Where the Hazard Map Reads Low: Japan's New Foreign Workforce and Natural-Hazard Exposure, with Evidence from the 2024 Noto Peninsula Earthquake

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Working paper prepared for the NBER Japan Project Meeting 2027. November 2026.

Abstract

Japan's foreign population more than doubled between 2012 and June 2026, to 4.28 million, and about one in five foreign residents now holds a Technical Intern Training or Specified Skilled Worker status. Unlike earlier migrants, these workers are placed by employers in sectors such as food processing, care, construction and agriculture, often in small towns. This paper asks whether this new workforce is more exposed to earthquakes and floods than the Japanese population, using prefecture data from the Immigration Services Agency for June 2026, the 2020 national seismic hazard maps and planned-scale flood inundation areas. Measured by the population-weighted probability of strong shaking within 30 years, intern and skilled-worker visa holders face almost exactly the national average (ratio 1.03, 95% CI 0.95–1.11), while other foreign residents, concentrated in Tokyo, Osaka and Aichi, face 17% more. Bangladeshi residents, mostly students and professionals in the Tokyo area, face 18% more. The concern lies elsewhere. In the sixteen prefectures the hazard maps rate lowest, foreign residents grew by 104% between 2012 and 2024, against 77–86% in the rest, and worker visas make up 35% of foreign residents there, twice the share in the high-hazard third. Ishikawa, rated in the lowest third with a 6.6% probability, was the site of the 2024 Noto earthquake; its foreign population had doubled since 2012 and 43% of it held worker visas. Average exposure is not where the risk to the new workforce lies. The risk lies in the places where Japan's preparedness for foreign residents has had the least reason to develop. I discuss what this implies for the Employment for Skill Development system that replaces technical intern training in April 2027, and for the planned recruitment of Bangladeshi workers.

Keywords: foreign workers; technical intern training; specified skilled worker; disaster risk; exposure; Noto Peninsula earthquake; Japan

JEL codes: J61, Q54, R23, J15

1. Introduction

On 1 January 2024 a magnitude 7.6 earthquake struck the Noto Peninsula in Ishikawa Prefecture, with a maximum seismic intensity of 7. By 31 March 2026 the Cabinet Office counted 722 deaths, including disaster-related deaths, and 6,536 buildings fully destroyed (Cabinet Office, 2026). Later counts by the prefectures raised the death toll to 755, of whom 527 died of disaster-related causes in the months after the shock (Kyodo, 2026). About 1,600 foreign residents lived in the six worst-hit municipalities of Oku-Noto, and technical intern trainees from Viet Nam, the Philippines, Indonesia and elsewhere had “increased rapidly in recent years” there (Tamura, 2024). When foreign residents in shelters were asked whether they had seen the multilingual signs put up for them, not one said they had (Tamura, 2024).

Ishikawa was not on anyone’s list of high-risk prefectures. In Japan’s 2020 national seismic hazard map, the probability that the prefectural capital Kanazawa would experience shaking of intensity 6-lower or greater within 30 years was 6.6%, placing Ishikawa twelfth lowest of 47 prefectures (Headquarters for Earthquake Research Promotion [HERP], 2021). That says more about the limits of 30-year probabilities at a single point than about any error in the map. It does raise a question that matters for the economics of Japan’s labour policy: where are the foreign workers that Japan has been admitting since 2012, and how does their location line up with the places where hazards are expected and prepared for?

This paper answers the first part of that question with prefecture data. The stock of foreign residents in Japan rose from 2.03 million at the end of 2012 to 4.28 million in June 2026 (Immigration Services Agency [ISA], 2026b). Much of that growth came through two channels. Technical Intern Training (TITP), in place since 1993, admits workers for up to five years under a training framework that ties them to an employer. The Specified Skilled Worker (SSW) status, created in April 2019, admits workers in designated sectors with fewer restrictions on job change (Yamaguchi, 2025). By June 2026 there were 456,813 trainees and 443,830 SSW holders, together 21.1% of foreign residents. The Cabinet set a ceiling of 820,000 SSW admissions for the five years from April 2024 (ISA, 2024), and from 1 April 2027 TITP is replaced by a new Employment for Skill Development (育成就労) system (ISA, n.d.).

These workers differ from earlier migrants in where they live. Students, professionals and long-term residents settle mostly in large cities, as migrants do everywhere (Bartel, 1989). Trainees and skilled workers go where their employer is: seafood plants on the coast, farms, care homes and construction sites in depopulating prefectures (Mazumi, 2019; Tian, 2023). A worker cannot easily choose a less exposed town, and in TITP cannot change employer at all. Studies of migrants in disasters show that language, isolation from local networks, insecure legal status and housing tied to the job all raise vulnerability for a given hazard (Donner & Rodríguez, 2008; Uekusa, 2019; Uekusa & Matthewman, 2017). The question here is the prior one, about the hazard and about the institutions that are built in response to it.

The results are in two parts. First, measured by the conventional exposure metrics, the new workforce is not more exposed than Japanese residents. The worker-visa population faces a mean 30-year probability of strong shaking of 35.8%, against 34.8% for the population as a whole, and practically the same share living in flood zones. Other foreign residents face more, because they are concentrated in the Tokyo, Osaka and Nagoya regions where the probabilities from the Nankai Trough and the Sagami Trough are high. Bangladeshi residents, whose number rose from 8,622 in 2012 to 53,398 in June 2026, are mostly students and professionals in this group, and their exposure ratio is 1.18.

Second, the new workforce has grown fastest relative to other foreigners in the places the maps rate lowest. Sorting prefectures into thirds by seismic probability, the foreign population of the lowest third grew by 104% between 2012 and 2024, against 77% in the middle third and 86% in the highest. In June 2026 worker visas made up 35.2% of foreign residents in the low-hazard third, 21.7% in the middle and 17.4% in the high-hazard third. Workers per head of population are the same in all three. What differs is that in the low-rated prefectures, the foreign population consists to a much larger degree of employer-placed workers on short permits, and it is these prefectures that have had the least practice in disaster response for foreign residents. Ishikawa fits the pattern closely: its foreign population doubled between 2012 and 2024, and 42.6% of foreign residents there held worker visas in 2026, twice the national 21.1%.

The paper contributes to three literatures. For the economics of Japan’s foreign labour, it adds a dimension, disaster risk, that the work on wages, sectors and location (Doi & Suzuki, 2025; Hashimoto et al., 2023; OECD, 2024) has not considered. For disaster studies, it moves from case studies of foreign residents in particular disasters (Leelawat et al., 2017; Uekusa & Matthewman, 2017; Yang et al., 2017) to a national map of where the exposure sits. For policy, it identifies a mismatch that the 2027 reform could address: preparedness for foreign residents is organised around where foreigners have historically lived, and the new workforce is moving away from those places.

2. Background

2.1 Japan’s worker-visa channels

Japan has long had a low share of foreign residents for an OECD economy, and its official stance until 2018 was that it did not admit unskilled foreign labour (Oishi, 2012; Peng, 2016). TITP filled that gap in practice. Trainees are formally in Japan to learn skills, but they work as low-wage labour in sectors that cannot find Japanese workers, and they are tied to the employer that sponsors them (Tian, 2019). The SSW status, introduced in April 2019 to respond to “serious labour shortages”, was the first channel openly designed to admit foreign workers for such jobs (Yamaguchi, 2025). By June 2026 the largest SSW(i) sectors were food and beverage manufacturing (23.7% of holders), care (18.8%), industrial products manufacturing (14.6%), construction (12.2%), food service (11.5%) and agriculture (10.3%) (ISA, 2026c).

The 2024 amendment to the Immigration Control Act, promulgated on 21 June 2024, replaces TITP with the Employment for Skill Development system from 1 April 2027 (ISA, n.d.). Under the new system workers can change employers within the same field after a period, and the system is meant to lead into SSW. The Cabinet's March 2024 decision set a five-year SSW ceiling of 820,000 and added four sectors, including motor transport and forestry (ISA, 2024). MHLW counted 2,571,037 foreign workers in October 2025, up 11.7% in a year (MHLW, 2026).

Bangladesh is a small but fast-growing source. Japan and Bangladesh signed a memorandum of cooperation on SSW in August 2019 (MOFA, 2019). In May 2025 the chairman of the Japanese business body NBCC said, during the Bangladeshi Chief Adviser's visit to Tokyo, that Japanese firms were "prepared to welcome more than 100,000 Bangladeshi workers" over five years (The Financial Express, 2025), a target the Bangladeshi ministry repeated in November 2025 (The Daily Observer, 2025). It is not a Japanese government quota. Bangladeshi residents numbered 53,398 at the end of June 2026, of whom 19,678 were students, 10,340 held the engineer and humanities status and only 3,699 held trainee or SSW status (ISA, 2026b).

2.2 Disaster preparedness for foreign residents

Japan's measures for foreign residents in disasters are national in design and local in delivery. Since FY2018 the Ministry of Internal Affairs and Communications has trained "disaster-time foreign resident support information coordinators", who match information from authorities with the needs of foreign residents in shelters; 217 had agreed to be listed in the public directory by July 2026 (Ministry of Internal Affairs and Communications [MIC], 2026). The Safety tips app pushes earthquake early warnings and other alerts, and the government's multilingual dictionary of disaster and weather terms covers 14 languages (Cabinet Office, 2019). When a disaster strikes, prefectures and their international exchange associations open multilingual disaster support centres; Ishikawa opened one on 2 January 2024 (Kikuchi, 2024).

After Noto, the national response for foreign workers came through immigration rules. From 16 January 2024 holders of work-based statuses in affected municipalities, including trainees, could receive special permission to work outside their status for up to eight hours a day for three months, without the usual changes to training plans (MHLW, ISA, & OTIT, 2024). Residence periods were extended to 30 June 2024 (ISA, 2024b). These measures dealt with the legal side of a worker's position. Reports from the ground describe the rest: sixteen Myanmar trainees in a meat-processing plant in Nanao were effectively dismissed and had to leave their company dormitory (Kobe Shimbun, 2024), and mosques in Ishikawa and Toyama began helping Indonesian Muslim trainees within about a week, filling a gap the formal system did not (Kotani et al., 2024). One civil-society account, reproduced in a Ministry of Internal Affairs document, reports that trainees in Suzu could not enter shelters and stayed in their dormitories (Osada & Abe, 2025).

3. Data and measures

The unit of observation is the prefecture. Foreign-resident counts come from the Immigration Services Agency's statistics on foreign residents. For June 2026 and December 2025 I use the prefecture-by-status tables (ISA, 2026a, 2026b), which give totals, TITP and SSW counts, and residents by nationality for the twenty largest nationalities. For the totals at the end of 2012, 2015, 2019 and 2024 I use the same ISA series as published through the Statistics Bureau's dashboard. Prefecture sums match the national totals except for a few thousand residents whose prefecture is undetermined. Population comes from the 2020 census.

Seismic hazard is the probability of ground shaking of seismic intensity 6-lower or greater within 30 years at the prefectural government office, from the 2020 edition of the national seismic hazard maps (HERP, 2021). It ranges from 2.2% in Sapporo to 81% in Mito. A single point per prefecture is a crude measure for large prefectures such as Hokkaido, and the hazard maps are designed for regional comparison rather than for prediction at a site. Flood exposure is the share of each prefecture's population living inside planned-scale flood inundation areas in 2015, from Hata and Maeda (2020), who overlay the national land information inundation zones on 500-metre census mesh data. Nationally, 35.4 million people lived in these zones.

For each group g (the total population, worker-visa holders, other foreign residents, and residents of a given nationality) I compute the group's mean exposure as a weighted average across prefectures:

$$E_g = \sum_{p=1}^{47} \frac{N_{gp}}{N_g} h_p \qquad (1)$$

where N_{gp} is the number of group members in prefecture p and h_p is the hazard measure. The exposure ratio $R_g = E_g / E_{pop}$ compares the group with the whole population. Values above one mean the group lives, on average, in more exposed prefectures. I report 95% confidence intervals from 5,000 bootstrap resamples of prefectures. I also report the Duncan dissimilarity index between each group and the population, $D_g = \frac{1}{2} \sum_p \left| N_{gp}/N_g - P_p/P \right|$, which is the share of the group that would have to move for its distribution to match the population's.

4. Results

4.1 Exposure of the new workforce

Table 1 shows the exposure of each group. The 900,643 trainee and SSW holders live in prefectures with a mean probability of strong shaking of 35.8% and a mean flood-zone share of 27.8%. The national population faces 34.8% and 27.7%. The ratios, 1.03 and 1.00, have confidence intervals that comfortably include one. Separately, trainees (1.02) and SSW holders (1.04) are almost identical.

Table 1. Hazard exposure by group, prefecture-weighted, June 2026

Group	Persons	Mean P(shaking ≥ 6-lower, 30 yrs), %	Ratio to population (95% CI)	Mean share in flood zones, %	Ratio to population (95% CI)	Dissimilarity vs population
Population (2020 census)	126,146,099	34.84	1	27.69	1	
Trainees + SSW	900,643	35.84	1.03 (0.95–1.11)	27.77	1.00 (0.97–1.04)	0.148
Technical intern trainees	456,813	35.35	1.02 (0.93–1.10)	27.98	1.01 (0.97–1.06)	0.174
Specified Skilled Workers	443,830	36.35	1.04 (0.96–1.13)	27.55	1.00 (0.96–1.03)	0.131
Other foreign residents	3,374,229	40.76	1.17 (1.07–1.30)	29.87	1.08 (1.01–1.16)	0.234
Bangladeshi residents	53,316	41.00	1.18 (1.02–1.35)	30.30	1.09 (0.99–1.21)	0.274
Vietnamese residents		38.51	1.11 (1.03–1.21)	30.10	1.09 (1.03–1.14)	0.175
Indonesian residents		35.48	1.02 (0.93–1.12)	27.06	0.98 (0.94–1.02)	0.154
Myanmar residents		37.66	1.08 (1.01–1.15)	28.65	1.04 (1.00–1.07)	0.146
Nepali residents		38.66	1.11 (0.97–1.24)	28.30	1.02 (0.94–1.10)	0.247
Chinese residents		41.96	1.20 (1.06–1.37)	30.35	1.10 (1.00–1.23)	0.336

Notes: Hazard is measured at the prefectural capital (HERP, 2021); flood share is the population share in planned-scale inundation areas, 2015 (Hata & Maeda, 2020). Weights are June 2026 counts of each group by prefecture (ISA, 2026b). Confidence intervals from 5,000 bootstrap resamples of prefectures. Person counts for nationalities are omitted where the twenty-nationality table does not separate status. Population counts and the 4,274,872 foreign residents allocated to prefectures differ slightly from national totals because of residents with undetermined prefecture.

The worker-visa population is also the least concentrated foreign group. Its dissimilarity index against the Japanese population is 0.148: about 15% of trainees and skilled workers would have to move for their distribution across prefectures to match that of the population. For other foreign residents the index is 0.234, and for Chinese residents it is 0.336. Trainees and SSW workers are spread across Japan much like the Japanese themselves, which is what one would expect of workers placed by employers in labour-short sectors located throughout the country.

The higher exposure of other foreigners comes from geography rather than from anything specific to migrants. Eighty percent of them live in prefectures where the 30-year probability is 26% or more, the band HERP describes as very high, against 63% of the population. Tokyo, Kanagawa,

Saitama, Chiba, Osaka and Aichi all fall in that band. Bangladeshi residents follow the same pattern: 77% live in the very-high band.

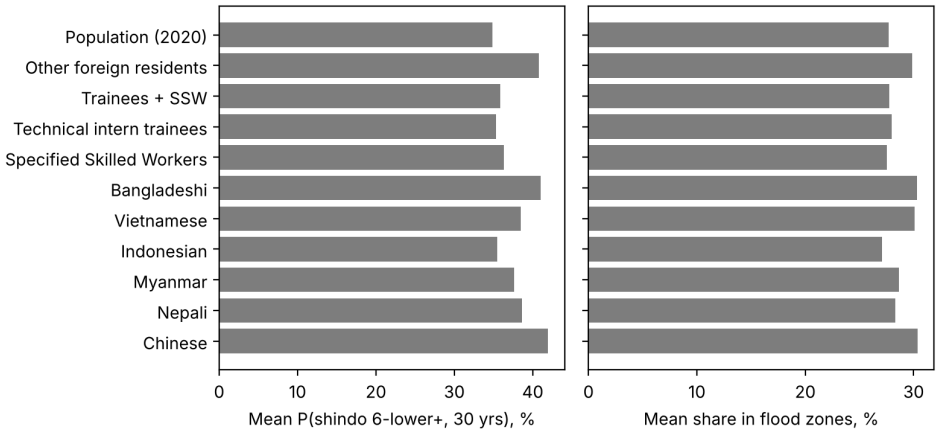


Figure 1. Mean hazard exposure by group, June 2026. Left: mean 30-year probability of shaking of intensity 6-lower or greater at the prefectural capital. Right: mean share of the prefecture's population living in planned-scale flood inundation areas.

4.2 Where the new workforce grew

Exposure averages hide a shift in composition. Table 2 sorts the 47 prefectures into thirds by seismic probability.

Table 2. Foreign residents by seismic-hazard third of prefectures

Hazard third	Prefectures	P(shaking ≥ 6-lower, 30 yrs)	Foreign residents, growth 2012–2024	Trainees + SSW as % of foreign residents, June 2026	Trainees + SSW per 100 population
Low	16	2.2–9.2%	+104.0%	35.2	0.70
Middle	15	10–43%	+77.3%	21.7	0.70
High	16	44–81%	+85.9%	17.4	0.73

Source: author's calculations from ISA (2026b), the Statistics Bureau's dashboard series of ISA totals, the 2020 census and HERP (2021).

The density of worker-visa holders is the same across the three groups, about 0.7 per 100 people. The foreign population of the low-hazard third, however, doubled between 2012 and 2024, faster than in the rest of the country, and in June 2026 over a third of it held trainee or SSW status. In the high-hazard third, which includes the metropolitan regions, worker visas are one in six foreign residents. The foreign population that a low-rated prefecture's disaster plan must reach is therefore, much more than in Tokyo or Osaka, a population of recently arrived workers on employer-tied permits, living in company housing, often with limited Japanese and few ties to local residents (Tian, 2023; Uekusa, 2020).

Figure 2 shows the prefecture-level picture. There is no relationship between the hazard probability and the number of worker-visa holders per head. Hokkaido, with the lowest probability of all, has 38,158 trainees and SSW holders, more than any prefecture except the large metropolitan ones. A simple regression of the growth of foreign residents between 2012 and 2024 on seismic probability, flood exposure and log population finds no relationship with seismic hazard (coefficient −0.05, p = 0.63) and a negative one with flood exposure (−0.64, p = 0.001). Foreign populations grew more slowly where more of the population lives in flood zones, a pattern I do not try to explain here.

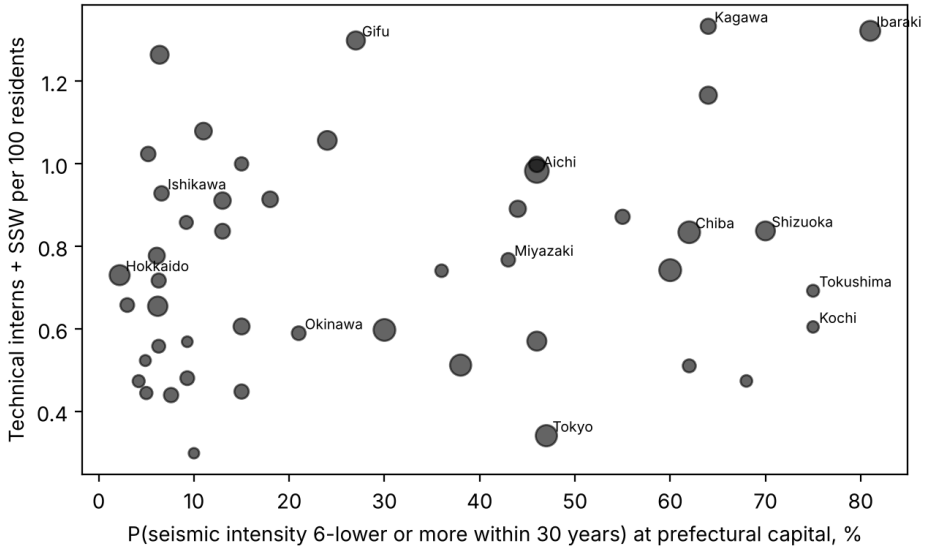


Figure 2. Trainees and Specified Skilled Workers per 100 residents against the 30-year probability of strong shaking at the prefectural capital, June 2026. Marker size is proportional to the square root of the number of workers.

4.3 Ishikawa

Ishikawa illustrates the pattern. Its foreign population was 10,839 at the end of 2012, 19,407 at the end of 2023, the last count before the earthquake, and 24,691 in June 2026. In June 2026, 10,515 of these, or 42.6%, held trainee or SSW status, twice the national share. The SSW holders there work mainly in industrial products manufacturing, food manufacturing, care and construction (ISA, 2025). At the municipal level the only figures available to me come from a civil-society presentation: in Suzu, 59 of 87 foreign residents, and in Noto Town, 114 of 159, were trainees or SSW holders at the end of 2023 (Osada & Abe, 2025). The official municipal tables exist but could not be read for this draft.

What the Noto experience shows, in the absence of any official count of foreign casualties or evacuees, is the kind of gap that appears where preparedness for foreign residents is thin. The prefecture had a multilingual support centre open the next day. The workers it most needed to reach lived in dormitories in small coastal towns, worked for firms that had themselves been hit, and depended on their employer for housing and legal status. The immigration measures of

January 2024 eased the legal position. They did not reach workers who had lost both job and housing at once, and the response that did reach some of them came from mosques and volunteer networks (Kotani et al., 2024).

5. Discussion

5.1 Reading the results

The first result is reassuring as far as it goes. Japan's new foreign workforce is not being placed in more hazardous prefectures than the Japanese population. Much of the literature on migrants and disasters starts from the observation that migrants live in riskier places, often because cheap housing is in floodplains or on unstable ground (Donner & Rodríguez, 2008; Méndez et al., 2020). At the prefecture level, at least, that is not true of Japan's trainees and skilled workers. The measures used here are coarse, however. A prefecture-wide average says nothing about whether workers in a given prefecture live on the coast, near rivers or in older dormitories, and the experience of the Tohoku tsunami (Aldrich & Sawada, 2015) shows how much mortality varies within prefectures. Finer data, at the municipal level and with housing type, could change this result.

The second result points to institutional exposure rather than physical exposure. The probability maps are a guide to where Japan expects large earthquakes, and preparedness, including for foreign residents, follows expectation and experience. Large cities with long-settled foreign communities have multilingual services, community organisations and people who have been through drills. In prefectures the maps rate low, foreign residents are fewer, and those who arrived after 2012 are disproportionately workers whose time in Japan is short and whose links run through their employer. When an earthquake does strike in such a place, as at Noto, the weak point is reaching these workers. Social capital mattered for survival and recovery after the 1995 and 2011 earthquakes (Aldrich, 2012), and employer-placed workers start with little of it outside the workplace (Uekusa, 2020).

This matters for Japan's economy, not only for the workers. Disaster-related deaths at Noto exceeded direct deaths by more than two to one, and the industries that rely on trainees, such as seafood processing, care and agriculture, are among those that sustained the local economy and its recovery. Disruptions travel through supply chains (Carvalho et al., 2021), and labour markets after disasters tend to reallocate workers toward reconstruction (Kirchberger, 2017). A workforce that leaves after a disaster, or cannot work because its legal status depends on an employer who has closed, removes labour exactly when local firms most need it.

5.2 Implications for policy

Three points follow, each stated with the caution the data require.

First, the transition to the Employment for Skill Development system in April 2027 is an opportunity to attach disaster obligations to the placement of workers. Supervising organisations and employers already have to provide housing and support plans. Adding a requirement that employers in all prefectures, not only those rated high-hazard, register their foreign workers with the municipal disaster plan and with the multilingual support centre would cost little. Allowing workers whose employer closes after a declared disaster to transfer to another employer immediately would remove the dependence that the January 2024 measures addressed only temporarily.

Second, the national programmes for foreign residents in disasters should be allocated by where the new workforce is, not only by where foreign residents historically lived. The 217 listed support coordinators (MIC, 2026) are a small corps for a country with 900,000 trainees and skilled workers spread across every prefecture. Training more of them in low-rated prefectures where worker visas make up a third of foreign residents would match resources to the composition shown in Table 2.

Third, the countries that send workers have a part to play. If the target of 100,000 Bangladeshi workers over five years is reached, the profile of Bangladeshi residents in Japan will change from students and professionals in the Tokyo region to employer-placed workers across the country. Pre-departure training in Bangladesh is the cheapest place to teach the Japanese early warning system and the location of local support centres, and Bangladesh's own experience with cyclone preparedness offers a model for community-based warning that does not depend on fluency in Japanese. Remittances and community finance, including Islamic social finance channels, are also how families in Bangladesh absorb shocks to workers abroad (Nipa et al., 2026).

5.3 Limits

The data have three main gaps. Sex is not available by prefecture and status in the tables I could read, so the gender dimension that the literature stresses (Enarson, 1998; Neumayer & Plümper, 2007; Saito, 2014) cannot be examined here; nationally, women were 48.8% of foreign residents in June 2026. Trainee and SSW counts by prefecture are available only for 2025 and 2026, so I compare changes in the total foreign population and the current composition rather than changes in each status. And the hazard measures are single points per prefecture. Each of these could be addressed with the ISA municipal tables and the J-SHIS mesh hazard data.

6. Conclusion

Japan has admitted close to a million foreign workers through its trainee and skilled-worker channels, and the number will grow under the new system from 2027. At the prefecture level these workers are no more exposed to earthquakes and floods than the people they work beside. They are, however, a much larger part of the foreign population in the prefectures the hazard maps rate lowest, where institutions for reaching foreign residents in a disaster have had the least reason

to develop. The Noto earthquake struck one of those prefectures. Matching preparedness to where the new workforce actually lives, rather than to where the probability maps and the older migrant communities point, is a low-cost way for Japan to protect a labour supply that its ageing regions increasingly depend on.

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