Sinking in the Hooks: Technical Standards and De Facto Aid Tying in ODA Infrastructure Projects

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Abstract
The practice of tying aid – attaching conditions which force procurement from the donor country – is widely regarded as negative, with the OECD noting how the practice can increase costs and reduce the freedom of recipients to procure goods and services from other countries. Indeed, since 1979, the practice of aid tying has declined significantly, from more than 50% among DAC members to just 10-20% in the 2010s. However, despite these promising headline figures, aid can still be "tied" via more subtle mechanisms which, intentionally or not, privilege the private sector of the donor nation and reduce value and freedom of choice for recipients. This paper utilises Japanese high speed rail projects in India and Vietnam as case studies, conducting life-cycle analyses of these projects to examine areas where the use of Japanese technical and industrial standards will reduce competition and reduce the freedom of choice for the recipient countries to seek non-Japanese suppliers or develop native alternatives. The paper argues that technical standards "sink in the hooks", creating a de facto tying effect which, while not technically binding on recipients, has much the same impact as formal tied aid in the long term. The paper ultimately concludes that further internationalisation of aid – the incorporation of third countries into bilateral aid flows and advocacy for the universality of technical standards where possible – will ultimately make international aid more sustainable, providing better value for recipient countries by reducing their long-term reliance on the economies of single bilateral donors.

Keywords: International Development, High-Speed Rail, Japan, India, Vietnam

Introduction

Aid tying is widely regarded as a negative in international development practice. Numerous countries note their preference for International Competitive Bidding (ICB) such as Japan (Japan International Cooperation Agency, 2009, p.64), the UK (UK Department for Business and Trade and UK Department for International Trade, 2021), and France (Agence Francaise de Development, 2023) all state this publicly, and indeed across all OECD-DAC donors some 80.72% of aid was untied in 2021 (OECD Stat, 2023). Nonetheless, when it comes to actual aid practice, it is not uncommon for bidding processes – intentionally or not – to favour the donor country's private sector. As one example, among Japanese aid projects, 70% of untied aid projects were awarded to Japanese firms in 2017 (OECD, 2020). This paper argues that one contributing factor to this is the promulgation and use of donor country technical standards in ODA projects, focusing on the example of Japanese development assistance in the area of High-Speed Rail (HSR). The core hypothesis on which this paper is based is that technical standards unintentionally make non-donor country firms less competitive in international bidding processes, which can have the unintended consequence of reducing the value of these project for recipient countries.

HSR projects are awash with specific technical requirements. Japan's *Shinkansen* bullet trains are perhaps the world's most famous and successful implementation of HSR infrastructure, and in recent years the Japanese government has attempted to export the technology behind them for large-scale loan aid-backed infrastructure projects in numerous countries, including India along the Mumbai-Ahmedabad corridor (Jain, 2019, p.2) and potentially in Vietnam to connect Hanoi and Ho Chi Minh City along the spine of the country (Onishi, 2019; Kaizuka, 2021). This paper uses these two examples as case studies to examine how technical standards can potentially create competitive advantages in near-term bidding processes and provide recurrent sources of revenue in the long term for private sector firms in the donor country, *de facto* tying aid by precluding the ability of the firms of other countries to effectively compete and "sinking in the hooks" by creating long term dependencies. Again, this is not to suggest that this is done with ill intent on the part of donors; rather this is a consequence of the highly technical nature of such projects and the knowledge and expertise of those drafting the plans and feasibility studies of such projects. This is achieved through analysis of the feasibility studies and technical papers surrounding both projects, with a focus initially on rail and track infrastructure, followed by an examination of the trainsets proposed for use. The paper ultimately concludes that greater internationalisation of the projects, including the incorporation of expertise from staff outside the donor country itself and further internationalisation of technical standards, is likely to deliver better value for recipient countries in the long term.

Literature Review

The literature on aid tying is voluminous and near-universal in its criticality of the practice, cited often without further qualification as "ineffective" (Easterly and Pfutze, 2008, p.30) or that it increases costs and is linked too heavily with commercial interests (Hall, 2011, p.648). The OECD, for its part, claims that as much as 15-30% can be added to the cost of a project if aid is tied, heavily criticising the practice in its own documentation noting that it reduces the value for money for recipients and encouraging donors to abandon the practice to the "greatest extent possible" (OECD, 2023). There are some caveats – for instance, Knack and Smets note that in circumstances where corruption is high, aid tying can still be a net positive and incur fewer losses than would arise from graft (Knack and Smets, 2013, p.71) – but nonetheless, there is a significant consensus against tied aid. This paper does not seek to challenge this

position; rather, it is useful in the framing of the research – if tied aid is almost universally viewed as a negative practice for reasons of value and recipient choice, how is it still perpetuated and can it be further reduced? This paper explores technical standards in ODA infrastructure projects in relation to this question.

Pioneering work in this field has been done by Estache and Iimi (Estache and Iimi, 2012), who argue that a perceived need for quality would lead to a lack of space for compromise and excludes potential bidders, noting the trade-off between quality assurance and the potential costs incurred by limiting those able to participate in bidding processes. Iimi's work further notes that this is also impacted by project type, with some projects such as road construction easier to divide among multiple bidders and requiring less technical means to carry out than subway or power plant projects which require more specific technical expertise (Iimi, 2006, p.123). The issue is also raised by Arase (Arase, 1994, pp.177–178) but this is only cursory and the issue is not explored in detail beyond a brief note that the use of technical standards can create long-term procurement and consumption effects. Coughlin, et al. likewise discuss issues relating to long-term industrial dependency, but the focus is specifically on components which might be locally producible (Coughlin et al., 1988, p.21) which is less likely to be the case in highly-specialised major infrastructure projects. Overall, however, technical standards in ODA are a somewhat neglected area in the literature in relation to long term dependencies; most of the existing literature notes the impact of meeting technical standards on bidding processes and the potential for the exclusion of the recipient country's private sector. This paper seeks to address this shortcoming and examine the issue of long-term dependency in more detail by engaging deeply with two core case studies – the Vietnamese North-South Express Railway (NSER) and the Indian Mumbai-Ahmedabad High Speed Railway (MAHSR).

The Vietnamese North-South Express Railway has thus far attracted relatively little attention in the academic literature, being still an on-paper only project. The author has previously examined the NSER from a sustainability perspective, finding that depending on the load factor of the railway, it may perform worse in some cases than planes for environmental impact (Kaizuka, 2021). This paper explored some of the technical standards involved in the railway, such as the use of Japan Industrial Standards (JIS) 60kg rails and the use of E5-Series Shinkansen (Kaizuka, 2021, p.11), but it did not explore these from the perspective of industrial dependency. Aside from the author's own work, most of the literature on the NSER focuses on economic perspectives, such as the work by Ngoc and Nishiuchi which examines the potential impacts on social equity (Ngoc and Nishiuchi, 2022), and the work by Kikuchi and Nakamura which questions the level of profitability the railway might achieve based on a comparison to performance of the Japanese *Shinkansen* network (Kikuchi and Nakamura, 2020) but overall the Vietnamese NSER is an emerging field of interest which requires further study. It is in part to address this deficiency that the NSER was chosen as a main point of analysis.

Of the two case studies, the literature surrounding the Mumbai-Ahmedabad HSR project is considerably more developed, especially among India and Japan-based academics who have already contributed voluminously to the literature on the project, across numerous fields. For instance, Purnendra Jain explores the political and geopolitical aspects of the Mumbai-Ahmedabad HSR project, arguing that it is a signal of the growing warmth between India and Japan and that for Japan there is a competitive aspect vis-à-vis Chinese aid programmes (Jain, 2019) and as with the Vietnamese NSER, much of the literature focuses on the potential economic ramifications of the project, such as the work by Sugimori, et al. which explores the potential impacts on inter-regional disparity along the route, concluding that for the line to have the greatest benefits, the areas along it should develop unique industrial structures (Sugimori

et al., 2022). Likewise, the work by Karmarkar, et al., examines the economic viability of the MAHSR in terms of how much customers are willing to pay for tickets over conventional rail, providing policy recommendations to optimise future ridership (Karmarkar et al., 2023). However, as with the Vietnamese NSER, issues surrounding potential dependency are scarcely explored in the existing literature, and again, this paper seeks to address this shortcoming.

Methodology

This paper uses publicly available data to assess the proposed technical standards on the two railways in relation to potential short and long-term dependencies. This is largely drawn from the respective JICA feasibility studies for the two railways (Japan International Cooperation Agency and Vietnam Railways, 2013; Japan International Cooperation Agency et al., 2015). Other sources are drawn on where appropriate, such as the website of National High Speed Rail Corporation, Ltd., the state-owned enterprise responsible for the execution of the MAHSR project (National High Speed Rail Corporation Limited, 2023b). It begins with an examination of the proposed rail and track infrastructure followed by an examination of the proposed trainsets, which in both cases are E5-series *Shinkansen* trainsets identical to the ones used in Japan (Japan International Cooperation Agency et al., 2015, 4.54; Japan International Cooperation Agency et al., 2019a, 4.87). The paper follows this by exploring which private companies offer products capable of meeting the technical standards laid out in the feasibility studies. These case studies are selected because of their profile – both are expensive projects, and the MAHSR in particular has become a kind of flagship for Japan's push to export *Shinkansen* technology. For both, the feasibility studies are already highly developed, and they are highly comparable in that they both seek to export fundamentally the same technology with the only difference being the market context. This ensures the robustness of the findings and ensures that unique points in a single market context do not distort the overall implications.

The two points of analysis – rail and track infrastructure and rolling stock – are selected because they are considered the most likely to present issues of dependency in the long-term, and because having two points of analysis will increase the robustness of the findings. Rail and track infrastructure is not widely interchangeable and must be constructed to specific standards vis-à-vis profile, weight, and gauge – for instance, JIS-60kg rails, as are used on *Shinkansen* tracks, have a different cross-sectional profile to those used on European, Australian or other railway lines (Nippon Steel Corporation, 2020, pp.10–11), meaning that they are not interoperable. The railway – short of a complete refit – would be limited to rails of the original specification. Likewise, the rolling stock – being constrained by numerous and cascading technical requirements such as the design of overhead power supplies and the car width for the purpose of passing through tunnels, among others – is likely to be a source of long-term dependency. Even with technology transfer agreements, the advanced and complex nature of manufacturing the rolling stock required for HSR would likely require large sums of capital investment and may be less viable than simply importing the vehicles in the long term or providing incentives for Japanese firms to manufacture the products locally (which is to some degree already the case in the MAHSR [National High Speed Rail Corporation Limited, 2023a]).

This comes with some limitations. It would be beyond the scope of this project to examine all of the private sector firms with the requisite capital to produce the products required to meet JIS requirements on the two railways, which would require significant and intricate knowledge of the product ranges, capital investitures, and internal processes of potentially hundreds of firms. As such, the paper limits itself to only high-end producers with public-facing product

catalogues. While this has the potential to exclude some firms able to compete in international competitive bidding, it is likely that these firms would not be able to compete in any case with high-end, major producers, due to the aforementioned issues with the level of capital investment required. Second, this paper does not cover the full set of technical standards which could potentially create dependencies. Again, it would be beyond the scope of this paper to do so, and other technical standards are as such best left for future research. This paper seeks only to work as a proof of concept that technical standards can lead to *de facto* and possibly unintentional tied aid, with the intention that the principle can be applied in analysis of other aid projects in different donor and recipient contexts.

Case 1: Rail Infrastructure

In both the Vietnamese and Indian HSR projects, the basic technical standards for the rail profile were recommended in the JICA feasibility studies to be based on JIS-60kg/m rails, identical to those used on *Shinkansen* tracks in Japan itself (Japan International Cooperation Agency et al., 2015, 9.161; Japan International Cooperation Agency et al., 2019a, 3.3). The MAHSR Feasibility Study did consider the possibility of the UIC (International Union of Railways) 60kg standard instead, but it noted the need to verify affinity with the wheel tread of the E5-series *Shinkansen* for stable operation at high speeds (Japan International Cooperation Agency et al., 2015, 9.161), and in any case the final decision taken was to use the JIS-60kg standard, and the National High Speed Rail Corporation is open about the fact that these will be imported from Japan (National High Speed Rail Corporation Limited, 2021). JIS-60kg rails are currently used mainly in Japan itself, with the only other major use case being in Taiwan which also uses *Shinkansen*-derived trains on its high speed rail network, combined with some European-derived components as part of the wider design (Chang, 2010, p.162). This, of course, naturally privileges Japanese, and to a lesser degree Taiwanese, companies which already produce them en masse and are most likely to have the capital resources to produce them cheaply. While it is, of course, possible, that other producers could manufacture rails to these standards, the requisite capital investment needed to do so may make them uncompetitive on price.

Domestically, the annual procurement of JIS-60kg rails by JR West alone averages 2.13bn yen[1] (West Japan Railway Company, 2023). This procurement covers an area of 812.6km of *Shinkansen* track across two lines, less than the Vietnamese NSER at 1541km but greater than the MAHSR at 508km (Japan International Cooperation Agency et al., 2019a, 1.21; National High Speed Rail Corporation Limited, 2021, p.1). The annual procurement cost, based on the JR West data, can be estimated at roughly 2.6 million yen per kilometre[2]. Notwithstanding any additional costs incurred by local circumstances, this would mean that the annual procurement value on the MAHSR would be some 1.3bn yen and 4.05bn yen on the Vietnamese NSER. This is clearly a large business, and one which will produce significant recurring revenue for companies which produce JIS-60kg rails. Of course, this will only increase further if more of the proposed Indian high speed railway lines are constructed, especially if they are constructed to the same technical standards.

[1] Approx. US$15.8m at time of writing on May 5th, 2023.
[2] 2,134,934,000 yen divided by 812.6, equalling 2,627,287.7 yen per kilometre.

Case 2: Rolling Stock

The proposed rolling stock on the MAHSR is based on E5-series *Shinkansen* trainsets, as are currently used on the Tohoku Shinkansen in Japan (National High Speed Rail Corporation Limited, 2021, p.21). While the final planning for the Vietnamese NSER is not yet completed, the extensive use of the E5-series as the point of reference in the JICA studies (Japan International Cooperation Agency et al., 2019a) implies that it is being recommended for use there as well. E5 trainsets are highly advanced technologically, and all *Shinkansen* designs require manufacturing processes which are not necessarily easily accessible outside Japan itself – for instance, the 9000+ tonne press used in the manufacture of the aluminium car bodies of the N700-series was one of only a handful in the entire world (Morimura and Seki, 2005, p.41). Likewise, they contain significant numbers of patented, proprietary components - searching the database for the Japan Patent Office using the terms *Shinkansen* (新幹線) or *Kousoku Tetsudou* (高速鉄道, high-speed rail) reveals 37 design and 407 utility patents and 21 design and 341 utility patents, respectively[3] (JPlatPat, 2023b; JPlatPat, 2023a). This is already a large number, and it does not even account for the potential cascade effects through the wider supply chain as individual components may also have proprietary and patented manufacturing processes which would not be visible in a search carried out in the above manner. Moreover, the trainsets themselves have wider bodies operating on a wider loading gauge when compared to European UIC-derived standards (Watson et al., 2022), meaning that non-Japanese designs would have to be modified to accommodate the Japanese technical standards. This may also have further impacts, such as in bridge and tunnel design, which Japanese firms are also better-positioned to meet.

The procurement cost of *Shinkansen* trainsets varies depending on the individual circumstances, and many of the procurement contracts are not made available to the public. However, some insight into the long term procurement costs can be seen via the Taiwan High Speed Rail network, which recently concluded an agreement to pay $930m for a purchase of 12 N700S-series *Shinkansen* trainsets from a consortium led by Hitachi and Toshiba (Ryugen, 2023). This permits a rough estimate of $77.5m per individual trainset, although this is an imperfect estimate since the cost was derived via a bidding process and is not fixed (Ryugen, 2023). The trainsets have variable service life-cycles, but they are generally intended to last 15 to 20 years without significant renovation during this time (Watson et al., 2022). Again, this is likely to become a significant form of recurring revenue for Japanese firms – for Japanese rolling stock companies, there will be significant repeat revenue both as the service life of individual trains ends and as the proposed lines expand their operations. Taiwan's HSR has been in operation since 2007 and the initial contracts were formulated in 1998 (Railway Bureau of Taiwan, 2019); if Taiwan, which possesses wealth similar to Japan (Kawate, 2022) and has similar advanced manufacturing capabilities, cannot create a competitive domestic alternative to simply purchasing from Japan in this span of time, then what hope exists for Vietnam or India to do the same?

Discussion

In both cases, there are clear avenues for long-term dependencies on Japanese companies where technical standards have had the effect of "sinking in the hooks". As one example, Nippon Steel, in particular, is likely to become a major beneficiary of both the MAHSR and the NSER

[3] Not all patents appearing through the use of the search term are directly related, but the overwhelming majority are.

– it enjoys a total monopoly on wheels and axles in the Japanese market alongside a major market share in bogie manufacturing (Nippon Steel Corporation, 2023b), being the only company producing train wheels in Japan (Nippon Steel Corporation, 2023a). Even if Indian or Vietnamese competitor products to these eventually become available, Nippon Steel will enjoy a virtual monopoly in these rolling stock components in the initial procurement phase and in the short term upon the opening of both lines. It also has a further business in rail manufacturing to the JIS-60kg standard, and it controls over 60% of the overall Japanese steel rail market (Barrow, 2014; Nippon Steel Corporation, 2020), giving it a powerful position in both rolling stock (albeit indirectly) and rail procurement processes. This is likely to be replicable on other individual components in the designs on the railway, where Japanese firms will be in key positions to benefit from any components required to be manufactured to a specific technical standard.

As noted above, the only existing example of *Shinkansen* systems having been successfully exported to date has been in Taiwan. The Taiwanese HSR has had since 1998 to develop domestic alternatives, but it still procures, at large cost, trainsets from Japan (Ryugen, 2023). Even the rails themselves are not produced by any major Taiwanese steel manufacturer, so it is likely that these are also still procured from Japan, in addition to other maintenance-related costs such as replacement wheels and axles. China Steel Corporation in particular is the world's 26th-largest steel producer (World Steel Association, 2023), and indeed it does produce some products to JIS specifications, but none of these are in the rail industry (China Steel Corporation, 2023). In India, it is conceivable that a company on the scale of Tata Steel, the world's tenth-largest producer (World Steel Association, 2023) could produce these products in the long-term, possessing a long products business (Tata Steel Long Products Limited, 2021) and a business producing rolling stock components (Financial Express, 2017), these are not currently manufactured to JIS specifications and in the latter case already face constraints on production capacity, meaning that significant capital investment would be required to be able to compete with existing producers. In Vietnam, the largest steel company, the state-owned Viet Nam Steel Corporation, has businesses in neither category (Viet Nam Steel Corporation, 2023). If Taiwanese steel manufacturers see no business potential in serving the domestic high speed rail network, despite advanced manufacturing capabilities, then it is probable that neither Indian nor Vietnamese steel producers will not see any business potential either. Japanese firms are thus able to benefit in the long term from procurement and replacement even after initial project completion.

This is a direct result of the relative uniqueness of Japanese Industrial Standards and the ensuing ripple effects through the supply chains of products which meet them. Even products which are designed with standardisation in mind have to be customised to meet the needs of different customers (Lacôte, 2005, p.6). JICA staff are aware of the problems that can be caused by this – indeed, their technical recommendations in other projects, such as in the Philippines, are formulated in a manner to deliberately avoid long-term technological reliance on Japan (Japan International Cooperation Agency, n.d., 3.6-3.7), but this approach has not been taken with HSR systems. There are two probable reasons for this which are common to both the MAHSR and the NSER.

First is the use of HSR systems as flag-flying "national prestige" projects. The MAHSR in particular saw heavy involvement from the top levels of the Japanese government, being launched personally by Prime Minister Abe in 2017 (BBC News, 2017). Japan is by no means the only country which has done this; China has attempted to do the same with its own infrastructure and HSR systems (Oh, 2018, p.534), as has France with TGV exports (Preston,

2016, p.48). HSR, perhaps more than any other type of infrastructure development, is often highly politicised, and is intended as a showcase for the achievements of the donor country in technological terms and as a vector for soft power – indeed, the history of the *Shinkansen* being utilised in this manner can be traced as far back as the original *Shinkansen* during the 1964 Olympics (Jeong and Grix, 2023, p.7). If this is, indeed, an objective of policymakers, then there is little point in promulgating a more open system of bidding and procurement where non-donor country technology can be easily incorporated or can be seen as a competitor – permitting such a scenario would undermine the ability to achieve a core objective in the design specification. Of course, these decisions are not taken one-sidedly – both India and Vietnam undertook their own decisions to proceed with these projects and will receive their own share of benefits as the projects begin to take shape, not least that they will have a highly advanced railway line. However, the inevitable cost of these benefits is a degree of long-term dependency with a *de facto* tying effect.

Second is the existing expertise of the JICA staff and the consulting firms which conducted the feasibility studies on both railways. In both cases, the consulting firms are mostly Japanese in origin – on the MAHSR, the firms on the 2015 feasibility study were Japan International Consultants for Transportation, Oriental Consultants Global, and Nippon Koei (Japan International Cooperation Agency et al., 2015), while on the Vietnamese NSER the firms working on the most recent data collection survey were PADECO, Yachiyo Engineering, and Fukken Engineering, with Ernst & Young ShinNihon being the only non-Japanese firm involved (Japan International Cooperation Agency et al., 2019b). Notwithstanding any commercial relationships these firms may have with construction firms, this naturally limits the pool of expertise to those used to dealing with specifically Japanese standards and engineering processes – they are unlikely to be in a position to recommend anything else. This is a common issue in JICA-led feasibility studies and projects, and it severely limits the diversity of opinion and experience being brought into these studies. This is *de facto* tying in itself, but it creates a further *de facto* tying effect by advantaging companies which already manufacture to Japanese technical and engineering standards.

Conclusions

In both the MAHSR and the NSER, a strong *de facto* tying effect has been introduced. This is partially a result of the politics surrounding the respective projects – especially on the MAHSR – but it is also in part the inadvertent result of the lack of non-Japanese expertise being involved in the feasibility study and data collection stages. In both cases, this would have been resolved by greater inclusion of non-Japanese experts to provide alternative viewpoints and to more comprehensively examine whether alternative systems might have offered better value for money for the countries involved in the long term, such as French, German or Italian designs, or even bespoke designs depending on the individual circumstances of the recipient country.

Moreover, feasibility studies should recommend the use of universal standards where possible. High speed rail is a particularly difficult area to do this in, considering that existing systems essentially fall into distinct camps which are not mutually compatible without modification (such as Hitachi's modified designs to meet European technical standards based on the company's A-Train design (Hiroi, 2022)). While such modifications are possible, they disadvantage the ability of firms to compete because the necessary modifications drive up costs or require new capital investment. The creation of universal standards in new HSR systems for developing countries would level the playing field in this regard – while in the short term this would also increase costs, in the long-term it would create a more competitive environment

and deliver better value for money for recipient countries which would not be forced into a choice between expensive investment in developing a local alternative or long-term procurement from a single source. These recommendations, where possible, should be adopted at OECD-DAC level.

These issues are by no means unique to Japanese ODA programmes, and are likely to be applicable to any large-scale, technologically advanced infrastructure project. Future research should consider the findings of this paper in relation to the promulgation of similar systems as led by other donor countries, and it should consider the practical basis for the further universalisation of rail standards to ensure competitiveness in bidding processes. As things stand, technical standards are "sinking in the hooks" and creating a *de facto* tying effect, driving up long-term costs for recipient countries by reducing long-term competition.

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