expand the geographical market area of tourist destinations (Sands, 1993, Masson, Petiot, 2009, Urena et al., 2009, Wang et al., 2012, Chen, Haynes, 2014) that are connected to the network within these countries, and even in certain cases influence the destination choices of tourists (Delaplace et al., 2014, 2016, Pagliara, 2015, Saladie et al., 2016).While economic analysis considers that transport time is a cost that must be minimized, the value of travel time savings associated with a high-speed rail service depends, however, on the importance given to time, its valorization and possible alternatives, as evidenced by the study by Zhao et al. (2015): in China, some passengers prefer to take a night train rather than a high-speed train. This also depends on being in a position to arbitrate between several possible choices. Moreover, the use of high speed cannot be understood in a society in which time is not valorized. People do not value or devalue the future solely on the basis of their age, situation or position in society: "Conceptions of time depend on the rules of the social game; behind the exchange, there is communication of signs and symbols" (Hugon, 1991, p. 343). Thus, behaviours and uses are determined by values and rules, which delineate the rules of the game and shape the preferences of agents (Windrum and Garcia Goni, 2008). These rules, these values, and these institutions (North, 1991) are different from one space to another, and from one society to another. The actions of agents are embedded in tissues of institutions that are likely to be different since these agents are located in specific societies. "What is necessary for full 'social' inclusion varies as the means and modes of mobility change and as the potential for 'access' develops with the emergence of new technologies such as charter flights, high-speed trains, budget air travel, SUVs, mobile phones, networked computers and so on. These developments transform what is 'necessary' for full social inclusion" (Cass et al., 2005, p. 542).

The set of possible choices for each individual as well as the set of uses he or she envisages are partly determined by location (Delaplace, 2017). High-speed rail is essentially a sign of modernity, and moving frequently over long distances is sometimes a sign of distinction. There is thus a symbolic dimension of the use of high speed that is likely to reinforce existing inequalities.

In addition, individuals do not always have the competencies to identify transport options and produce their own itineraries.

3.5 Inequalities in terms of competencies required to use high-speed rail

As Orfeuil pointed out (2010, 7), "mobility is also a matter of competence". In both developed and developing countries, there may be a form of exclusion linked to the inability to construct a travel itinerary. Because of a very simplified world representation, it may be difficult for certain population categories to identify journey break points, etc. Others may not be able to build complex routes involving transfers between stations. Similarly, populations without bank accounts and/or internet access or who do not have a smartphone cannot buy tickets remotely. Indeed, like any new object, high-speed rail must be appropriated and domesticated (Haddon, 2011) in order to be used (Akrich, 1990). The ability to plan a journey to discover a museum, city, region or country depends on the competencies of individuals. The cultural resources (or cultural capital – Bourdieu, 1979) available to them determine their ability to envisage a given destination and a particular journey. This capacity or "capability", to use Sen's terminology can be analysed as the possibility for each individual to choose the type of life he or she wishes, "the various combinations of functionings (beings and doings)" (Sen, 1989, p. 44) that the person can achieve, and consequently the associated form of mobility or immobility. However, this capacity is linked to one's level of education, which in developing countries is on average lower than in the so-called developed countries, as shown by the inequality-adjusted education index (Table 4).

Table 4. Index of Inequality-adjusted education in developing countries with operational or planned HSLs

Country	HDI	Inequality-adjusted education (%)	Inequality-adjusted education index (value)
Pays à revenu intermédiaire de la tranche inférieure			
India	0.624	39,4	0, 324
Vietnam	0.683	17,6	0, 508
Morocco	0.647	45,8	0, 273
Egypt	0.691	35,0	0, 390
Indonesia	0.689	20,8	0, 492
South Africa	0.666	13,8	0, 608
Pays à revenu intermédiaire de la tranche supérieure			
Thailand	0.740	16,1	0, 538
Iran	0.774	37,3	0, 441
Kazakhstan	0.794	5,9	0, 758
China	0.738	Nc	Nc
Mexico	0.762	19,7	0, 525
Brazil	0.754	22,6	0, 527
Russia	0.804	2,2	0, 798
Malaysia	0.789	Nc	Nc
Turkey	0.767	14,2	0, 574
Developing countries	0.668	31	0,391
High countries	0.892	7,2	0, 797

Based on data from Human development report, 2016

From this point of view, and to paraphrase Myrdal (1957), there may be circular and cumulative causality in terms of inequality in developing countries. High-speed rail might increase the already significant inequalities in these countries.

The question is now to identify the effects of high-speed rail on inequalities in Morocco.

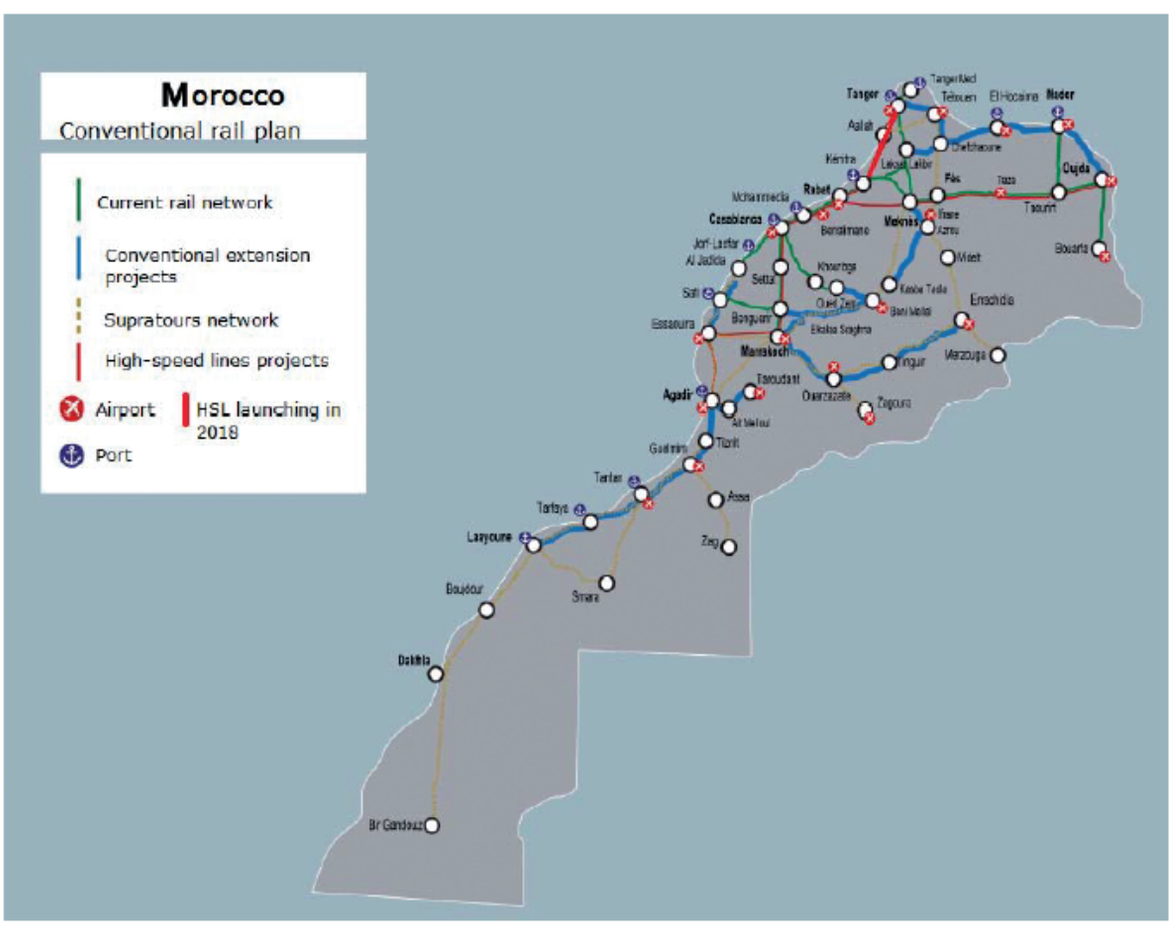
4. High-speed rail in Morocco and the issue of access inequalities

A national master plan for high-speed lines in Morocco was drawn up in 2005. The construction of 1,500 km of lines is expected by 2035 along two axes: the Atlantic axis and the Maghreb axis [12]. This plan could reinforce the already significant inequalities in access to rail transport. Other possible inequalities are associated with income levels and uses of rail transport.

4.1 The national master plan for high-speed lines and the public transport network in Morocco

The west and north of Morocco are equipped with a railway network serving both travellers and freight (shown in green on Map 1).

Map 1. High-speed lines and the wider public transport network in Morocco



Source: modified from Ipemed, 2014, p. 81.

12 This second axis, planned for the very long term, might enable services from Rabat to the eastern part of Morocco, and in particular Meknes and Fez, then Taza, Taourirt and Oujda, and then Algeria and Tunisia.

Inherited from the colonial era, the rail network has been modernized since the 1980s[13] and new sections have been built. The investment budget devoted to rail transport more than doubled between 2008–2011 and 2012–2015, from MAD 13.2 billion to MAD 30.8 billion. Morocco has begun major renovations of several stations (Hakimi, 2017).

Following network modernization, passenger rail traffic growth – and thus growth of mobility – was very strong, increasing from 14.7 million passengers in 2002 to 18.5 million in 2004, 31 million in 2010, 34 million in 2011 and 40 million in 2015. It is in this context of traffic growth in western and northern Morocco that the first section of the high-speed rail line along the Atlantic axis was built. It is 200 km long and connects Tangier to Kenitra (Map 1)[14] without any intermediate stations[15]. It is the first high-speed line in Africa. Trains will start operating in June 2018. Beyond Kenitra, the trains will continue on conventional lines at 160 km/h, or on some sections 220 km/h, in order to reach Rabat (the political capital of Morocco) and then Casablanca (the country's economic centre). Subsequently, the line is due to be extended to Settat, Benguerir, and then Marrakesh (480 km), and in the longer term from Marrakesh to Essaouira[16] and Agadir.

These lines are supposed to enable increased mobility. The Moroccan National Railways Office (ONCF) estimates that the total number of passengers on its routes in 2035 will be 133 million compared with 52 million without the high-speed line. High-speed rail will thus contribute to the development of rail traffic and consequently to exchanges between the cities served. The ONCF has announced that the number of travellers is set to double (from 3 million to 6 million per year) on the Tangier–Casablanca[17] route. Of these, 4 million (66%) would come from the usual demand for rail (including induced traffic estimated at 12%), while the other 2 million would be new customers (34%) switching from road-based transport. This corresponds to a modal shift from road to rail (all modes of individual or public transport) as well as to air travel (2%) (ONCF, 2015). This growth in passenger numbers resulting from such modal shifts – as well as partly from growth in overall mobility – is very strong; however, it will also be accompanied by significant inequalities in access.

4.2 A significant improvement in accessibility associated with inequalities in access

Given the relatively outdated state of existing rail transport, the Tangier–Kenitra high-speed line will allow for a considerable reduction in journey times, although these reductions will vary according to the city, since some will be served in part by high-speed trains running on conventional tracks. The Moroccan TGV is an adaptation of the French TGV[18]. They have been adapted to conditions in Morocco, particularly in terms of outdoor temperatures and the effects of sand. The 12 duplex trains that have been purchased can circulate at an operating speed of 320 km/h (the equivalent of the East European HSL). Journey times will be cut by 76% between Tangier and Kenitra (entirely on HSLs), a reduction much higher than that made possible by the commissioning of HSLs in countries such as France[19]. They will decrease by 57% between

13 Between 2005 and 2009, the Casablanca-Fez, Casablanca-Kenitra, Casablanca-El Jadida and Fez-Sidi-Kacem lines, which were previously single-track, have been split. New tracks linking Tangier to the Tanger Med passenger and cargo port and Taourirt to Nador have been built (AT, 2011).

14 Intermediate city located at 50 km north of the capital.

15 The station planned for Larache, 90 km to the south of Tanger, has been temporarily abandoned. Land reserves have nevertheless been preserved for a possible station.

16 This project seems to have been modified in 2017. The new project doesn't serve Essaouira and instead provides a direct link from Marrakesh to Agadir. See: https://www.tgvmaroc.ma/projet/.

17 See: https://www.tgvmaroc.ma/projet/retombees/.

18 The trains are built by Alstom, the company which builds the French TGV (source: Alstom Transport (AT), June 2011).

19 For comparison, the East European high-speed line cut journey times by 44% from Paris to Nancy and by 50% from Paris to Reims.

Tangier and Rabat, and by 51% between Tangier and Casablanca; in both cases, trains coming from Kenitra will run on conventional lines (Table 5).

Table 5. Time savings in June 2018

Origin-Destination	Time savings (%)	Origin-Destination	Time savings (%)
Tangier–Kenitra	47 min instead of 3 h 15 (-76%)	Tangier–Fez	3 h instead of 5 h (-40%)
Tangier–Rabat	1 h 20 instead of 3 h 45 (-57%)	Tangier–Meknes	2 h 30 instead of 4 h 30 (-41%)
Tangier–Casablanca	2 h 10 instead of 4 h 45 (-51%)	Tangier–Marrakesh	4 h 30 instead of 8 h (-44%)

Source: based on ONCF data. 0

Moreover, with the interconnection made possible in Kenitra, the high-speed train will bring Tangier significantly closer to other Moroccan cities like Fez, Meknes and Marrakesh. Although the latter are currently well served in terms of frequency (two trains per hour between the cities of Fez and Meknes on the one hand and Kenitra on the other), journey times are currently very long. Highspeed rail will significantly reduce these times, as Fez will be connected to Tangier in less than 3 hours, compared to 5 hours today (a 40% reduction in travel time); and Meknes will be connected to Tangier in 2½ hours, compared to 4¼ hours on average today (a decrease of 41%).
Similarly, with the doubling and upgrading of the Casablanca–Marrakesh line, Marrakesh is expected to be at 4½ hours from Tangier in June 2018, compared with 8 hours at present – a decrease of 44%. Lastly, in Tangier, a connection will exist with El Jadida, a tourist town on the Atlantic Ocean, with Tangier airport, and with the port dedicated to passenger transport (at Tanger Med).

Beyond travel times, improvements in accessibility depend on the service frequency.

Each of the 12 duplex trains can carry up to 533 passengers and consists of 8 carriages (two first-class carriages, one buffet car and five second-class carriages). The 10 trains in circulation (2 will be kept in reserve) will allow for a maximum of 40 rotations per day. The frequency between Tangier and Kenitra and then Rabat and Casablanca will make possible a frequency of one train per hour[20] (probably a little more during peak hours) from 6 a.m. to 9 p.m. (compared with 5.30 a.m. to 1.30 p.m. today with conventional trains). Although the timetable is not currently known, it will be primarily intended to facilitate business mobility between the cities served.
Improving accessibility will thus be extremely important for the cities that are on the network (Tangier and Kenitra), and very important for those connected to the network but served on a conventional line (Rabat, Casablanca, Fez and Marrakesh).

The overall population concerned by this line and its services can be estimated. If we consider only the cities served by high-speed lines and population centres near these cities served by conventional lines, just over 6.2 million inhabitants of Moroccan cities – out of a national population of 33 million – will benefit from this service[21].

20 Source: http://www.usinenouvelle.com/article/quand-l-oncf-fait-la-promo-en-video-du-train-a-grandevitesse-marocain.N341962/.

21 Source: http://rgph2014.hcp.ma/Repartition-geographique-de-la-population-d-apres-les-donnees-du-Recensement-General-de-la-Population-et-de-l-Habitat-de_a380.html/

22 As with other indicators in developing countries, population data must be treated with caution, as accurate data collection is often difficult to achieve.(tabla 6)

Table 6. Population[22] growth in Moroccan cities served by high-speed trains		
City	**Population**	**Average annual rate of population growth, 2004–2014 (%)**
Tangier	947,952	3.26
Kenitra	423,890	N/K
Rabat	577,827	-0.79
Salé	890,4	1.59
Casablanca	3,359,818	1.03

Source: based on data from HCP 2014.

The inhabitants of Fez (1,112,072 inhabitants), Meknes (632,079 inhabitants) and Marrakesh (928,850 inhabitants) – a total of 2,673,000 residents – will also benefit from a significant reduction in journey times to Tangier, but with an interchange at Kenitra.

However, a large part of Morocco is not only excluded from high-speed rail access but also excluded from the conventional rail network (see Map 1 above). Those areas of Morocco to the east and south of Marrakesh (which represent half of the country's geographical area) are served by the Supratours bus network (shown in orange on Map 1). The populations of the Moroccan regions of GuelmimEs Semara (501,921 inhabitants), Laâyoune-Boujdour-Sakia El Hamra (301,744 inhabitants), Oued EdDahab-Lagouira (142,955 inhabitants) (i.e. 2,097,629 inhabitants in total) and those in the south-east of Meknes-Tafilalet (2,316,865 inhabitants) are not served by either the conventional or the highspeed rail network.

The cities that are served, by contrast, are among the most dynamic cities in Morocco.

4.3 A first section of HSL that could reinforce existing dynamics

As indicated by the ONCF, the first section of high-speed line should enable "the rapprochement, synergy and integration of the two most dynamic regions of the Moroccan economy: the Casablanca–Rabat–Kenitra historic core, and the emerging business leisure and tourism centre in the northern region". It is expected that "there will be significant benefits in terms of […] the country's international and regional reputation and its image and attractiveness within the tourism and business sectors (investors, business community, etc.)" (ONCF, p. 3).

High-speed rail will benefit Tanger Med, which is one of the largest intermodal platforms on the Mediterranean coast and the largest container port in Africa (World Bank, 2015. For example, the HCP report (2016) points out that the regions of Casablanca-Settat and Rabat-Salé-Kenitra made the largest contributions to national GDP in 2014, with Rabat-Salé-Kenitra generating 32% of GDP and Casablanca-Settat 16.3%. The Tangier-Tetouan-Al Hoceima region arrives in third position with 9.4% of GDP. These three regions are thus characterized by GDP growth rates well above the national average (2.9%), with 7.1% for the Rabat-Salé-Kenitra region, 5.3% for the Casablanca-Settat region and 4% for Tangier-Tetouan-Al Hoceima (HCP, 2016).

As in many countries, high-speed rail service serves the most populous cities – and also the richest ones – so as to generate sufficient demand.

The question is now to identify how high-speed rail is integrated into Moroccan society, in terms of income and uses.

4.4 Limited access inequalities in terms of fares

According to the ONCF, the Moroccan HSR project has been designed differently from other similar projects developed elsewhere – especially in Europe, where high-speed trains compete with air travel. It is expected that HSR will be used by a large majority of Moroccans and not just the wealthiest sections of the population (ONCF, p. 18). If this turns out to be the case, Moroccan high speed-rail services could be compared to Turkish HSR, which offers relatively cheap fares (cf. above) and directly competes with bus services. In Morocco, "pricing will be incentive-based and competitive, in harmony with the purchasing power of conventional train users" (ONCF, p. 18), in accordance with the King's wishes that the service be designed for the greatest possible number of people. The inequalities of access in terms of pricing should therefore be relatively low.

However, the exact fare structure and prices are not yet known, as of August 2017.

But we can estimate the prices. According to the journal *Jeune Afrique*[23] and the ONCF, the price increase should be very low. Casablanca–Tangier ticket prices should only increase by MAD 17 (EUR 1.50), that is to say an increase of 12.9%, and should cost just under MAD 150[24], or about EUR 45 in PPP, for 350 km. This would be only MAD 4 more than the bus ride[25].

Assuming that the 12.9% increase will apply to all journeys[26], the price of a journey from Tangier to Kenitra would be MAD 100.80 (MAD 90 currently + MAD 10.80), or about EUR 30.10 in PPP, while a ticket for Marrakesh to Tangier would cost MAD 243.80 (216 + 27.80), compared with MAD 235 for the same journey by bus, which corresponds to a little more than EUR 73 in PPP.

If our estimates are correct, it is clear that pricing will be low and likely to be set at a level close to current ticket prices for bus travel. Moreover, unlike Turkey, where prices are fixed, pricing will be based on a yield-management system. This means it will be possible to buy tickets at prices close to the cost of classic tickets for certain timetable slots, thus encouraging use by more diversified populations.

The next question, however, is to know what these prices represent in Morocco – in other words, what is the purchasing power of the Moroccan currency?

Morocco is characterized by a relatively low level of development. With $7,266 of GDP per capita (current international PPP $ from 2011; cf. Table 2 above) in 2014, it is among the lower-middleincome countries according to the World Bank. In terms of the Human Development Index (HDI), Morocco's score of 0.647 in 2015 placed it in 123rd position out of 188 countries, although this ranking has been constantly increasing since 1980.

In 2015, the non-agricultural minimum wage was MAD 2,570 per hour (or EUR 240 per month).

23 See: http://www.jeuneafrique.com/30394/economie/le-tgv-tanger-casablanca-en-sept-points/.

24 It should be borne in mind, however, that ticket prices did increase in early 2016 as a result of a rise in the VAT rate from 14% to 20%. Source: http://telquel.ma/2016/01/05/decouvrez-les-nouveaux-tarifsloncf_1476364/.

25 Our calculation, based on Supratours data; source: http://www.supratours.ma/.

26 This will not necessarily be the case, as certain journeys or sections of journeys will be made by HST but on conventional lines; any price increases that are implemented for such journeys are therefore likely to be limited.

The average wage in the private sector varies between MAD 4,811 (EUR 442), for the 3 million employees affiliated to the National Social-Security Fund (CNSS), and MAD 11,205.60 for the 580,000 employees affiliated to the Moroccan Interprofessional Pension Fund (CIMR), for a total employed labour force of 11.5 million. However, just over 87% of workers affiliated with the CNSS receive less than MAD 6,000 per month, and 43.4% receive a sum equal to or lower than the minimum wage.

Finally, the inactive population amounts to just over 22 million and the unemployment rate stands at 16.4%.

With this in mind, a Casablanca–Tangier high-speed rail ticket would represent a little more than 5.8% (MAD 150 / MAD 2,579) of the minimum wage[27]. It should therefore be noted that prices represent a relatively small percentage of income.

Of course, not all Moroccans are salaried, and some earn less than the minimum wage. Moreover, Morocco is characterized by significant inequalities that are likely to lead to inequalities in HSR use.

4.5 Potential inequalities deriving from possible uses linked to gender inequalities

While high-speed rail is used for long-distance mobility associated with professional travel or commuting (see above), we have little data on these mobilities in Morocco[28].

These being the case, professional mobility or long-distance commuting are often linked to income and/or a high level of education. Furthermore, Morocco is characterized by an average duration of schooling for the population aged over 25 that is not just very low (5 years) but also much lower than other countries in the same category (for which the average is 6.6 years), and even less that the average duration in sub-Saharan Africa (5.4 years). In addition, educational inequalities are very marked. For example, Morocco's inequality-adjusted education index (0.273; see Table 4 above) is much lower than the other countries in its category[29]. Moreover, it is also characterized by a GenderRelated Development Index (GDI) of 0.826, which is at a lower level than other countries in the same region, such as Algeria or Tunisia, or than countries in the same category (lower-middle-income countries). This GDI value signifies that the level of human development of Moroccan women is only 82.6% of that of men, compared with an average of 87.1% for countries with average human development and 84.9% for countries with weak human development; this rate is lower than that of sub-Saharan African countries. And it is once again educational inequalities that are at stake: the average duration of schooling for women over 25 is just 3.8 years, compared with 6.4 for men.

In this domain, too, Morocco is characterized by results equivalent to those of the least developed countries in the world. As noted in the UNDP Africa report, "gender disparities are particularly acute in Egypt, Morocco and Mauritania" (UNDP, 2016, p. 174). An analysis of the different elements of gender inequality in Morocco shows that women's incomes are 30% lower than those of men, as is the case everywhere in North Africa. Morocco is also characterized by

27 For comparison, a normal Paris–Strasbourg ticket costs between EUR 107 and EUR 149 in second class – that is, between 9.3% and 13% of the net minimum wage (EUR 1,149 per month).

28 Except for trips outside Morocco (whether migratory or tourism-related), but these are not of interest for this analysis.

29 The index for Morocco is on a par with some of the countries with the lowest human development indices on the planet (Haiti, Togo, etc.).

a lower number of women than men with a secondary-level education (7 women for every 10 men among the population aged 25 and over), and only 11.7% of members of parliament are women. In addition, the percentage of companies headed by women is extremely low (less than 5%), the lowest in Africa after Sudan. Lastly, the unemployment rate for women is 29.6%, compared with 12.4% for men.

Accordingly, the types of inequalities that HSR services could reinforce, in terms of gender, are likely to be inequalities of professional mobility: the population likely to use HSR will probably be more male than female.

But high-speed rail services can also be used for tourism-related mobility.

Morocco's "Prospective Maroc 2030" long-term perspectives initiative (HCP, 2007) and "Vision 2020" tourism development strategy aim to continue to make tourism one of the motors of the economic, social and cultural development of Morocco (SMIT, 2011). Indeed, Morocco recorded 9.3 million tourist arrivals at its border posts in 2013, rising to 10.4 million in 2014 and 10.2 million in 2015. From this point of view, HSR services could be used by foreign tourists for certain journeys within Morocco, in particular between Tangier and Marrakesh[30]. However, given the existing competition with airlines from the main countries of origin of tourists visiting Morocco, this use seems unlikely.

But HSR services could also be used for domestic tourism, which has long been ignored, even if certain authors, such as Mohamed Berriane, stressed how important this was as early as 1989. "With an average departure rate of over 30%, Moroccan urban dwellers account for between 18% and 20% of overnight hotel stays (depending on the year), with some also choosing to lodge with local residents" (Berriane, 1989, p. 10). The Moroccan administration wishes to develop this type of tourism with the aim of tripling the number of domestic travellers. In 2015, the domestic tourist market has continued to grow, as has been the case since 2010. Overnight stays in hotels grew by 11% to represent 32% of the total, a larger percentage than those of the French market (20%). It is thus not just the wealthiest Moroccan categories, but also those within the middle classes who are able to benefit from tourism activities, that are liable to travel by high-speed train.

In such cases, the organization of connections and intermodality in order to access or exit from stations when travelling to or from the seaside destinations of M'Diq, Tetouan, Fnideq and Cabo Negro on the Mediterranean coast, or Larache[31] on the Atlantic coast near Tangier, or the resorts of Mehdia or Salé close to Kenitra will therefore be of central importance. Indeed, for tourism-related trips, links between HSR stations and final destinations must be designed so that the time saved by high-speed rail is not lost in reaching the station or the final destination.

5. Conclusion

In this article, we have highlighted the fact that there are many high-speed rail projects under way in developing countries. We subsequently showed how these countries' socio-economic contexts, marked by significant inequalities, could influence the use of HSR. We put forward the hypothesis that the innovations in terms of service improvement represented by high-speed rail – which are considerable in Morocco – could actually reinforce these inequalities insofar as infrastructure and services are differentiated in spatial terms; however, we also pointed out that these inequalities could be spatial, economic, social and use-related. In

30 High-speed rail is used by tourist foreigners in China, for example (Chen and Haynes, 2014).

31 Where land reserves have been made for a planned high-speed rail station (cf. above).

the case of Morocco, considerable spatial inequalities already existed, in particular because the conventional railway network is old and very unequally distributed in spatial terms. Consequently, with the arrival of high-speed rail, accessibility inequalities between different Moroccan cities will become much greater. On the other hand, if our estimates are correct, inequalities in terms of pricing may well be relatively low for people who are in employment. But economic, social and educational inequalities could combine with gender inequalities to make use of high-speed rail highly unequal.

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