Key Points

• The construction of the Haramain High-Speed Rail in Saudi Arabia was carried out in two primary phases and involved numerous stakeholders. With respect to operation and maintenance, the Saudi Arabian high-speed rail system follows the Spanish standard of one employee per kilometer of line to ensure efficiency.

• This policy brief presents a set of recommendations stemming from the Haramain High-Speed Rail, which we hope will be useful and applicable to other high-speed rail systems.

• Of the seven recommendations, three focus on the operational aspect of high-speed rail systems. We recommend that such systems maximize their ability to execute eco-friendly practices, institute measures that promote quality of life, and implement a stable mobility network by adjusting operational times to known high-traffic periods and integrating with existing transport systems.

• The fourth and fifth recommendations focus on cultural and social aspects. High-speed rail systems should be in sync with national policies and localized social standards. Furthermore, a high-speed rail system should adopt a multidimensional approach that simultaneously improves training programs technically, socially, and culturally to ensure that knowledge is effectively transferred from the trainers to the next generation of employees.

• The last two recommendations highlight the construction phase of high-speed rail systems. High-speed rail operators are encouraged to have a robust stakeholder management system in place and also examine the viability of outsourcing some products and functions.

Introduction

The evolution of high-speed rail (HSR) over the course of the late 20th and early 21st century has not only made significant contributions to the entire transportation system but has also shown significant potential to promote regional development. To preserve this positive momentum, global advancement of the construction, and the operation and maintenance (O&M) of HSR systems is imperative. This policy brief provides a detailed overview of the newly developed Haramain HSR and provides recommendations and lessons that can be drawn from this distinctive HSR system.

The Development of HSR in Saudi Arabia

The Haramain HSR is a double-track 450-kilometer electric-rail link that connects the major Saudi Arabian cities of Makkah (Mecca), Madinah, Jeddah, and King Abdullah Economic City (KAEC). It is the first HSR system in the Middle East and is faster than its Saudi Arabian predecessors: the Dammam-Riyadh Line and the North-South Railway Line. The Saudi Railway Organization began construction of the Haramain HSR in 2009 and divided the project into two phases through a public-private partnership that allocated $16 billion in investment (Alarabiya News 2016; Railway Technology).

This policy brief is based on the January 28, 2022 workshop, Global Experiences on Capacity Development for O&M of High-Speed Rail, and supplemented with additional sources published online.

The event in January was the third and final in a series of invitation-only learning workshops organized to support the planned training of NHSRCL’s key O&M leaders. Various operators of HSR were invited as panelists to provide their views about their HSR systems, elaborate on their experience with capacity-building strategies, and share information on O&M lessons. In addition, the workshop aimed to facilitate additional dialogue between Japan and India to collaborate on specific expectations and concerns for training and capacity development.
Phase I Construction

Phase I Package I involved the transfer of properties situated along the planned railway track and addressed civil works like the installation of bridges, viaducts, retaining walls, subways, shafts, tunnels, and embankments (Ortega and Preston 2018). Al Rajhi Alliance, which consisted of Mada Group, Bouygues, Al Arrab Contracting Company, Arup, and China Railway Engineering Corporation, was awarded the contract for Phase I Package I (Railway Gazette International 2009; Railway Technology). Khatib and Alami provided consulting and the Scott Wilson Group offered project management support throughout this phase and package (Khatib and Alami; Meed 2010).

Phase I Package II focused on the construction of the five passenger stations: Makkah, Madinah, Jeddah, King Abdullah Economic City (KAEC), and King Abdulaziz International Airport (KAIA), and King Abdullah Economic City (KAEC). While the stations of Makkah, Madinah, Jeddah, and KAEC were built along the main line, KAIA Station was situated on the short branch line of 3.75 kilometers (Ortega and Preston 2018). Each of the five passenger stations was carefully positioned according to the path of the sun (Middle East Architect 2018; Foster + Partners). For instance, Makkah Station faces the North and Madinah Station faces the East (Middle East Architect 2018; Foster + Partners). The orientations of these passenger stations were vividly articulated through openings in the roof, which bring forth natural light to the concourse levels (Foster + Partners). The KAIA Station is the most distinct of all because it was fully integrated into the Main Airport Terminal Building. Foster + Partners and Buro Happold were responsible for the design of four of the passenger stations (Foster + Partners). As for physical construction, the workload was divided through a joint venture. Jeddah Station and KAEC Station were handled by Saudi Oger Ltd., while Makkah Station was entrusted to Saudi Bin Laden Group, and Madinah Station to Yapi Merkezi (Railway Gazette International 2011; Yapi Merkezi).

Phase II Construction

Phase II was dedicated to completing the construction of all remaining rail infrastructure (e.g., track, signaling, telecommunications system, power supply, and catenary) and the initial procurement of 36 trains (DB Engineering and Consulting). All but one of the trains were Talgo-Bombardier 350 and were quite similar in nature to the Class 102 and 112 high-speed trains utilized in Spain (Renfe; Railway Technology; Talgo). As shown in Table 1, each train is composed of 13 coaches (two of which are wheelchair accessible or have a cafeteria) and 417 seats (304 economy class seats and 113 business class seats). The 36th train was a VIP train for the Saudi Arabian royal family. The contract further stipulated an option to secure 23 additional trains upon request and thus an additional VIP train is expected to be supplied to the royal family in the near future. The contract for Phase II was awarded to the Saudi-Spanish consortium known as Al Shoula Group, which consisted of ADIF, Cobra, Consultrans, COPASA, Dimetronic, Imathia, Abengoa-Inabensa, Ineco, Indra, OHL, Renfe, Talgo, Al Rosan, and Al Shoula (Renfe; ArcelorMittal; Cobral; COPASA; Imathia Construction; ADIF; Ortega and Preston 2018). It is worth highlighting that Phase II also included the O&M of the Haramain HSR for 12 years following the completion of construction. As a result of Spain’s extensive involvement in construction and O&M, many characteristics of the Haramain HSR were adapted from the Spanish HSR system.

Table 1: Train Layout by Coaches

<table>
<thead>
<tr>
<th>Type of Coach</th>
<th>Number of Coaches</th>
<th>Seats</th>
<th>Total Seats</th>
</tr>
</thead>
<tbody>
<tr>
<td>End Economy Class</td>
<td>1</td>
<td>38</td>
<td>304</td>
</tr>
<tr>
<td>Economy Class</td>
<td>7</td>
<td>38</td>
<td></td>
</tr>
<tr>
<td>Business Class with Cafeteria Lounge</td>
<td>1</td>
<td>14</td>
<td>113</td>
</tr>
<tr>
<td>Business Class with Wheelchair Accessibility</td>
<td>1</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>Business Class</td>
<td>2</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td>End Business Class</td>
<td>1</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>13</strong></td>
<td><strong>417</strong></td>
<td></td>
</tr>
</tbody>
</table>

Source: January 28, 2022 Workshop – Global Experiences on Capacity Development for O&M of High-Speed Rail.
O&M of HSR in Saudi Arabia

Following the construction of infrastructure for the Haramain HSR, a soft opening was strategically initiated for 1 week, which gave the operators the opportunity to foresee and address problems that might have arisen during the introductory period of O&M. The Haramain HSR was officially opened to the public in October 2018, marking the true beginning of O&M for this HSR.

Operation of Trains

The trains of Haramain HSR operate at 300 kilometers per hour and have a maximum design speed of 350 kilometers per hour. The average duration of travel between Makkah and Medina Stations is 2 hours and 20 minutes. The first train of the day departs at approximately 7:30 am and the last train of the day arrives at around midnight. There are typically 36 services during the “C5 Service Plan Normal Days” (Sunday, Monday, Tuesday, Wednesday) and “C5 Service Plan Weekend Days” (Thursday, Friday, Saturday). Both service plans offer 12 single services between Makkah and Madinah and 14 single services between Makkah and KAIA. As for the service between KAIA and Madinah, 10 single services are carried out on “Normal Days,” and 8 single services in combination with 2 twin services are provided during the “Weekend Days.”

However, the operational frequency of these trains dramatically increases during special occasions such as Ramadan or Hajj seasons. Makkah attracts up to 2.5 million pilgrims during Hajj and more than 2 million Umrah performers during the month of Ramadan (Railway Technology; Ortega and Preston 2018). Personal vehicles, buses, private taxis, and the usual services from the Haramain HSR are, in combination, insufficient in preserving safety and dealing with traffic congestion during such large-scale events (Ortega and Preston 2018). To compensate for this surge, the Haramain HSR modifies its schedule of O&M. Instead of operating for a maximum of 18 hours and subsequently conducting maintenance for 6 hours, the HSR will extend its operational hours to a maximum of 36 hours and thereafter perform maintenance for 18 hours. By making such strategic adjustments, the Haramain HSR has become capable of transporting 60 million passengers per year (Ortega and Preston 2018).

Employment of Train Drivers

With respect to the drivers operating these high-speed trains, all of them are Saudi nationals. Furthermore, there are plans to have a minimum of 30 female train drivers. The recent first round of hiring for female train drivers is noteworthy given that Saudi Arabia only began to permit women to ride bikes and drive cars in 2018 (BBC 2018; Dierking 2018; Marris 2018). The alleviation of social restrictions for these modes of transit is a part of Crown Prince Mohammed bin Salman’s reform program to modernize the country and strengthen the economy through areas other than oil (BBC 2022). The initial group of female train drivers alone raises the participation of women in the domestic workforce from approximately 28.4% to 32%. The reception of 28,000 female applicants during the first round of hiring also instills hope and confidence that the female workforce in Saudi Arabia will continue to grow and that the Haramain HSR will have many more qualified women operating its trains in the coming years (BBC 2022; Burroughs 2022; Sky News 2022). With the latest addition of 30 qualified women, Saudi Arabia will have a total of 160 train drivers for the time being.

Operation of Stations

As for passenger stations, they have the capacity to serve 20,000 passengers per hour (Foster + Partners). The temperature of the passenger stations is set to 28°Celsius (Arch Daily; Foster + Partners). The platforms are equipped with large fans and misting devices to ensure that the designated temperature is preserved throughout the entire station (Arch Daily; Foster + Partners). In addition to providing common accommodations such as shops, restaurants, and parking lots, the passenger stations have unique features such as helipads and VIP lounges (Railway Gazette International 2011). Depots and Maintenance Bases

There are two train depots and three maintenance bases along the Haramain HSR. The two train depots are placed at the end of the line in Makkah and Medina or at the 5 and 350 kilometer-markers, respectively. The train depot in Medina is considerably larger than the one in Makkah. It is worth noting that the two
train depots are not only designed to handle the initial procurement of 36 trains, but also have the capacity to handle the 23 additional trains that may be ordered within the first 12 years of O&M. As for the 3 maintenance bases, they are situated at the 65, 190, and 350 kilometer-markers, respectively. The maintenance bases were transformed from the assembly bases that were used during the construction of the line (COPASA 2017).

**Workforce Required for O&M**

As for the workforce required for O&M, the Haramain HSR adheres to the standard used in Spain, which is one employee per kilometer of line. The only exception to this standard is the number of commercial staff at the passenger stations. There is a need for a greater number of commercial staff at the stations because passengers in Saudi Arabia tend to be less familiar with train travel than their Spanish counterparts.

### Training Programs

Prior to formal employment, the Haramain HSR provides various training programs to ensure that all employees conduct their duties adequately. Each training program is specially tailored to the occupation type. For example, staff from the Operation Control Center (OCC) undergo 131 hours of theoretical training and 66 hours of practical training. Train drivers participate in a training program that is more arduous and extensive. They receive 483 hours of theoretical training and 674 hours of practical training. Tables 2 and 3 provide more details on the training programs for the OCC staff and train drivers.

### Policy Recommendations

Given the inputs from the Haramain HSR, we offer the following general lessons and policy recommendations, which we hope will be useful and applicable to other HSR systems.

#### Table 2: Training Program for OCC Staff

<table>
<thead>
<tr>
<th>Theoretical Training</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>6</td>
</tr>
<tr>
<td>OCC Overview</td>
<td>5</td>
</tr>
<tr>
<td>Human Resources/Health and Safety</td>
<td>5</td>
</tr>
<tr>
<td>Soft Skills</td>
<td>5</td>
</tr>
<tr>
<td>Customer Relations</td>
<td>5</td>
</tr>
<tr>
<td>Contingency Management</td>
<td>5</td>
</tr>
<tr>
<td>Planning</td>
<td>10</td>
</tr>
<tr>
<td>OCC Start Up</td>
<td>5</td>
</tr>
<tr>
<td>OCC Real Time Procedure</td>
<td>10</td>
</tr>
<tr>
<td>European Traffic Management System</td>
<td>25</td>
</tr>
<tr>
<td>Specific Procedure</td>
<td>25</td>
</tr>
<tr>
<td>Incident Sheet</td>
<td>25</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Practical Training</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>OCC Visit</td>
<td>4</td>
</tr>
<tr>
<td>Train Visit and Train Knowledge</td>
<td>8</td>
</tr>
<tr>
<td>OCC Practices</td>
<td>54</td>
</tr>
</tbody>
</table>

Source: January 28, 2022, Workshop – Global Experiences on Capacity Development for O&M of High-Speed Rail.
1. HSR systems should maximize their ability to execute eco-friendly practices. Over the years, the world has witnessed a persistent increase in sea levels, shrinking of glaciers, increase in ocean acidification, and change in weather patterns. 2016 and 2020 (the 2 warmest years on record) were seen as the culmination of the effects of climate change (Bateman 2021). The execution of eco-friendly practices would align HSR systems with the Paris Agreement of 2015, which is a worldwide initiative to limit the global temperature increase in this century to 2°C Celsius and pursue a greater ambition to cap the escalation by 1.5°C Celsius (United Nations Climate Action).

The significance of a collective effort to combat climate change cannot be overstated and HSR systems have the potential to play a vital role in this international endeavor. HSR systems can establish innovative benchmarks of sustainability not only within the rail sector, but also across the transportation industry.

Even if eco-friendly practices are conducted on a small scale, HSR operators should not be deterred from carrying them out. The Haramain HSR vividly demonstrated that when an eco-friendly practice (e.g., utilization of electric trains instead of diesel trains or use of natural light to illuminate the concourse levels) is combined with other eco-friendly practices and regularly executed over time, the accumulated incremental changes can be a significant contributor to reducing greenhouse gas emissions.

2. HSR systems should continue to institute measures that will promote quality of life. Traveling can be a stressful experience for a passenger. Among other factors, there is a perpetual need to remain conscious of not misplacing one’s belongings, to accurately navigate through multiple modes of transportation to reach the final destination, and to stay informed about the latest departure and arrival times. Traveling can be a challenging experience.

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Table 3: Training Program for Train Drivers

<table>
<thead>
<tr>
<th>Theoretical Training</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Railway Concepts and Technology</td>
<td>56</td>
</tr>
<tr>
<td>Safety Management System</td>
<td>7</td>
</tr>
<tr>
<td>Traffic Safety Regulations for Train Driver</td>
<td>133</td>
</tr>
<tr>
<td>European Train Control System/European Traffic Management System L2</td>
<td>42</td>
</tr>
<tr>
<td>Specific Occupational Risks (Health and Safety and First Aid)</td>
<td>28</td>
</tr>
<tr>
<td>Railway Rolling Stock Knowledge (Basic)</td>
<td>63</td>
</tr>
<tr>
<td>Braking Systems</td>
<td>63</td>
</tr>
<tr>
<td>Good Practices (Lessons Learnt)</td>
<td>7</td>
</tr>
<tr>
<td>Railway Rolling Stock Knowledge</td>
<td>70</td>
</tr>
<tr>
<td>HSR Line Knowledge</td>
<td>14</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Practical Training</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Practical Training for Train Driver (Simulations and Cab Journeys)</td>
<td>70</td>
</tr>
<tr>
<td>Driving Practices (At Least 216 Hours of Actual Driving)</td>
<td>220</td>
</tr>
<tr>
<td>Additional Practical Training Including Train, Line, and European Traffic Management System</td>
<td>384</td>
</tr>
</tbody>
</table>

Source: January 28 2022 Workshop – Global Experiences on Capacity Development for O&M of High-Speed Rail.
and tiring situation for those who are seniors, traveling with minors, have a disability, traveling alone, or are not familiar with the process of reaching their destination. As a result, a high quality of service at the passenger stations, such as climate-controlled conditions and sufficient availability of commercial staff, can minimize stress, and thereby, enhance passengers’ quality of life.

3. The operational times for HSR systems should be adjusted to known high-traffic periods and integrated with existing transport systems (i.e., last-mile travel to and from the station). To achieve this, HSR systems should collaborate with other transportation authorities and conduct a comprehensive analysis of passengers’ travel patterns. The implementation of a more stable mobility network can ensure that the demand from passengers is sufficiently met and travel time is optimized.

4. HSR systems should not only seek to improve the technical components of their training programs but also focus on improving the cultural and social aspects. With factors including but not limited to age, ethnicity, language competence, educational attainment, and work experience, the classroom is often made up of trainees with diverse backgrounds. By adopting a multidimensional approach that simultaneously improves training programs technically, socially, and culturally, the knowledge is not merely communicated but transferred effectively from the trainers to the next generation of employees. This empowers the trainees to become highly competent professionals within the dynamic realm of HSR.

5. It is of utmost importance that HSR systems institute measures that are in sync with national policies and localized social standards. One way the Haramain HSR uniquely demonstrated this is when it included women in the workforce and ensured that female train drivers did not spend the night away from base. By taking both national policies and localized social standards into consideration, HSR operators are less likely to encounter reputational risk, social resistance, legal issues, or financial losses.

6. HSR systems must place a high priority on effective stakeholder management. HSR systems are large-scale projects with an operational lifespan of approximately 50 years and are characterized by a multi-stage planning process that involves many stakeholders with diverse interests, positions, responsibilities, and levels of influence.

Without a robust stakeholder management system in place, HSR systems face the risk of cost and/or schedule overruns (Bugalia et al. 2022). A prime example of such a risk materializing is Stuttgart 21.

Stuttgart 21, noted as one of the biggest and most ambitious railway and urban development projects in all of Europe, is a multi-billion-euro initiative in Germany. Since its announcement in the early 1990s, the project aimed to transform an above-ground terminal station into an underground through-station and maximize the real estate potential of the station area (Novy and Deike 2012).

However, as of 2019, the project encountered a cost overrun of €12.3 billion and was delayed to late 2025, with one of the root causes being the lack of effective stakeholder management. Discussions to determine the key characteristics of Stuttgart 21 occurred behind closed doors, bypassing the process of legitimization and decision-making by the general public or elected officials of the city and state legislatures. It was only after the major decisions had been finalized that the process was opened to the public, effectively denying this group of stakeholders the opportunity to provide inputs that could change the landscape of the project (Novy and Deike 2012).

The involvement of all relevant stakeholders in the earliest stages of project development is one way to exercise effective stakeholder management. Another aspect of effective stakeholder management is establishing a framework that identifies gaps and/or overlaps in the responsibilities of different stakeholders. In addition, appointing a qualified leader or coordinator who can serve as a mediator among the wide range of stakeholders is an essential element of good stakeholder management. Furthermore, digital tools like social media can play a valuable role in this regard. Not only does social media facilitate the convenient
and widespread dissemination of information surrounding the project, but it also enables often-marginalized stakeholders with another medium to express their views. Incorporating a multifaceted strategy of effective stakeholder management strongly supports the successful construction and long-term sustainability of HSR systems (Bugalia et al. 2022; Hayashi, Seetha Ram, and Bharule 2020; Hayashi, Rothengatter, and Seetha Ram 2021).

7. HSR systems should explore the option of outsourcing certain products and functions to qualified external providers. The practice of outsourcing has become quite popular in the HSR industry. An example of this trend can be seen in India’s upcoming HSR system known as the Mumbai-Ahmedabad High Speed Rail Corridor (MAHSR). As part of its initial fleet, the MAHSR decided to import E5 series trains, which resemble the rolling stock used along the Tohoku and Hokkaido Shinkansen lines in Japan (Japan Rail Pass).

Furthermore, the MAHSR opted to outsource its “non-core” activities for the long term. This encompasses a wide array of significant responsibilities including but not limited to the maintenance of electrical and mechanical equipment like lifts and escalators, cleaning of rolling stock at the depots, housekeeping of station premises and other service buildings, safeguarding of installations, support for administrative tasks at the headquarters, and daily transportation of staff via road. HSR systems such as the Haramain HSR and MAHSR have chosen to outsource due to the myriad benefits this business strategy provides. For instance, external providers are more likely to have access to economies of scale. Because such external providers frequently provide products and services to multiple clients, they have the potential to achieve higher production levels and lower costs per unit.

In addition, the use of external providers allows HSR operators to reallocate their internal resources and invest more into other critical components of their HSR system. Moreover, external providers often possess specialized knowledge and experience that enable them to deliver a particular good or service more efficiently. While the Haramain HSR and MAHSR are two HSR systems that adopted the practice of outsourcing, it cannot be concluded definitively that outsourcing is always suitable for all HSR systems. Therefore, it is imperative that HSR systems conduct a preliminary assessment to check whether outsourcing is viable.

Conclusion

There are often cases where HSR systems across the globe have similar features. For instance, one similarity between the Haramain HSR in Saudi Arabia and MAHSR in India is that both HSR systems imported electric trains from overseas suppliers. But in the end, it is important to recognize that no one HSR system is identical to another. Each HSR system is carefully tailored to its own unique context to ensure that it satisfies the requirements of its particular region. By providing an in-depth overview of the Haramain HSR and offering a set of recommendations, we hope that this information will be a valuable reference for other regions seeking to develop their own HSR systems.
Questions and Answers (Q&A)

Q: Aside from Saudi Arabia, has Spain, more specifically ADIF, provided assistance in modernizing and improving another country’s HSR system?

A: As a public company attached to the Spanish Ministry of Transport, Mobility, and Urban Agenda, ADIF is responsible for designing, constructing, supervising, and maintaining the rail system in domestic and international contexts. In addition to the Haramain HSR in Saudi Arabia, ADIF has been presented the opportunity to provide assistance in the modernization and improvement of HSR systems in the following countries: Egypt, India, Japan, Morocco, Russian Federation, Sweden, Turkiye, and the United States.

Q: During Spain’s training of Saudi Arabian staff for the Haramain HSR, were there always interpreters on site?

A: Initially there were interpreters supporting the Spanish trainers. However, the current training curriculum is conducted in English and thus interpreters were not required.

Q: Are any special arrangements being made for women in the work environment of the Haramain HSR?

A: As of now, there is one special arrangement in place for the first cohort of female train drivers. They will be based in one location (Jeddah). This is so that despite any unforeseen circumstances (e.g., failures or delays with the trains), they do not have to spend the night away from home and are not asked to deviate from their social practices.

Q: What is the attrition rate and how many years does a person work before departing from their post in HSR?

A: The number of years a person works before leaving varies on a case-by-case basis in Spain and Saudi Arabia. As for Spain’s level of attrition within HSR, it is extremely low. In the case of Saudi Arabia, the percentage of people leaving for other jobs is relatively higher. It has been a particular challenge to retain the Saudi Arabian staff who have received specialized training.

Q: Is it easy or difficult for a consortium to coordinate all activities, which include but are not limited to construction, O&M, and training?

A: There are advantages and disadvantages to a consortium. An advantage is that a consortium allows members to share their skills and expertise, and appropriately divide the activities related to the Haramain HSR. However, a consortium does make the coordinating process more complex and difficult because each member acts as a shareholder and subcontractor.

Q: In recognition of the complex organizational structure to carry out the O&M of the Haramain HSR, are there instances of duplication or overlap with high-level decisions?

A: These scenarios do not typically arise because the Haramain HSR is led by a primary organization or singular body. It holds the license, makes all executive decisions, and conducts O&M for all aspects of the HSR (e.g., stations, trains, etc.).

Q: What recommendations or comments can be provided to trainers who work in an international environment and are often confronted with cultural borders and language barriers?

A: Although it is possible to send trainees within HSR to study abroad, an alternative method worth considering is sending the trainers to the country in which the HSR project is located (e.g., Spanish trainers sent to Saudi Arabia for the Haramain HSR). This encourages trainers to be further immersed into the training program and become more aware of the trainees’ background and culture.

Q: During Saudi Arabia’s collaboration with Spain, were there any original techniques or work procedures from Spain that had to be revised or adapted?

A: Broadly speaking, all procedures and techniques needed to be adjusted to suit local conditions. Although the list is long, here are some examples of aspects that are unique to the Saudi Arabian experience: (1) the infrastructure must be resilient to sandstorms; (2) air conditioning needs to be placed on top of the train and not the bottom; (3) in the summer, maintenance of the track and rolling stock needs to be conducted during the evenings due to the scorching weather; (4) passengers need to be offered more thorough guidance as there tends to be a greater number of individuals unfamiliar with the HSR system.
Globally Advancing the Construction and Operation and Maintenance of High-Speed Rail

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Khatib and Alami. Haramain High-Speed Rail – Phase I – KSA.


Railway Technology. Haramain High-Speed Rail Project.


Renfe. Haramain Project.


Talgo. Haramain.

United Nations Climate Action. The Paris Agreement.

Yapi Merkezi. Mecca and Madinah Stations.

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