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গ্রেগরিয়ান ক্যালেন্ডারের ১৮৬৮ সালে থেকে ১৯১২ সাল পর্যন্ত চলা মেইজি যুগে প্রণীত জাপানের প্রথম আধুনিক সংবিধানে এমন বিধান ছিল যে একজন সম্রাটের শাসনামলের জন্য একটি করে যুগের নাম প্রদান করা হবে। তার আগে অমঙ্গল দূর করা ইত্যাদির উদ্দেশ্যে কোনো একজন সম্রাটের আমলে ঘনঘন যুগের নাম পরিবর্তন করা কোনো বিরল ঘটনা ছিল না। নতুন করে প্রবর্তিত আইন অনুযায়ী মেইজির পর প্রত্যেকটি যুগের সঙ্গে একজন করে সম্রাটের সংশ্লিষ্টতা থাকে। তাই যুগের নাম শুনে সেই নাম বহনকারী সম্রাটের প্রতিরূপ মনের পটে আঁকে, এমন লোক থাকলেও থাকতে পারে। কিন্তু আমার বেলায় সে রকম কখনো হয় না। তার পরিবর্তে মনে ভেসে আসে পরলোকগত ঠাকুমা সহ আত্মীয়-স্বজনদের মুখ।

আমার ঠাকুমা জন্ম মেইজি যুগের ২০তম বছরে, অর্থাৎ ১৮৮৭ সালে। বাবা-মা জন্মেছিলেন যথাক্রমে তাইশো যুগের ১৪ ও ১৫তম বর্ষে। মেইজির পর তাইশো যুগের আয়ুষ্কাল ছিল স্বল্প; ১৫ বছর। এর কারণ সম্রাট ইয়োশিহিতো মাত্র ৪৭ বছর বয়সে পরলোক গমন করেন। ১৯২৬ সালের ২৫ ডিসেম্বর থেকে একই মাসের ৩১ তারিখ পর্যন্ত এক সপ্তাহ শোওয়ার প্রথম বছর হিসাবে গণ্য করা হয়। তার পর প্রায় ৬৪ বছর ধরে চলে শোওয়া যুগ। আমার নিজের জীবনের সূচনা হয় এই শোওয়াতে। তার পর পুত্র-কন্যাদের জন্ম একই শোওয়াতে হলেও তাদের পরের প্রজন্মের সকলের এই পৃথিবীতে আবির্ভাব প্রত্যক্ষ করতে পেরেছি ১৯৮৯ সালে হেইসেই যুগ শুরু হওয়ার পর।

আমি ঠাকুরদাকে কোনো দিন দেখি নি। তিনি দ্বিতীয় মহাযুদ্ধ শুরু হওয়ার আগেই মারা গিয়েছিলেন। মৃত্যুর আগে তিনি নাকি নাগোয়া শহরে স্থানীয় সরকারের অফিসে চাকরি করতেন। একথা সম্ভবত ঠাকুমার কাছ থেকে শোনা। তবে ঠাকুমা তাঁর স্বামী সম্বন্ধে তেমন কিছু আমাকে বলতেন না। ছোট ছিলাম বলে আমিও ঠাকুরদার জীবন সম্পর্কে বিস্তারিত জানার তাগিদ অনুভব করিনি।

ঠাকুমা মধ্য জাপানের আইচি জেলার এক ছোট শহরে আমাদের সঙ্গে থাকতেন। তাঁর জন্ম ও বড় হওয়া একই জেলার প্রধান শহর নাগোয়াতে। ১৯৪১ সালে হাওয়াই দ্বীপের পার্ল হারবারে আকস্মিক বিমান হামলা পরিচালনার মাধ্যমে যুক্তরাষ্ট্রের সঙ্গে প্রশান্ত মহাসাগরীয় যুদ্ধে লিপ্ত হবার পর জাপান কিছু দিনের জন্য আধিপত্য বজায় রাখতে পারলেও সেই গতি ধরে রাখতে পারেনি। অচিরেই অন্যান্য বড় শহরের মত নাগোয়াতেও মার্কিন বাহিনীর বিমান আক্রমণ শুরু হয়। অধিকন্তু দ্বিতীয় মহাযুদ্ধের অবসানের আগের বছর ১৯৪৪ সালে ঠাকুমার বড় ছেলে (অর্থাৎ আমার জ্যামহাশয়) যক্ষ্মারোগে আক্রান্ত হয়ে অল্প বয়সে মারা যান। আদরের ও নির্ভরশীল সন্তানকে হারিয়ে, সেই সঙ্গে নিজেদের জীবন রক্ষার জন্য ঠাকুমা সিদ্ধান্ত নেন নাগোয়া শহরের জীবন চুকিয়ে একই আইচি জেলার অপেক্ষাকৃত নিরাপদ স্থানে চলে যাওয়ার। সেখানে তাঁর বড় মেয়ে বিয়ে সূত্রে বসবাস করতেন। ঠাকুমা ছোট ছেলে (মানে আমার বাবা)-র সঙ্গে তাঁর মেয়ের বাড়িতে আশ্রয় নিলেন। বাবা তখন সবে বিশ্ববিদ্যালয়ে ভর্তি হয়েছিলেন।

যুদ্ধ শেষ হবার পরও ঠাকুমা সেই শহরে থেকে গেলেন। আমার বাবা ততদিনে পড়াশোনার পর্ব শেষ করে সেই শহরে চাকরি নিলেন। বিয়েও করেন সেখানেই। শোওয়ার ২৭তম বছরে আমার জন্ম হয়। ঠাকুমা আমাকে খুব আদর করতেন। আমিও ঠাকুমাকে ভীষণ ভালবাসতাম। তিনি ১৯৭৫ সালে ৮৯ বছর বয়সে মৃত্যু বরণ করেন। জীবনের শেষ ৩০ বছর নাগোয়ার বাইরে কাটালেও ঠাকুমা আজীবন নাগোয়ার আঞ্চলিক ভাষায় কথা বলতেন। আইচি জেলার মধ্যে নাগোয়াসহ পশ্চিম ভাগ এবং আমি যেখানে বড় হয়েছি সেই পূর্ব ভাগে ভাষাগত পার্থক্য বিদ্যমান। আমি ঠাকুমার মুখে নাগোয়ার ভাষা শুনে শুনে বড় হয়েছি। এখনো নাগোয়াতে গিয়ে হঠাৎ সেখানকার টানের কথোপকথন - বিশেষ করে কোনো বয়স্ক মহিলার মুখ থেকে উচ্চারিত- কানে এলে ঠাকুমার কথাই মনে পড়ে যায়।

ঠাকুমার মত মা-বাবারও জীবনের পথ বদলে যায় যুদ্ধের কারণে। দ্বিতীয় মহাযুদ্ধ চলাকালে মা টোকিওতে লেখাপড়া করতেন। ঠাকুমা ও বাবার মত মাও যুদ্ধের অগ্নিশিখা এড়াতে আইচি জেলায় আশ্রয় নিতে চলে যান। সেখানে তাঁর পিতৃপক্ষের বাড়ি ছিল। ঠাকুমা, বাবা ও মা- সবাই যুদ্ধ প্রত্যক্ষ করেছেন। মায়ের মুখ থেকে শুনেছি তাঁর অভিজ্ঞতা করা বিভীষিকা ঘটনার কথা; একদিন টোকিওতে মার্কিন বাহিনীর বিমান আক্রমণ

এড়ানোর জন্য তিনি যখন ছুটে পালাচ্ছিলেন, হঠাৎ দেখেন একজন তরুণী মা পিঠে শিশু বেঁধে দিয়ে তাঁর পাশ দিয়ে ছুটে চলে গেলেন। মা তখন লক্ষ্য করলেন, শিশুটির মাথা ফেটে গিয়ে ততক্ষণে সে মারা গেল। হয়ত বোমার টুকরো তার মাথার উপরে পড়লে সে সঙ্গে সঙ্গে নিহত হয়। কিন্তু শিশুটির মার তাতে খেয়াল হয়নি। তিনি তাঁর নিজের এবং সন্তানের জীবন রক্ষার জন্য নিরাপদ জায়গায় আশ্রয় নেওয়ার প্রাণপণ চেষ্টা করছিলেন। যুদ্ধের পর খাদ্যের অভাব সহ বিভিন্ন সামাজিক সমস্যার মধ্যে অন্য সকলের মত আমার ঠাকুমা ও মা-বাবাদেরও রীতিমত কষ্ট করতে হত।

৬০ বছরেরও বেশি দিন ধরে চলা শোওয়াকে তিন ভাগে ভাগ করে প্রথম ২০ বছরের মধ্যে অথবা তার আগে যারা জন্মেছিলেন, তাদের বাধ্য করা হত মেইজি যুগে প্রবর্তিত সংবিধানের অধীনে সম্রাটকে নরেশ্বর হিসাবে বিশ্বাস করতে। কিন্তু মাত্র একদিনে সব কিছু পালটে যায়। ১৯৪৫ সালের ১৫ই আগস্ট পর্যন্ত সবাই শত্রু পক্ষের গালাগালি দিয়ে বলত যুক্তরাষ্ট্র শয়তানের দেশ, কিন্তু সেই দিন জাপানের পরাজয় মেনে নিয়ে সম্রাট ঘোষণা দেওয়ার পর প্রাণ বয়স্করা হঠাৎ মত পরিবর্তন করে বলতে শুরু করে যে যুক্তরাষ্ট্র চমৎকার একটি দেশ এবং জাপানকে তার অনুকরণ করতে হবে। এটা দেখে শিশুদের মনের মধ্যে বড়দের প্রতি যে অশ্রদ্ধা জন্মেছিল সেটাই স্বাভাবিক। ১৯৪৬ সালে জারি হওয়া নতুন শাসনতন্ত্রে বিধান করা হয়, সম্রাট দেশের প্রতীক। তিনি কোনো রাজনৈতিক ক্ষমতার অধিকারী নন। একই বছরে দেওয়া এক ঘোষণায় সম্রাট নিজেই বলেন, তিনি দেবতা নন, মানুষ।

আমার পরিবারের লোকেরা এসব পরিবর্তনকে কিভাবে নিলেন, জানি না। আমার বয়স যখন মাত্র তিন, বাবা গুরুতর অসুখে আক্রান্ত হয়ে শয্যাশায়ী হয়েছিলেন। পরিবার ভরণপোষণের দায়িত্ব একা মায়ের উপরে বর্তায়। কঠিন জীবন সংগ্রামের মধ্যে যুদ্ধোত্তর নতুন সামাজিক ব্যবস্থার মানে বা তাৎপর্য নিয়ে ভাববার মত সময় ও মানসিকতা মায়ের ছিল বলে মনে হয় না। কিন্তু একথা মনে আছে যে জাতীয় ছুটির দিনে কোনো কোনো বাড়ির সদর দরজার পাশে জাতীয় পতাকা টাঙ্গাতে দেখা দিলেও আমার বাড়িতে সেই অভ্যাস ছিল না। শোওয়া যুগের দ্বিতীয় ভাগে অর্থাৎ ১৯৪৫ সাল থেকে ৬৫ বা ৭০ সাল পর্যন্ত জাপানের অর্থনীতি উর্ধ্বমুখী হতে শুরু হলেও দেশটি তখনও ছিল যথেষ্ট গরিব। আমার পরিবার অন্যান্য পরিবারের তুলনায় আরো গরিব, কারণ এক ওষুধের দোকানে খণ্ডকালীন চাকরি করে মা যে আয় করতেন, তা দিয়ে গোটা পরিবারকে চালানো সহজ কাজ ছিল না। কিন্তু সেই কঠিন আর্থিক অবস্থার মধ্যে একদিন আমাদের বাড়িতেও টেলিভিশন এল। আমি তখন ক্লাস থ্রি অথবা ফোর-এ পড়ি। বিভিন্ন হিসাব মতে সেই ১৯৬০ দশকের গোড়ার দিকে জাপানে প্রায় ৮০ শতাংশ পরিবারে টেলিভিশন ছিল। আর গড়পড়তা টেলিভিশনের দাম তখন ছিল প্রায় ৬০ হাজার ইয়েন। আমার এখনো মনে আছে, আমি যখন প্রাথমিক স্কুলের তৃতীয় বর্ষে পড়ি, সেই সময় জানতে পারলাম মা এক মাসে ৩০ হাজার ইয়েন বেতন পেতেন। এই অবস্থায় মা কিভাবে টেলিভিশন কেনার ব্যবস্থা করলেন, বুঝতে পাচ্ছি না। সে যাই হোক, টেলিভিশনে প্রচারিত মার্কিন নির্মিত সিরিয়ালে সে দেশের সাধারণ নাগরিকদের জীবনে প্রাচুর্য দেখে অবাক হতাম। প্রত্যেক পরিবারে মোটরগাড়ি ও ফ্রিজ, আর সুন্দর ও বড় কুকুর বাড়ির ভিতরে দিয়ে ঘুরে বেড়াচ্ছে! তখন ভাবতেও পারিনি একদিন আমরাও তাদের মত সমৃদ্ধ জীবন যাপন করতে পারব।

তার পর জাপান বিশ্বকে চমক লাগিয়ে অর্থনৈতিক উন্নয়নের পথে দ্রুত চলতে শুরু করে। আমার বাড়িতেও বাবা অনেক দিন পর বিছানা ছেড়ে আবার কাজ করতে সক্ষম হওয়ায় পারিবারিক অর্থনীতিতেও মোটামুটি সচ্ছলতা এল। ৭০-এর দশকে বিশ্বব্যাপী তেল সংকটের কারণে অর্থনৈতিক প্রবৃদ্ধির গতি কিছুটা মন্থর হলেও জাপান ততদিনে বিশ্বের শিল্পোন্নত দেশের তালিকাভুক্ত হয়। অনেকেই ধারণা করতে শুরু করে যে একদিন জাপান যুক্তরাষ্ট্রকে ছাড়িয়ে বিশ্বের বৃহত্তম অর্থনৈতিক শক্তিতে পরিণত হবে। কিন্তু সেই মায়ী কেটে গেল ৯০-এর দশকের গোড়ার দিকে অর্থনৈতিক বৃদ্ধি ফেটে যাওয়ার সঙ্গে সঙ্গে। ১৯৮৯ সালে হেইসেই যুগ শুরু হওয়ার পর কিছু দিন জাপানে অর্থনীতির সক্রিয় গতি থাকলেও অচিরেই সেটা হারিয়ে যায় এবং দেশটি দীর্ঘস্থায়ী অর্থনৈতিক স্থবিরতায় ভুগতে শুরু করে।

ব্যক্তিগতভাবে শোওয়ার শেষ ২০-২৫ বছরে জাপানি ও বিশ্ব সমাজের গতিপ্রকৃতিতে সংশয় বা বিদ্বেষ অনুভব করতে শুরু করি। ১৯৭০ সালের আগে ও পরে সারা জাপানে বিশ্ববিদ্যালয়গুলোকে কেন্দ্র করে ছাত্র বিক্ষোভ ডানা বেঁধে উঠেছিল। কখনো এসব আন্দোলনে জড়িত না হলেও তরুণ প্রজন্মের একজন হিসাবে আমি আন্দোলনকারীদের কোনো কোনো দাবির ব্যাপারে সহানুভূতিশীল হতাম। তবে এই আন্দোলন অতি হিংস্র হয়ে উঠে গিয়ে যখন সামাজিক বিশৃঙ্খলা সৃষ্টি করতে শুরু করে, তখন আন্দোলনকারীদের মাত্রাতিরিক্ত কার্যক্রম ও তরুণ প্রজন্মের অসন্তোষে সঠিক সাড়া দিতে না পারার কর্তৃপক্ষ, উভয়েরই বিরুদ্ধে ক্ষোভ জন্ম নিল আমার মনের মধ্যে। ব্যক্তিগত জীবনে পরিবার এবং কর্মস্থলে সুখ ও আনন্দের মুহূর্ত প্রায়ই অনুভব করলেও জাপানি সমাজ সম্বন্ধে আমার সংশয় কখনো মিলিয়ে যায় নি—আর সেই একই প্রবণতা এখনো রয়ে গেছে।

শোওয়া যুগের শেষ বছরে সম্রাট গুরুতর অসুস্থ হয়ে পড়েন। টেলিভিশনের খবরে রোজ শুনতে হত সম্রাট কত সিসি রক্তকরণ করলেন, তাঁর রক্তের চাপ কত ইত্যাদি ইত্যাদি। টেলিভিশনের পর্দায় যারা আসেন, সকলের গায়ে অনুজ্জ্বল রঙের জামা। মনে হল যেন সারা জাপান শুধু সম্রাটের স্বাস্থ্য নিয়ে চিন্তা গ্রস্ত হয়ে পড়েছে। সম্রাট দেশের প্রতীক, তাই তাঁর স্বাস্থ্য নিয়ে দুশ্চিন্তা অস্বাভাবিক কিছু নয়, কিন্তু অবাক হয়ে ভাবতাম, এটা বেশী মাত্রায় হয়ে যাচ্ছে না তো?

১৯৮৯ সালের ৭ই জানুয়ারি সম্রাট হিরোহিতোর জীবনাবসান ঘটে। সেই সঙ্গে শোওয়াও শেষ হয়ে শুরু হয় হেইসেই যুগ। ‘হেইসেই’ নামটি নাকি নেওয়া হয়েছে চীনের দুটি ঐতিহাসিক আখ্যান থেকে এবং এর অর্থ ‘দেশের ভিতরে ও বাইরে তথা আকাশে ও ভূমিতে শান্তি অর্জন’। অর্থাৎ বিশ্বব্যাপী শান্তি প্রতিষ্ঠা কামনা করে এই নামকরণ করা হয়। বাস্তবে অবশ্য হেইসেই হয়েছিল অশান্তিপূর্ণ ঘটনাবহুল একটা যুগ। যে বছরে হেইসেই শুরু হয়, সে বছরে পূর্ব ও পশ্চিম জার্মানিকে বিভক্তকারী বার্লিনের প্রাচীর ভেঙ্গে ফেলা হয়। আমরা প্রত্যক্ষ করেছি দুই জার্মানির একীভূতকরণ। সোভিয়েত ইউনিয়নকে কেন্দ্র করে গড়ে ওঠা সমাজতান্ত্রিক বিশ্বে পরের পর রাজনৈতিক ও সামাজিক পরিবর্তন ঘটতে থাকে এবং শেষ পর্যন্ত সোভিয়েত ইউনিয়ন তার অস্তিত্ব হারায়। সোভিয়েত ইউনিয়নের পতনের পর বিশ্বের একটিমাত্র পরাশক্তিতে পরিণত হয় মার্কিন যুক্তরাষ্ট্র। কিন্তু যুক্তরাষ্ট্রের পক্ষেও সেই মর্যাদা দীর্ঘ দিন উপভোগ করা সম্ভব হয় নি। উপসাগরীয় যুদ্ধ এবং ইরাক যুদ্ধে হস্তক্ষেপের ফলে যুক্তরাষ্ট্রের বিরুদ্ধে সাম্প্রদায়িক বিদ্বেষকে মাথা চালা দিয়ে উঠতে দেখা যায়। ২০০১ সালের ১১ সেপ্টেম্বর নিউ ইয়র্কের বিশ্ব বাণিজ্য কেন্দ্রসহ যুক্তরাষ্ট্রের বিভিন্ন স্থাপনাকে লক্ষ্য করে যুগপৎভাবে পরিচালিত হয় সন্ত্রাসী হামলা।

অর্থনীতির ক্ষেত্রেও যুক্তরাষ্ট্র শান্তিতে থাকতে পারেনি। দেশটিতে ঘটে যাওয়া সাবপ্রাইম মর্টগেজ সংকট অন্যান্য দেশেও ছড়িয়ে পড়ে এবং ২০০৮ সালে ব্যাপক অর্থনৈতিক মন্দার খপ্পরে পড়ে সারা বিশ্ব।

১৯৯১ সালে অর্থনৈতিক বৃদ্ধি ফেটে যাওয়ার পর মন্দায় কবলিত জাপানের অর্থনীতি এই ধাক্কায় আরো ক্ষতিগ্রস্ত হয়। জাপানের অভ্যন্তরীণ চাহিদা কমতে থাকে, মুদ্রা সংকোচনে ভুগতে হয় দেশটির অর্থনীতিকে। সেই প্রবণতা এখনো পুরোপুরি কাটিয়ে উঠতে পারেনি জাপান। অধিকন্তু হেইসেই যুগে ঘনঘন ব্যাপক প্রাকৃতিক দুর্যোগের শিকার হতে হয় জাপানকে। ১৯৯৫ সালে পশ্চিম জাপানের কোবে শহরকে বিনষ্ট করে ঘটে গেল এক মহা ভূমিকম্প। সেই দুঃস্বপ্ন কাটতে না কাটতেই ২০১১ সালের ১১ মার্চ অপর একটা মহা ভূমিকম্প পূর্ব জাপানে আগাত হানে। এর বাইরে প্রায় প্রত্যেক বছরের মত জাপানে ঘটে যাচ্ছে ঘূর্ণিঝড় বা মৌসুমি বৃষ্টির কারণে সৃষ্ট অনেক প্রাণহানির ঘটনা।

হেইসেই যুগের অবসান ঘটে সম্রাট আকিহিতোর ঘোষণা অনুযায়ী এবছর ৩০ এপ্রিলে, ঘটনাচক্রে যে দিন ছিল আমাদের ৪০তম বিবাহ বার্ষিকী। নতুন যুগের নাম দেওয়া হয় রেইওয়া। জাপান সরকারের ব্যাখ্যা অনুযায়ী রেইওয়ার মানে ‘মনোহর সামঞ্জস্য’। নামটিতে হয়ত সুন্দর সমন্বয়ের মাধ্যমে এক সাথে শান্তিপূর্ণভাবে বসবাস করতে পারার মত সমাজের জন্য আশা প্রকাশ করা হয়েছে। এই নামের মত শান্তিপূর্ণ বিশ্ব যদি সত্যি সত্যিই দেখতে পারা যায়, তাহলে তো কথাই নেই। কিন্তু হেইসেই যুগে সেই নামে অন্তর্গত প্রার্থনার মত কাঙ্ক্ষিত ঘটনাবলীতে যে ভরপুর ছিল না, সেই সত্যতা আমরা দেখেছি। শোওয়া নামটিও নাকি বিশ্বের শান্তিপূর্ণ সহাবস্থানের কামনা থেকে দেওয়া হয়েছিল, তবে শেষ পর্যন্ত সেই আশা পূর্ণ হয়নি।

শোওয়া যুগের শেষের দিনগুলিতে সম্রাট হিরোহিতোর অসুস্থতার কারণে জাপানি সমাজের যে প্রতিক্রিয়া হয়েছিল, তাঁর পুত্র সম্রাট আকিহিতো মেইজির পর প্রতিষ্ঠিত অভ্যাস ভেঙ্গে দিয়ে আগেভাগে সিংহাসন ত্যাগের ঘোষণা দেওয়ায় এবার সেরকম পরিস্থিতি হয়নি। বরং সারা দেশ জুড়ে এক ধরনের উৎসবমুখর পরিবেশ তৈরি করা হল। তবে খুলে বলি, আমি নিজে তার সঙ্গে একাঙ্গ বোধ করতে পারিনি। যুগের নাম পরিবর্তনের ফলে যে কিছু যে বদলে যাবে, সে কথা সহজে বিশ্বাস করা আমিসহ অনেকের পক্ষে কঠিন, যদিও আমি মনের অন্তর থেকে কামনা করি যে ভবিষ্যৎ প্রজন্মকে যেন তাদের জীবনে কখনো যুদ্ধ বাধতে দেখতে হয় না, আর তারা যেন সুখের জীবন কাটাতে পারে। মনে মনে ভাবি, আমার ঠাকুমা, বাবা ও মা—যারা দ্বিতীয় মহাযুদ্ধের আগে ও পরে জাপানি সমাজের এবং জাপানি মূল্যবোধের বড় পরিবর্তন লক্ষ্য করেছিলেন, তাঁরা এবারের ঘটনাবলি দেখে কী বলবেন। ■



Japan Industry in the Current of Inclusive Global Change in Heisei era

- Manikchandra Ghosh

Japan, the Industrial nation, began a new chapter in its history marking a new era 'Reiwa-the Beautiful Harmony' with the ascending of Crown Prince Naruhito to the Throne on May 1st, 2019, after the voluntary abdication of his father Akihito declaring the end of thirty-year long 'Heisei era-the Peace Everywhere' on April 30th, 2019. It was not only a great event that filled with many expectations and aspirations of all people in Japan but also an important landmark in Japan's history. On the 30th celebration of our Durga puja in this new Japan era, we, therefore, look back at the leading events of the past three decades and beyond, and see specifically how Japanese industry sailed in the current of inclusive changes across the globe in the Heisei era.

After World War-II, Japan made tremendous progress in almost all industrial domains including heavy industry, chemical and petrochemical industry, electrical and electronics industry, consumer goods production and pharmaceutical industry. Japanese innovative ideas, systematic approach, quality consciousness, and unique skill of adaptation grew Japan's Industry quickly after post war, on the world stage and received recognition as a techno-industrial superpower.

Japanese Industry initially triggered its growth and rapid recovery from war devastated damage mainly with close interaction with USA that favored the inflow of technology and expertise from the United States to Japan, through both industrial relationships and interactions involving government laboratories and universities. However, Japanese Industry acclimatized those imported technologies and expertise by amalgamation with its own innovation, quality and miniaturization. This approach made Japanese Industry successful in inventing new kind of products that created its own market in the contemporary world. For instance, utilizing imported transistor technology, Sony launched its small radio that became popular across the globe. Flat panel displays in calculator in early 1970s by Sharp, utilizing imported liquid crystal technology that was developed in 1960 is another instance.

Indeed, the proper acquisition, effective adaptation, and improvisation of the imported technologies by Japanese industry served as the basis for Japan's rapid economic growth and its international competitiveness. It is also true that certain economic cum political crisis in the past also worked in favor of Japan in achieving its accelerated growth. For instance, during 1980s when oil price became high, demand for large size cars decreased. Japan took that opportunity and exported their small cars to the USA. It ultimately helped Japan capture the Automobile Market. During Korean War, Japan Automobile Industry boosted its exports as the U.S. military procured special vehicles from Japan.

This trend of rapid advancement of Japan's industry continued up to the early Heisei era, when Economic empowerment of Japan led Sony to go for the acquisition of Hollywood's Columbia Pictures and Mitsubishi Estate to buy New York's Rockefeller Center. That success drew the international attention and admiration. However, only three years later, Japan's asset-price bubble collapsed, triggering a full-fledged financial system crisis and setting the stage for long stagnation of Japanese Industry. Several factors could possibly be attributed to the long stagnation of Japanese Industry growth and its economy. Major ones are briefly described below:

- (1) As Japanese Industry had grown and it had demonstrated its superior manufacturing skills through launching several new products in almost in every domain of production, history also witnessed that the favorable atmosphere for cooperation from foreign countries that accelerated its growth had disappeared. It experienced competition from all corners. It had lost its easy access to foreign technology. For further growth, Japan Industry became dependent on its own basic research and innovation.
- (2) Watching the phenomenal growth rate, other nations had also adopted strategy of their own industrial growth, like the one followed by Japan after World War II. Those measures helped them to some extent to make reasonable progress in developing their industry. With that effort, they ultimately, became competitors to the Japanese companies in some areas.
- (3) Foreign investment that boomed at the early Heisei era had declined sharply after bubble economy collapsed. It had an adverse effect on Japan's Industrial growth.
- (4) Japan faced two major natural disasters during Heisei era-(a) the Great Hanshin Earthquake in 1995 and (b) the Great East Japan Earthquake and tsunami in 2011. Those two disasters had an impact on Japan's Economy and industry.
- (5) Information technology (IT) and Internet that was born in the United States in Heisei era, integrated the world with the flow of knowledge, and information at an amazing speed. It created new kinds of diverse businesses that the world could not imagine before. However, it appears that Japanese electronics Industry had failed to recognize its potential in a timely manner. As a result, Japanese Firms lagged in exploiting its full potential and boosting industrial growth for the electronic market in comparison to other nations. Eventually, Japanese firms were forced to share the mobile phone market with Chinese, South Korean and American Company in Heisei era and that trend still continues today.

Historical events show that Japanese industry recognized the issue of stagnation subsequent to the economic bubble burst and looked for several options to escape from it. Some effort of Japanese Industry as early as 1991 carries the signature of its attempt. Most important measures that Japanese Industry took in Heisei era are highlighted below:

- (1) Japanese Industry always gave importance to productivity. The secret of achieving productivity in Japanese Way was revealed by Toyota. Based on management innovation, 'Toyota Production system' was made public by Toyota Motor Corporation in 1992. It was applied extensively to achieve the several goals. Most important ones were to reduce cost through minimizing waste, to make the process easier and maintain high quality, to create a business focused work culture, and to nurture a lean production system capable of responding immediately to demands in the market.
- (2) Anticipating difficulties in obtaining technology from foreign companies, both Japan's Industry and government gave emphasis on indigenous innovation and industrial research.
- (3) As early as around 1991, in line with the concept of

supply chain management, some Japanese firms started shifting some of their manufacturing units abroad with an aspiration and expectation of harvesting the advantage of growing emerging markets and the lower cost of manufacturing goods abroad due to lower cost of work force and material. As a result offshore operations of Japanese firm were increased about 3.3 times in year 2016 in comparison to that of 1990.

- (4) Japanese industry, particularly electronics industry, adopted modularization approach in manufacturing and started integrating their offshore units located mostly in neighboring Asian Countries in the main stream of management horizontally in around 1990. One of the oblivious merits of that integration was noticed in improvement in regional cooperation and liberalization of investment without compromising quality.
- (5) Japanese Corporate took a radically new decision at the level of the corporate culture in order to align with concept of globalization in the end of 1990s. It started hiring non-Japanese and accepting English as a medium of international communication in parallel to Japanese. That approach helped Japanese Firm lead their business effectively across the globe.

In the new era 'Reiwa-the Beautiful Harmony' Japanese Industry has confidently moved forward with its strong work force treasuring its worldwide reputation as a quality conscious nation. It is expected that all the positive thoughtful measures already taken by the Industry in the past will continue in the new era. Emphasis will be given more on innovative research and technology development particularly in the newly emerging high-tech areas such as robotics, artificial intelligence, etc. and preparing itself for the next phase of industrial revolution. With all these sincere efforts by Japanese industry together with the industrial policy recently introduced by Japan Government, it is likely that it will be ready to move forward on the path of harmony for embracing the global business market with full understanding of the diverse needs across the world in order to overcome its stagnation.

On the auspicious occasion of the new era 'Reiwa', like Japanese Industry, we, a group of individuals, also cherish our experience and learning from the past 'Heisei era'. We uphold the spirit of 'Reiwa –the harmony', through our celebration of *Druga puja*. We pray to goddess Durga for achieving the beautiful harmony, the motto of new era in true sense in our every effort and action for advancement, and wellbeing of every individual, our society, and industry. ■

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History of Indians in Japan

- Yogendra Puranik

Councillor of Edogawa City in Tokyo

The India-Japan relation started in the 6th century when Hinduism and Buddhism were conveyed to Japan. Bodhisena, an Indian Buddhist scholar and monk, visited Japan in the 7th century, lived here for 25 years and preached Buddhism. He met the Japanese Emperor and was treated with great honour. Thereafter he stayed in a temple called Daian where he started Kegon school of Buddhism and taught Sanskrit. He participated in the eye-opening ceremony of the giant Buddha statue in Nara Todai temple. Bodhisena's bones were laid in Ryoujusen mountain in 760. Records say that thereafter Japanese scholars and monks started visiting India to study at Nalanda University.

The history of modern Indian settlement in Japan started from 1870s when some Sindhi and Parsi businessmen and their families settled down in Yokohama and Okinawa. Before that few Indians came to Japan on Portuguese boats in the 16th and 17th century and on the British boats in the 18th and 19th century. As per the statistics released by Japanese government, there were 30 Indians in Japan in 1901. Thereafter Indians started settling in Hyogo prefecture. By 1905 there were around 70 Indians in Hyogo prefecture. In the aftermath of the Great Kanto earthquake in 1923, many Indians moved from Yokohama to Kobe.

The Indian population in Japan grew to 632 in 1939 which reduced to 114 in 1942 owing to British sanctions against Japan. The Indian National Army and Japanese army collaboration formed under the leadership of R. B. Bose, for achieving Indian independence, is well known. As a part of this collaboration, the INA youngsters joined Japanese military schools for training. However, the whole plan stopped after the sudden disappearance of INA Chief S. C. Bose. After the end of world war, the Indian population in Japan grew again, just to a few hundreds, mainly the businessmen community around Kobe.

India, represented by R. B. Pal, supported Japan in the post-war international tribunal. In 1949, the then Indian prime minister Nehru gifted an elephant to Japan. Thereafter, as Japan became an ally of the US and India of the Soviet Union, India and Indians were not looking east. By 1980 the Indian population in Japan was a bit less than 2000, led by the businessmen community, 40% of which lived in Hyogo prefecture. Kobe was the largest port heading towards Asia. In Kobe, places of worship were established during these times.

It was only in the 1990s, when the Indian immigrants to Japan showed a steep increase and that too around Tokyo area. The year 2000 issue of information systems opened the flood gates for Indian IT engineers. For the Japanese, it was just a one-off activity they needed help from the Indian IT industry. However, this gave a realization to some corporates about the usefulness of Indian IT engineers, project managers and business managers. By 2001, the Indian population in Japan was around 10,000.

In the meantime, Indian scholars started coming to Japan, in very low numbers though as compared to neighbouring countries. For Indians, Russia, Germany, and later the Americas were most popular destinations. However, during the last few years, as the India and Japan ties have strengthened, the number of scholarships offered to Indian students and vice versa, have significantly increased.

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Indian restaurant business in Japan started from 1970s in Tokyo. The north Indian food was quite popular in Japan until the year 2000 after which south Indian food restaurants also started picking up. Today, there are around 1300 to 1400 Indian restaurants only in Tokyo out of which only a handful are run by Indians and rest by the Nepalese.

Since 2001, the demand of Indian IT engineers increased steadily on a continuing basis. In the beginning, the Indian IT companies would largely work as partner with the Japanese IT companies to offer services to customers in Japan. Over years, a good number of customers have chosen to work directly with Indian IT companies to reap the advantages of labour arbitrage. Given this, the large Japanese IT companies have also opened their centres in India and started direct recruitments from India.

This development has led to change in life styles of the Indians in Japan. As compared to a project-based visit to Japan in the past, more Indians are now coming to Japan for long term jobs, along with their families. The Indian community in Tokyo now has more than 1000 school going kids. These kids attend schooling primarily in the Indian and other international schools in and around Tokyo. Education is yet a challenge as Indian parents are looking for better schooling for their kids. Getting admissions into Japanese universities is a further challenge due to the big language barrier. Most of the kids opt to go overseas for their under-graduate and graduate studies.

The change in durations of stay in Japan also brought a lot of changes in the life styles of people. Many Indians are buying homes in Japan. The number of permanent residency applicants is showing a steep rise over last few years and many are even considering citizenship of Japan. Many IT engineers, girls and boys of age around 25 are single when they come to Japan. Once they like Japan they want to stay here for long for which I am seeing a trend that they are seeking life partners within Japan.

Many region-based Indian communities are active in Japan like the Tokyo Marathi Mandal, Tamil Sangham, Odisha community, Bengali community and so on. Hindu Swayamsevak Sangh is also very active in Japan. Japan is prone to natural calamities. Many Indians left Japan after the large earthquake in 2011. Learning from those lessons, the newly formed All Japan Association of Indians (AJAI) is trying to put up a national framework or network to offer social support, information to all Indians across Japan. As the daily life becomes complex, people need all sorts of information and support spanning legal, medical/health, childcare, education, social and other areas.

As of the end of year 2018, there were around 39,000 Indians in Japan comprising of approximately 10000 engineers, 2000 students, 6000 skilled labour, 500 entrepreneurs and business managers, 500 teachers, 300 plus diplomats, around 3000 on short term visits and rest are family, dependents and other categories. The Indian community started its journey to Japan in the Meiji Era and started building up in the Showa era mainly through the businessman community, grew its presence through the IT population in the Heisei Era and will now become a part of the local Japanese community in the Reiwa Era. Japanese and Indians are coming closer than ever. ■

Japan's Emergence as an Economic Power House

- Partha Kumar

With the devastation that followed towards the end of World war II, rising of Japan from the debris and ashes and re-invent herself as a leader in global economy almost seems to be a fairy tale. Over past 70 years, Japan not only did that but also led the way for others to follow in the post crisis world. If 80s was time for Japanese companies to lead the market by consumer products, recent years have shown marked improvement in financial product development, technology adaptation and compliance policies creating one of the largest and robust market in the world. Japanese Yen has also replaced Swiss franc over the years as currency of choice in time of distress.

Following the recovery of the US economy in the 80s under the Reagan administration, Japan's exports began to expand on a massive scale. This development was supported by an appreciating dollar and a budget deficit in US created by significant tax cut without a complimentary expense reduction measure. The favorable condition propelled Japan's export led growth strategy which was replicated successfully by Japan's neighbors in later years.

When Japan emerged as a major creditor in the global financial system many economists started believing that Japan was bound to surpass US at some point. From the postwar days to early 1980s, Japan had been continuously a net borrower. With large current account surplus fueled by export oriented growth strategy Japan started running a large surplus from 1982. Only in next four years, Japan had positioned herself as the largest net creditor. Annual net export towards late 80s used to run into 100 billion USD and net external asset touched 300 billion USD, both numbers were not seen or heard in that era.

Needless to say that Japan's monetary easing post bubble 80s created nothing but cynicism and Governor Hayami's policy were dissected many times by economist and politicians of the west until a similar bubble erupted in the US with the crash of mortgage backed securities and Lehman bankruptcy. Despite hesitation and criticism, it only took months to determine that the only path forward to recover from the crisis lies in same policies Japan had adopted almost two decades before.

The ultimate reason for Japan's emergence as a creditor can be found in Japanese developmental state that relied mostly on a system of financial repression to sustain rapid economic growth. A high savings rate allowed the policy makers to fund industrial sectors which are thought to be strategic for the growth. Some criticism is appropriate in this regard as western policy makers focused on improving average life of the population with the surplus, which came to Japan much later in the cycle. When economic growth slowed somewhat in the 1970s and demand for corporate investment decreased, the policy makers refrained from reforming the financial system for the sake of maintaining control over the economic development. Even though the financial system was subject to liberalization pressure and eventually it started opening up in late 90s, some elements of repression were always there.

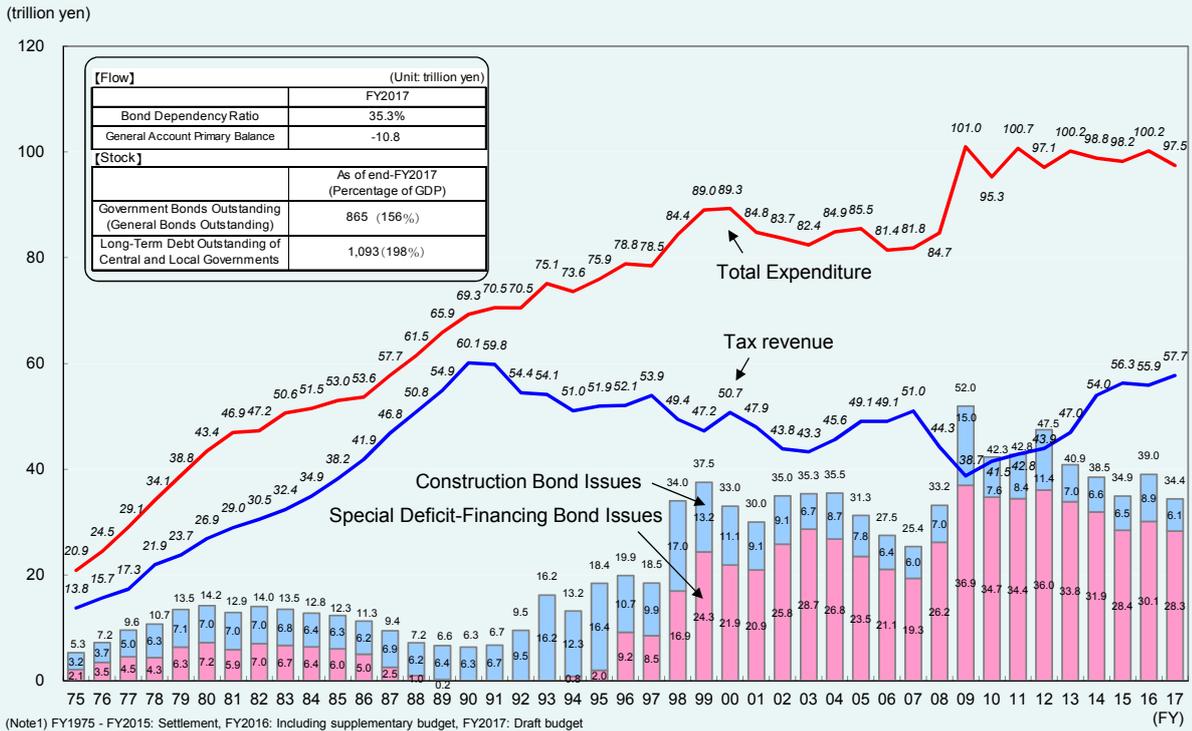
Following the financial big-bang of late 90s and advent of technology, Japan became second largest market in early 2000s. The period also saw rapid introduction of modern derivatives products in Japanese markets, significant reform of locally traded Bond and Equities markets and continuous reform to position Japanese market as an efficient, open marketplace for global asset managers. Sadly, the tax structure has not helped all the way towards the re-positioning of Japan. I will discuss briefly the reason in next section.

Post Lehman shock, as US started implementing various regulations, Japan still kept herself ahead with the introduction of first derivatives clearing infrastructure in the world and continued to leap forward with disclosure and compliance while introducing waves of changes for ultra-high speed trading technology and implementing schemes to trade Japanese products from overseas markets.

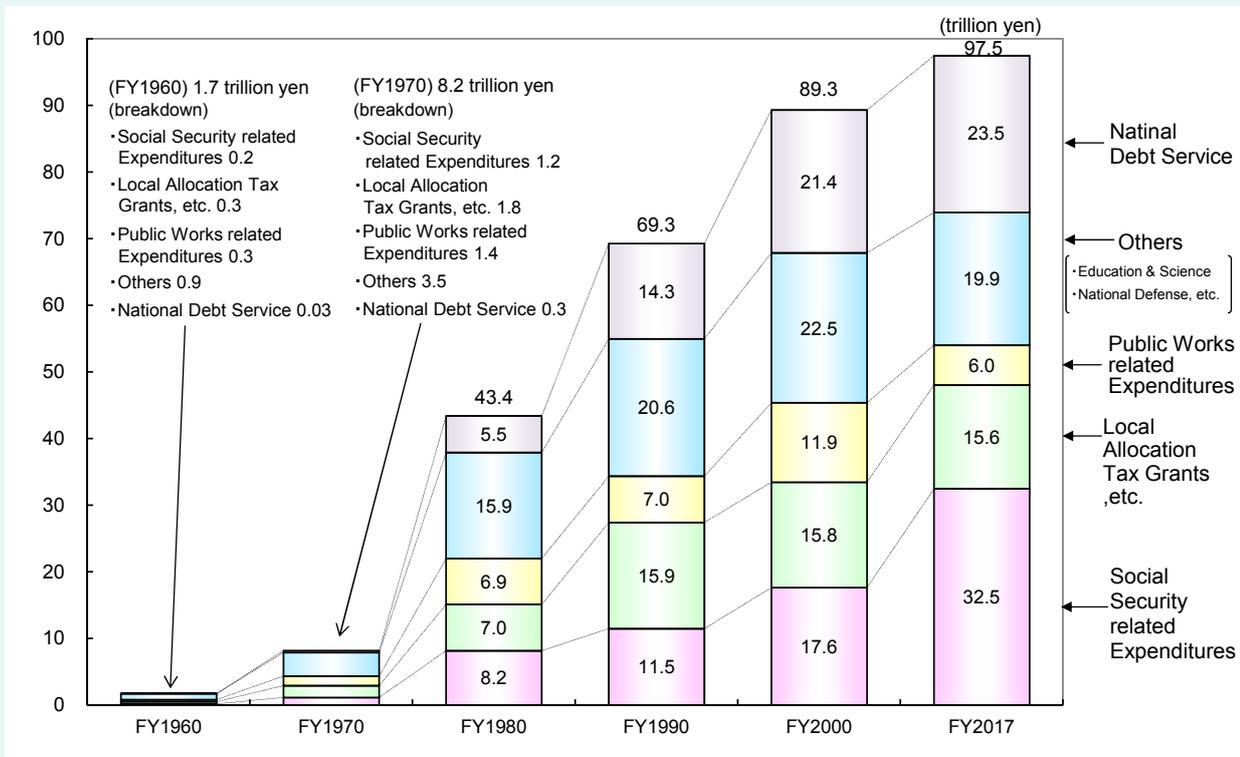


Japan's Emergence as an Economic Power House

The challenges ahead can be explained with the help of two charts below published by Ministry of Finance, showing gap between total expenditure and tax revenue which has only widened since 90s, however thankfully trending a recovery since 2009 and increasing debt servicing and social security related expenditures which need no further explanation.

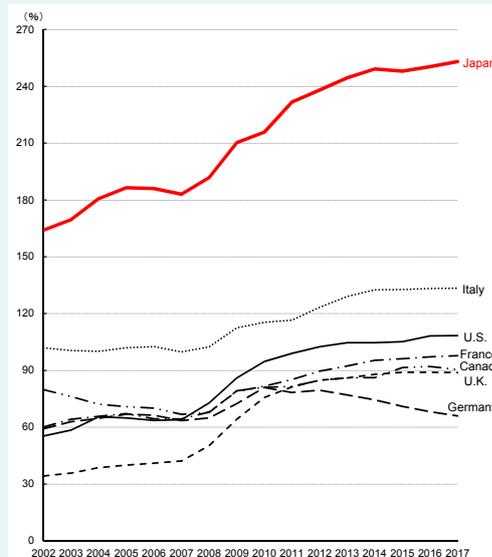


(Note1) FY1975 - FY2015: Settlement, FY2016: Including supplementary budget, FY2017: Draft budget
 (Note2) Following various bonds are excluded: Ad-hoc Special Deficit-Financing Bonds issued in FY1990 as a source of funds to support peace and reconstruction activities in the Persian Gulf Region, Tax reduction-related Special Deficit-Financing Bonds issued in FY1994 - FY1996 to make up for decline in tax revenue due to a series of income tax cuts preceding consumption tax hike from 3% to 5%, Reconstruction Bonds issued in FY2011 as a source of funds to implement measures for the Reconstruction from the Great East Japan Earthquake, Pension-related Special Deficit-Financing Bonds issued in FY2012 and FY2013 as a source of funds to achieve the targeted national contribution to one-half of basic pension.
 (Note3) General Account Primary Balance is calculated by subtracting Primary Expenditure from the sum of Tax Revenue and Other Revenue: It is different from the Central Government Primary Balance on SNA basis.

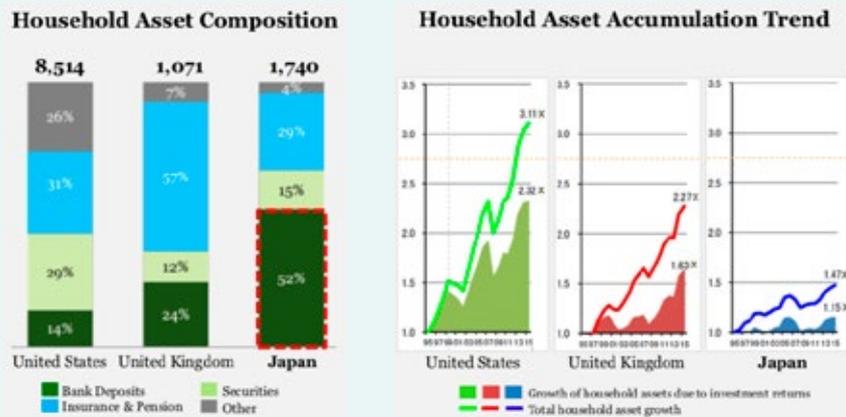


Tax reform is an integral part of this recovery and recent years have shown how rigorously it can be followed. My colleagues in Singapore and Hong Kong had moved offices and businesses over past years due to high corporate and individual tax structures in Japan, needless to say that it is hurting a few growth opportunities for Japan, but mounting costs of debt servicing and social security won't leave any other options.

Fellow readers are likely to get a little nervous with the next chart which shows a comparison of General Government Gross debt. Some consolation can be offered by the facts that most of these debt is held within Japan (and in recent times more than half is held by Bank of Japan). Also, you might find it particularly interesting that the trend of growth for Japan and US in this comparison is very similar, especially after 2008.



A comparison of household assets among Japan, US and UK would instantly point the lack of investment in securities, and despite low interest rates, the inclination of keeping liquid assets. Although the rate of household asset accumulation in recent times has not been able to keep pace with global peers, the trend has improved with Abe administration's policies, however investment returns have not really helped much when compared to others.



I meant to end the article in a positive note due to two reasons, one being it is written on the occasion of Puja and secondly I want all the readers who are mostly long term residents of Japan to understand that all hopes are not lost. Japan has tremendous potential to reinvent her over next two decades in services industry where it still leads light years, tourism is a growing business and Japan has already shown a niche sector of tourism for ultra-high net worth individuals, the combination of rich heritage, history, safety and reliable transportation can rarely be replicated in another country. Japan is a late entrant to the aviation and defense industry, but it is already creating waves with the introduction of some of the first line of products in these segment. Creativity has been at the core of Japan during the entire period, the new generation is taking it to the next level with augmented reality, a new generation of gaming and entertainment industry has already born. Lastly, Japan may not have a silicon valley but a good part of the investment dollars working hard in silicon valley are from a Japanese company Softbank, who have shown how to do it at a large scale. ■

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Scientific Achievements in Heisei Era

(1989 – 2019)

- Prabir Patra

The Heisei Era has seen many ups and downs in science, education, and sports. Natural disasters have also thrown many challenges: Japan has experienced severe typhoons, earthquakes, and tsunamis. Some say natural disasters and tougher living conditions force people to innovate through scientific and technological developments. The tsunami of March 11th, 2011 claimed more than 12,000 lives and triggered the infamous nuclear accident. This forced the Japanese government to take a bold step to shutdown all nuclear power plants (NPPs) across the country, where nuclear power supplies about 25% of the electricity. This was to ensure upgradation of all apparatus in the NPPs and make other associated arrangements to minimize the effect of tsunamis on the NPPs in the future. It is thought that the tsunami water damaged the cooling system of the nuclear rods at the ill-fated Fukushima Dai-ichi Power Plant. A major technological development in terms of nuclear fusion is needed to make the NPPs even safer and to avoid piling up of nuclear waste. We are hoping that the International Thermonuclear Experimental Reactor (ITER) will achieve the milestone through Japanese investment that has started in the Heisei Era.

The hi-tech science is at its forefront in Japan. It is one of the only few places on earth which has produced Nobel laureates in the same department from the same institution successively. The first was the Niels Bohr – Max Planck institution, and now the University of Tokyo, which oversees the neutrino observatory at the Super-Kamiokande. Prof. Masatoshi Koshiba first won the Nobel Prize in 2002 for the detection of cosmic neutrinos, massless virtual particles which gives insight into the origin of the universe (or the so-called Big Bang Theory). Soon after, Prof. Takaaki Kajita further improved the detection technology, thus helped prove the existence of neutrino oscillations and that neutrinos are, in fact, not massless, which earned him a Nobel Prize in 2015. The other hi-tech research of note are the achievements of Shinya Yamanaka, from Kyoto University, on developing Induced Pluripotent Stem (iPS) cells. Such is the importance of this discovery, the iPS cells are now under testing for treatment of Parkinson's Disease in Japan. For this, he won a Nobel Prize in 2012. In the same discipline, Prof. Tasuku Honjo won a Nobel Prize in 2018 for his pioneering work for discovering a protein for treating cancer cells.

A practice I appreciate, living in Japan, is how quickly advanced research is applied to the betterment of our lives. The scientists involved in this process are obvious choices for the Nobel Committee to choose as Laureates. For example, Professors Isamu Akasaki, Hiroshi Amano, and Shuji Nakamura first discovered the blue LED, and Prof. Satoshi Omura was the first to make use of naturally occurring microorganisms to treat infections caused by roundworm parasites. Once the blue LED was developed, it was put to immediate use in making household lightbulbs; the medicine produced by Omura's discovery was already widespread when he was awarded the Nobel Prize. What further surprised me was the Nobel Committee's work to find Mr. Koichi Tanaka, of the Shimadzu Corporation, a man who had no academic recognition but had created the method used in MRI scanning based on nuclear magnetic resonance (NMR) spectroscopy. These successes do not come overnight or easily: Japan has invested heavily in R&D many centuries ago, and the citizens have performed their duties with utmost dignity. I remember from my early days, when the then-Prime Minister Junichiro Koizumi once said that Japan wanted to have 50 Nobel Laureate in a certain time. It is now clear that high returns come from heavy investment and such visions. This is something the present generation is enjoying, including myself.

I came to Japan in H-12 (2001), the year Japan became the only other nation, apart from the US, to develop the fastest supercomputer in the world. What was fascinating was that this supercomputer system was built for civilians' use to develop numerical models for predicting Earth's climate 100-200 years in advance, to learn about the past of some millions of years ago, and to develop models to predict weather a week in advance at very high resolutions (of city scale at hourly timestamps). Aptly known as the Earth Simulator, other research relating to our solar and planetary systems are also conducted using the supercomputer. Major scientific groups from the US and Europe were stationed in Yokohama to access to the facility, which had no external connectivity. We felt so privileged to have that access in-house. Because of that investment in the 1990s, Japan has become an integral part of the Intergovernmental Panel for Climate Change (IPCC) assessment reports, which was also conferred a Nobel Peace Prize in 2007.

While there is no apparent financial gain to us, why was this investment in the supercomputer so important? Apart from the technological prowess, we can model the history of the Earth, which will allow us to understand trends of climate change, and what we have to do to protect the planet we live in, or even the only known planet in our solar system to have life (as far as our knowledge goes). The early planet has gone through many adjustments millions of years ago for the initiation of life. Until 20 million years ago, the level of carbon dioxide (CO₂) was too high for the planet to be habitable. When Homo Sapiens came to be, around 0.2 million years ago, the CO₂ level was already stabilized at about 270 ppm (1 ppm = 1 part per million molecules). This evolution of Earth's atmosphere is well recorded in various proxies we derive from the Arctic and Antarctic ice cores. The pre-industrial conditions of the Earth (circa. 1750) is believed to be the most comfortable for human civilization. For example, the seasonal climate variations in the temperate regions provides survivable winters and pleasant summers, and the tropics had pleasant winters and slightly difficult summers. The monsoons bring respite from the summer heat to the billions of people and provides the much-needed water for livelihood (water from the temperate regions came from snowfall or cold precipitation). Since the use of fossil fuels during the Industrial Revolution, CO₂ levels in the atmosphere have been rising, leading to an increase in Earth's surface temperature.

Although there are no visible or accountable benefits of keeping the Earth's climate to the pre-industrial state, the United Nations Framework Convention for Climate Change (UNFCCC) has come up with the Paris Agreement (2016), a target to limit the global mean surface-air temperature change at 2°C or lower, relative to the pre-industrial era, by the year 2100. This is a daunting task for rich and poor nations alike: the rich nations are already major emitters of greenhouse gases (e.g. CO₂), while the poor nations are likely to rely on fossil fuel to sustain their economic transition. For a reference, the mean air temperature has already increased by about 1°C from the decade of the 1890s to the 2010s, caused primarily due to the human activities. Are we depriving people of equality by introducing policies to limit global warming? Perhaps not. I am conscious, though, that everyone in the world could not afford the "American lifestyle". We simply do not have the resources on the Earth, not at least for the space and fossil fuel resources. For a bit of clarity, Japan would not be as beautiful as it is today if every one of us lived in a three-story bungalow. More than 68% of Japanese land comprises of national parks or restricted land. Being content in what they have and refraining from wasting precious resources

was arguably what separated many of the Asian nations from Western ideologies in the first place. Recently, towards the end of the Heisei Era, Japan has again started to promote the idea of wastefulness through the term “Mottainai” to reduce unnecessary industrial consumptions. The per capita fossil fuel consumption in Japan and India are at about 50% and 0.1%, respectively, of that of the average American. This is due to smaller Japanese houses, compromises in room temperatures, smaller cars, and the use of public transportation.

To achieve something as big and drastic as the Paris Agreement, we need a more proactive approach. Thus, each country has to have a goal to reduce fossil fuel emissions either in total or in terms of emission intensity, that is, how much emission per economic output. There are several options to achieve these goals: simply make the energy resources “green”. Actually, nuclear power is considered green for climate change; that’s why I am personally interested to see the nuclear industry become safer and more sustainable. We already see other widespread use of small-scale green energy, such as from solar panels and wind turbines. The scale is small because the current level of energy production from solar and wind does not support large scale industrial operation. Also, we have seen the recent power failure in England is blamed on the green energy sources, as its energy production cannot be increased when needed. However, the situation is changing dramatically. About 10% of energy in China comes from green sources, and Germany plans to go green by 2050, just 30 years from now. The Cochin Airport in India is fully run by solar power.

Despite all this progress, many argue it may be too little too late, because we have failed to take GHG emission mitigation actions since the Kyoto Protocol in 1996. Now time has come to enforce strong policies top-down, from the UNFCCC in negotiation with the Conference of Parties (COP). We now have experience and confidence in implementing policies for environmental protection. In the beginning of the Heisei Era, the Montreal Protocol was successfully implemented for protection of the stratospheric ozone (O₃) layer, which protects us from the biologically harmful ultraviolet radiation from the sun. The chlorofluorocarbons (CFCs) and Halons were introduced in the market in the 1940s for common use as coolants, fire retardants or solvents, because of their inert nature in the troposphere. Scientists found them to destroy ozone in the stratosphere where these man-made chemicals can be broken down to chlorine and bromine atoms. Banning the use of these ozone depleting substance was easy because the chemicals were both produced and used by the rich nations and those countries mostly located in the high latitudes were most affected by the ozone depletion. Finding of replacement chemicals in hydrogenated halocarbons (HCFCs and HFCs) was easy without affecting the operation of

refrigerant industry. All these changes over the past 50 years are well recorded by direct measurements.

The policy implementation for mitigating global warming is a much tougher proposition. Replacing coal, oil and gas which is part of our daily life and available abundantly in our planet (Mother Earth) poses a much difficult task without sacrificing our luxurious lifestyle and dampening economic growth in each country. First of all, we are not aiming at removal of all the CO₂ in atmosphere which has increased due to our industrial activities. CO₂ being a very stable gas converting it to another form through natural processes takes longer than 100 years once in the atmosphere. Our aim has been modified to become “carbon-neutral” by means of environmentally friendly lifestyle and technology development for greater efficiency. The thermal power plants now produce more energy by more complete combustion, coal and oil fields are better managed, the Earth’s surface is greening overall due to afforestation - to name a few. The carbon-neutrality cannot be achieved solely by these processes. On the contrary the demand for energy-intensive meat-protein production becoming a cause of concern. Restoration of forested land and their sustenance to store carbon at multidecadal timescale is also an issue. We have heard the burned area due to forest fires in 2019 is almost twice of that in 2013. Deforestation (forest clearing for urban settlements and farm land) and forest fires is the second largest cause of atmospheric CO₂ increase since the preindustrial time.

Given these situations, CO₂ emission reduction policies are very complicated, particularly when the cumulative major emitters do not want to comply with international policy decisions considering own economic growth. Action was only needed from the rich and affected nations under the Montreal Protocol, but we need participation of every nation under the Paris Agreement. The poor nations are most likely to face major challenges from sea-level rise due to global warming or ocean acidification, both are manifestation of the activities in the rich nations. The ocean acidification is direct cause of enhanced CO₂ level in atmosphere, which dissolves in the seawater to free up hydrogen ions. The stakes are high to take action for reduction of CO₂ emissions in order to mitigate the rise of Mother Earth’s surface air temperature. Hopefully nations take responsibility for their own actions.

The Heisei Era has been a pivotal time in scientific advancement and technological development within Japan. Foundations have been laid for achieving greater feats in the present Reiwa Era. For that, the present generation and the next have to take responsibilities under international frameworks: diversification and collaboration is becoming increasingly important, as the challenges we face as a human race is greater than ever, and goes beyond the boundaries of any individual country. ■



Japan and the Earthquakes: Technology Evolutions in the Heisei-era

- Ashoke Karmokar

Beyond doubt, Japan is one of the most earthquake-prone countries in the world. Feeling tremors is rather a regular unpleasant fact of life here. On the other hand, Japan is also a leader in disseminating earthquake management technologies to the world. The effort to achieve advanced technology has become possible by constantly involving innumerable researchers. Besides, the R&D refinements prosper by leveraging on the experiences of past earthquakes. However, the Great Hanshin earthquake in 1995, which struck Kobe city, was a wakeup call for Japan's national authorities. Many significant turnarounds in the policies were enacted since this early Heisei-era (Heisei-era started from 1989). As a matter of fact, there was no notable earthquake that directly struck a large city in Japan since the Great Kanto earthquake in 1923 till the Great Hanshin earthquake in 1995. Further, the authority believed that major destruction would not happen in case of a quake due to significant advancements in design and construction technologies.

The Great Hanshin earthquake on January 17, 1995, had changed the situation. This massive earthquake hit the western part of Japan. A quake of 6.8 magnitude in the Japanese earthquake scale wreaked havoc in the Kobe city of Hyogo prefecture. It was so-called the biggest natural disaster in postwar Japan. Over 6,000 people lost their lives, and around 300,000 people became homeless. Many people were crushed to death under rubbles, and many others died in the fires caused by the tremor. The lifelines mostly halted, expressways collapsed; railroads and telephone lines were disrupted. Many buildings were toppled, destroyed, or became uninhabitable in the worst-hit areas.

In Japan, the building design standards law was amended in 1981 to enforce advanced design and construction for earthquake resistance buildings, which was known as 'new basic earthquake-resistant standards' (Shin-Taishin). However, the aftermaths in the Great Hanshin earthquake changed Japanese Government's minds. Since then, many new regulatory policies got introduced based on a foresighted vision that they should do more to disseminate advanced technologies toward developing quake-resistant structures. Under the Government's umbrella, the Central Disaster Management Council of Japan implemented a project on Earthquake Disaster Management Reduction plan. It defined concrete goals for disaster mitigation by promoting strategic policies on making public facilities and housings earthquake resistant. This strategy gave particular importance to probable tools for reducing economic damages from a major earthquake.

Japan Meteorological Agency (JMA) measures quake levels based on the degree of shaking units. This measurement procedure considers the degree of shaking at target points on the ground level, instead of the amount of energy released at the earthquake epicenter. In the Japanese standard of earthquake scale, seismic tremors are divided from 0 to 7, with 7 being the harshest level. Before the implementation of 'new basic earthquake-resistant standard' in 1981, buildings were designed only to withstand damage from tremors registering level 5 on the Japanese earthquake scale (level #5 implies that walking is difficult without holding onto something stable; unreinforced concrete block walls may collapse, etc.). After 1981, however, buildings had to be designed to withstand damage from tremors registering levels 6-7 on the Japanese earthquake scale (level 6-7 implies that people need to crawl

and might get thrown out; reinforced structure with low earthquake-resistance may collapse and buildings with high reinforcement may tilt).

Damage from the Great Hanshin earthquake in 1995 provided strong evidence that a higher number of buildings constructed with the 1981 amended 'new basic earthquake-resistant standard' performed well. However, a collective opinion was that the compliance to this new earthquake-resistant standard alone could not provide safety to the building from collapsing or suffering damages in the event of a major earthquake. Moreover, the fact that people in the society did not realize the beneficial effects of earthquake-resistant technologies before the Hanshin earthquake, the importance of technology dissemination and implementation were further recognized. In fact, quake-resistant building construction technologies grabbed the critical spotlight after 1995, and in course, Japan became a world leader in earthquake-resistant technologies, especially in constructions of earthquake-resistant buildings.

To mention a few on the type of technologies evolved, the major designated systems are 'basic earthquake-resistant system' (Taishin), 'vibration control system' (Seishin), and 'seismic base isolation system' (Menshin), as shown in Fig.1. In the 'basic earthquake-resistant' system, the load-bearing pillar and/or wall reinforced with specific stiffening materials make them stronger against shaking. In 'vibration control system,' the building is designed to equip with dampening devices (like shock absorbers) for dissipating kinetic energy.

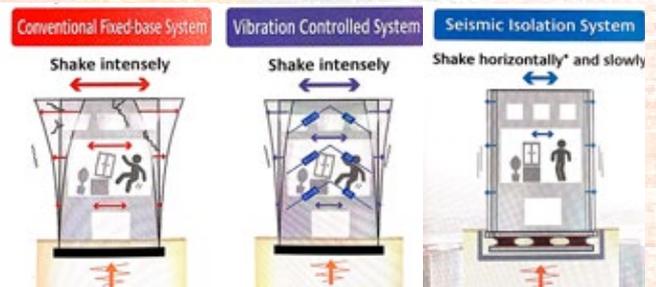


Fig.1 Earthquake-resistant system used in Japan.

In 'base isolation system,' a device is used for separating the building from the ground, and thus prevent transmitting of shock waves to the structure. Although designed with any system constructs structure with better earthquake-resistance,

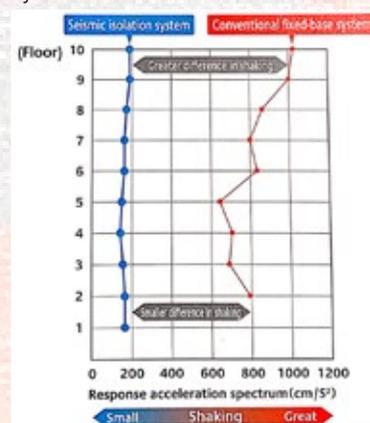


Fig.2 Results of simulated analysis.

base-isolated system claimed to be the best for lowering the total amount of shaking in the structure. Compared to the two other systems, it limits the shaking to moderately horizontal movements. Structures with the base-isolated system experience only about two-thirds less shakeup as evident in simulated measurements shown

in Fig.2. As a result, the acceptances of introducing the base isolation technologies are increasing.

The use of rubber bearing is the most prevalent technology in Japan, and it is also becoming popular around the world. The system performs by placing several specially designed rubber bearings under the building. In the event



Fig.3 Model of rubber bearing.

of a quake, these bearings absorb tremors and support the building constructed above. The rubber bearings are high-tech engineered component composed of thin rubber layers and steel plates placed alternately in a layered structure (Fig.3). The layers firmly bonded to each other in the rubber vulcanization process. These steel plates prevent the bulging of rubber, which is in contrast to the simple rubber block that easily deforms and bulges outside under compression. Due to such engineering, the bearings, when placed under the building, can move flexibly in a horizontal direction and has strong capability of dissipating the quake tremors.

As a core device, the bearing needs to have high vertical stiffness for durability and safe sustaining of the structure above. As explained, the base isolation system protects the building by installing isolating components between its foundation and the structure, so the system decouples the building from the shaking foundation. Structural parameters, including height, diameter, etc., are determined by the overburden load of the building to be supported. The largest available seismic isolating bearing available in Japan, called supersized seismic isolating bearing, is 1800mm in diameter and 684mm in height including flanges. It is said to be competent to support a maximum load of 3800ton per bearing (suitable for about 150m high-class building). These bearings do not buckle under a substantial building overload because of the number of steel plates included in the engineered composite device.

Currently, priorities are given mainly to important establishments in Japan, such as hospitals, art museums, embassies, data-centers, high-rise housing, etc., for the application of the base isolation system. Considering the importance of sustaining corporate activities for current business environments, and for mitigating the risk management issues, a significant number of companies in Japan have also



Fig.4 The building used seismic base-isolation system.

started to introduce the base-isolation system for their office buildings and production plants. As an example, Fig.4 shows the R&D center building of a corporate company situated in the western outskirts of Tokyo constructed with the base-isolation system. Fig. 5 shows the rubber bearing used at the basement of this building.



Fig.5 Rubber bearing used for seismic base isolation system.

As evident now, there is well-established technology in which focus has been paid to apply the quake-resistant base isolation technology to existing buildings, old heritage structures, etc. Apart from the technologies those employed in the green-field constructions, base isolation retrofitting technologies for the existing buildings demand a very high



Fig.6 Retrofitted Japan Railway Tokyo station Marunouchi building.

degree of skills. As an example, the retrofit project of Tokyo Station Marunouchi building (Fig.6) completed by installing around 350 base isolating bearings at its base. Now, there is a more favorable scenario that depicts Japan is moving forward to cope with the possible massive earthquakes in the future with the base isolation system. Thanks to the Great Hanshin earthquake.

Some of the damaged/collapsed buildings in the Great Hanshin earthquake essentially engineered to fulfill enhanced earthquake-resistant performances and thoughtfully designed to be safe in case of a major quake. However, the surprising failures of such buildings expose an issue to the policymakers in Japan; calculations alone are insufficient to predict the very complex movement that could bring down buildings in case of a major earthquake. So to complement, Japan's National Institute for Earth Science and Disaster Prevention (NIED) has established an earthquake simulator named 'E-Defense' shaking table. The simulator, located in the outskirts of Kobe city, is a platform fitted with numerous pneumatic pistons attached at the bottom and controlled by large hydraulic systems. The shaking table (platform) measuring 20m by 15m is the world's largest simulator, which is capable of testing wooden and/or

concrete structures with a payload of up to 1200 tons. It could test structures with quake magnitudes as high as level 7.0 in Japanese earthquake scale.

As in earthquake, the platform receives thrust because the waves generated in the simulator move outward from the quake's epicenter. The seismographs record ground motion along the 3-axes as displacement occurs in all three directions, and considerations of 3D forces make structural behavior more realistic to predict. The ability to replay and/or reproduce of any recorded earthquake in its vectors is a unique feature of this 'E-Defense' simulator. Multiple cameras also record shakings both inside and outside of the structure during testing, thus projects the structure's ability to absorb quake shocks and identify weak points that can lead to the structure's failure. Experimenting with two structures placed side-by-side on the same platform could also be performed to evaluate the efficacy of earthquake measuring systems versus structure without any such measurements. This simulator is also used to test old houses/homes constructed in Japan's post-war boom for studying technologies required for retrofitting those structures against earthquake damages.

As expected, the implementation of this base-isolated earthquake-resistant system that rolled-out in the Heisei-era will vastly be proliferated in this Reiwa-regime. It is because the natural issues and geographical position of Japan place more demands on the high-rise multistory structures, and that is where the competent earthquake-resistant technology essentially called on to play the part. However, high-rise structures are not the only area that brings benefits from the advancements in earthquake mitigation technologies. There is also a much-focused research area for earthquake countermeasures in the mobility and transportation area. As an example, technical innovation progressed enormously in the

Heisei-era for ensuring earthquake-readiness of the Super-Fast Express trains (Shinkansen, the high-speed rails linking cities throughout Japan).

Along with the improvements of strengthening structures such as stations, bridges, etc., the efforts of preventing derailment also by installing various measures continued after the Great Hanshin earthquake. The East Japan Railway Company (JR East) introduced the 'Earthquake Early Warning System' for the Super-Fast Express trains. The system detects preliminary tremors from the seismographs located at various points in their network and then brings the train to stop by interrupting the electricity supply, if needed. Emergency stops in case of a crisis, thus prevent massive accidents during a major earthquake. Many media lauded the fact that all trains operating then throughout the Tohoku Super-Fast Express train tracks brought to a stop position safely, during the Great East Japan earthquake that struck the Tohoku region in 2011. There are reports now that other Japan Railways companies have their plan to introduce such early earthquake warning systems in turn.

It is important to note that Japan's geographic position means that it will continue to face earthquakes regardless of the magnitude. Under such circumstances, structures could only be designed to mitigate damages rather than avoiding total losses from an earthquake on whatever scale that the forces of nature determine. In that sense, 'E-Defense' facility may be the most sophisticated and world's largest earthquake simulator. However, it is still meant to help minimizing structural damages, and not to perform the impossible of eliminating total economic and human loss. Similarly, in the mobility and transportation area as described before, safety measures never end, and improving safety further will also be the ongoing concern in the Reiwa-regime. ■

(The above content is based on information gathered from various booklets, brochures, reports, literature, etc., available in the public domains.

A few to mention are:

Bridgestone Corporation Seismic Isolation and Vibration Control Products Business Department, 'Seismic Isolation Bearing brochures;

[https://resources.realestate.co.jp/buy/earthquake-building-codes-and-technology-in-japan/;](https://resources.realestate.co.jp/buy/earthquake-building-codes-and-technology-in-japan/)

<https://www.japantimes.co.jp/news/2009/07/08/national/japan-leads-the-way-with-quake-resistant-technology/#.XU4ACej7Suk;>

[https://resources.realestate.co.jp/living/are-you-prepared-for-the-next-big-earthquake-in-japan/;](https://resources.realestate.co.jp/living/are-you-prepared-for-the-next-big-earthquake-in-japan/)

[https://www.japan.go.jp/regions/resilientjapan/;](https://www.japan.go.jp/regions/resilientjapan/)

[https://www.telegraph.co.uk/news/worldnews/asia/japan/8375591/Japan-earthquake-country-better-prepared-than-anyone-for-quakes-and-tsunamis.html;](https://www.telegraph.co.uk/news/worldnews/asia/japan/8375591/Japan-earthquake-country-better-prepared-than-anyone-for-quakes-and-tsunamis.html)

[https://www.japan.go.jp/regions/resilientjapan/earthquake.html;](https://www.japan.go.jp/regions/resilientjapan/earthquake.html)

[https://resources.realestate.co.jp/news/the-worlds-largest-earthquake-simulator-japans-e-defense/.](https://resources.realestate.co.jp/news/the-worlds-largest-earthquake-simulator-japans-e-defense/)

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