

TODAY

Tomorrow & Beyond

LEVERAGING LEADERSHIP, DIVERSITY AND INNOVATION





Tracie Griffitt
Jacobs

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Next generation
capital operating system





Filipe Barbosa
Sr. Partner,
McKinsey & Company

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Agenda – Next generation capital operating system

Welcome and introductions

5 mins

Next generation capital operating system:
increasing productivity and profitability

10 mins

Facilitated panel discussion

35 mins

Audience Q&A

10 mins

Our moderators and panelists



Filipe Barbosa
Sr. Partner,
McKinsey &
Company



Manuel Junco
Senior Vice
President,
Jacobs



Matt Parsons
Partner,
McKinsey &
Company



Judd Kuehn
Project
Manager (Ret.),
Chevron



Mike Tecza
Vice President,
McKinsey &
Company CP&I

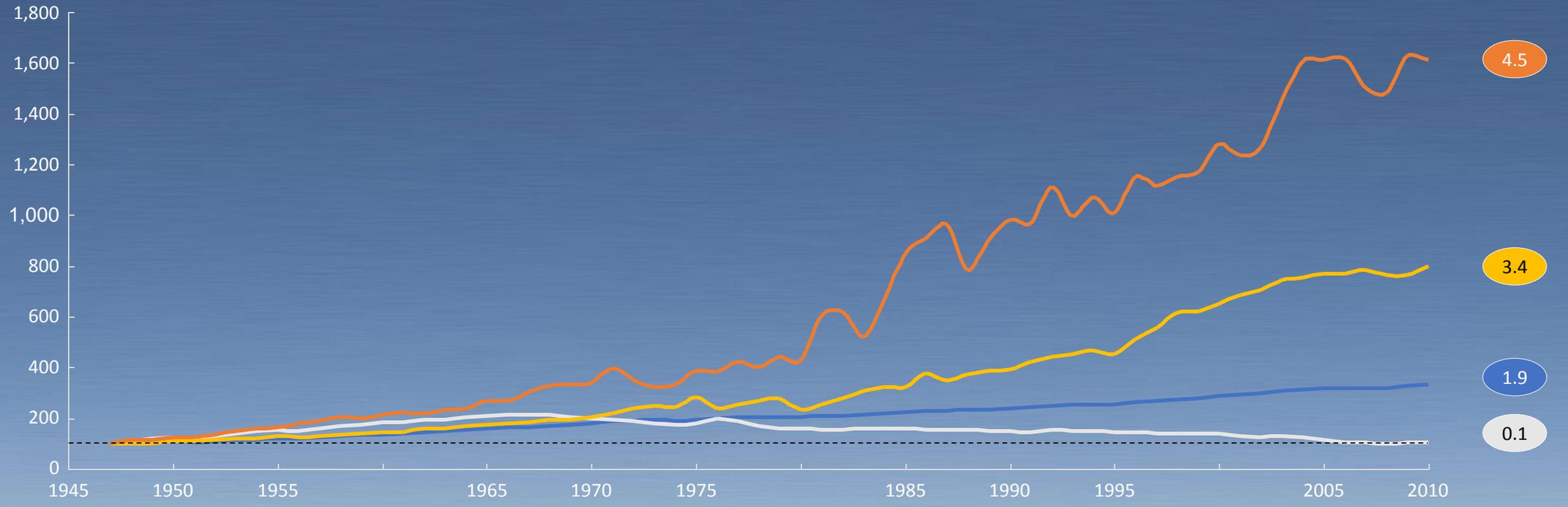
What happened in 1968? US construction productivity has been declining for 5 decades

- Overall economy
- Construction
- Wholesale & retail
- Agriculture

CAGR
%, 1947-2010

US Sector Productivity since 1947

Gross value added per hour worked, constant prices
Index 1947 = 100

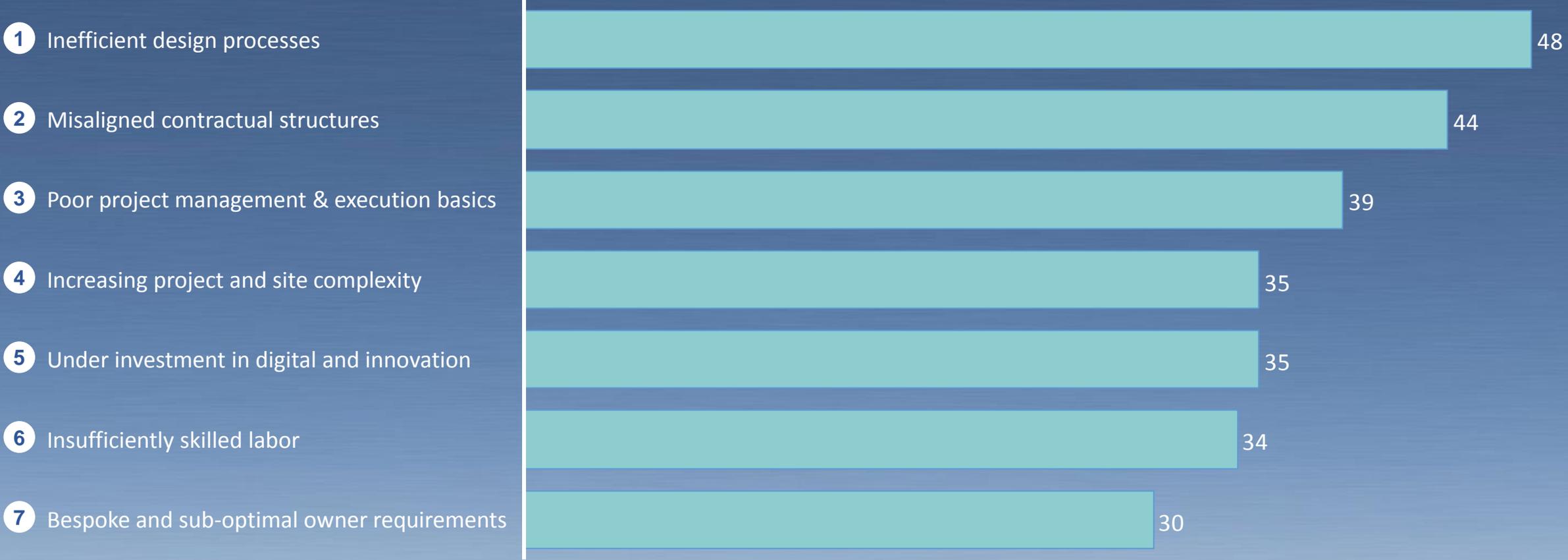


SOURCE: US Bureau of Labor Statistics; World KLEMS

Initial results from our survey surface 7 primary root-causes of low construction productivity

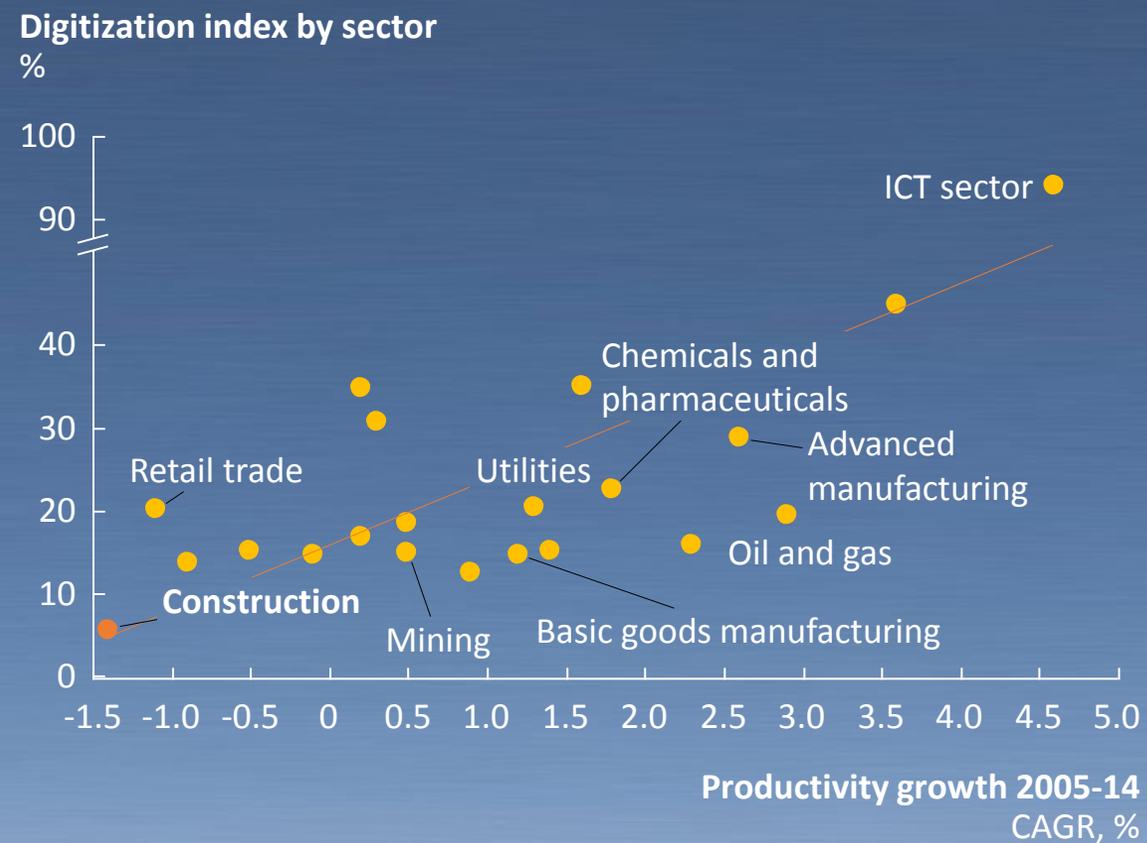
Relative importance of root causes of low productivity for the industrial and civil asset classes (n=193)

% of responses with root cause ranked as "high importance"

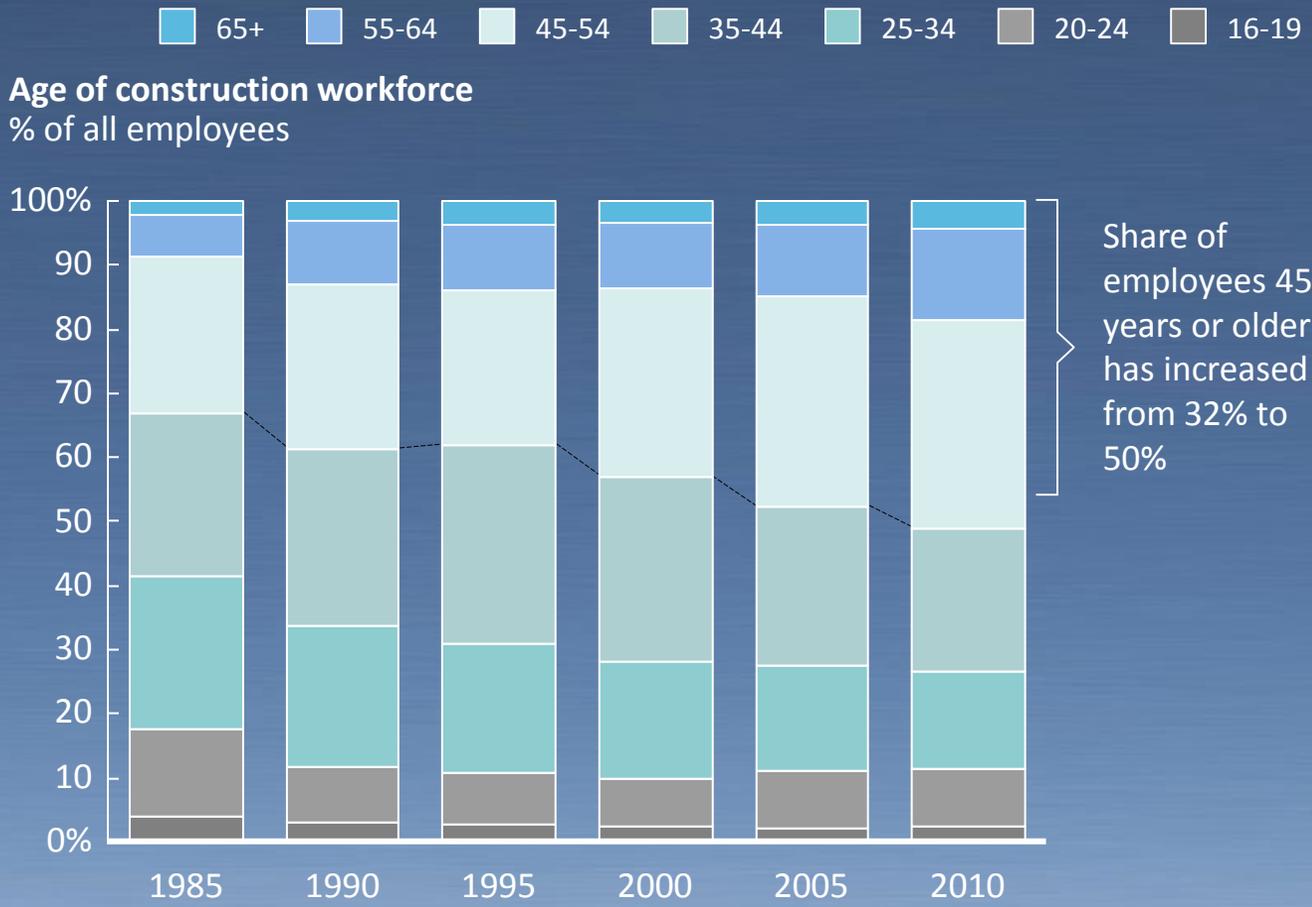


SOURCE: McKinsey Global Institute Construction Survey

The construction value chain has not sufficiently invested in technology or people to crack this performance challenge



Clear relationship between degree of digitization & productivity



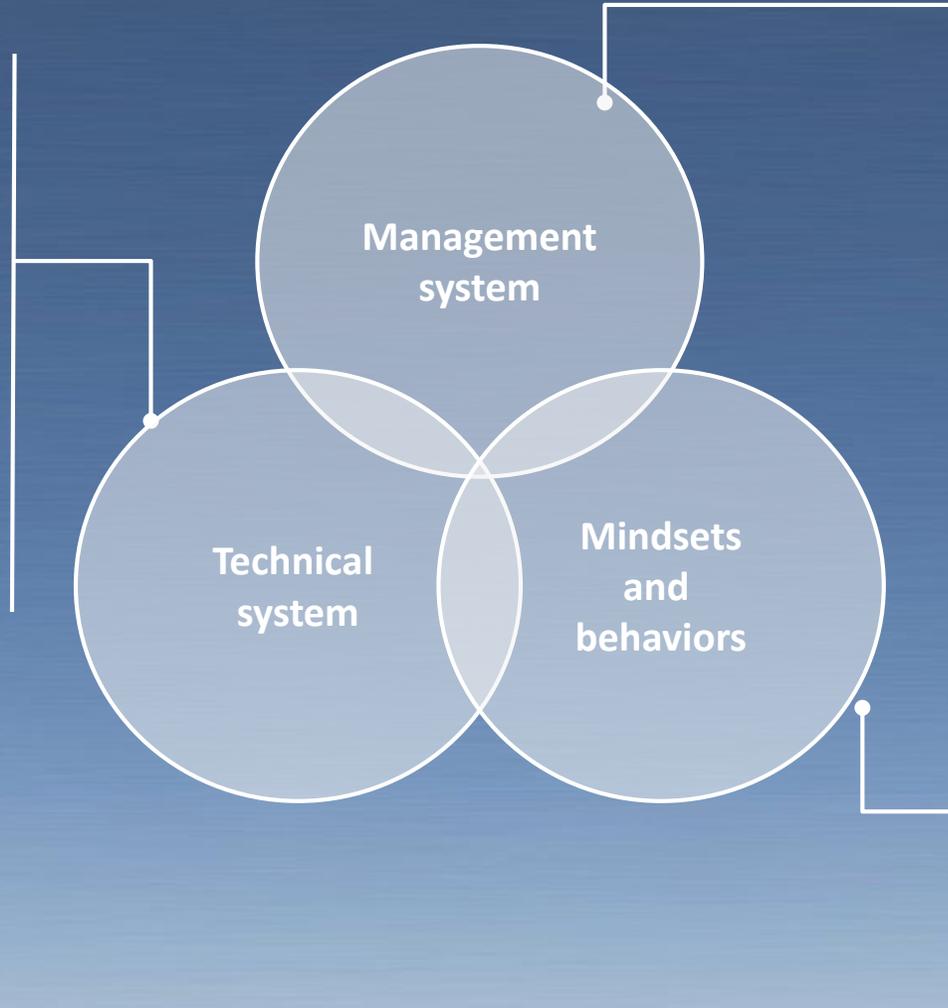
The construction workforce is aging and on aggregate lower skilled than other sectors

SOURCE: BEA; BLS; US Census; IDC; Gartner; McKinsey social technology survey; McKinsey Payments Map; LiveChat customer satisfaction report; Appbrain; US contact center decision-makers guide; eMarketer; Bluewolf; Computer Economics; industry expert interviews; McKinsey Global Institute analysis; The U.S. Construction Chart Book (5th Edition, April 2013) by CPWR

Effective “operating systems” holistically address 3 critical areas

The way tools, physical assets, and resources are configured and optimized to create value and minimize losses

- Technical tools
- Operational excellence
- Asset configuration



The structures, processes, and systems through which the project is managed to deliver business objectives

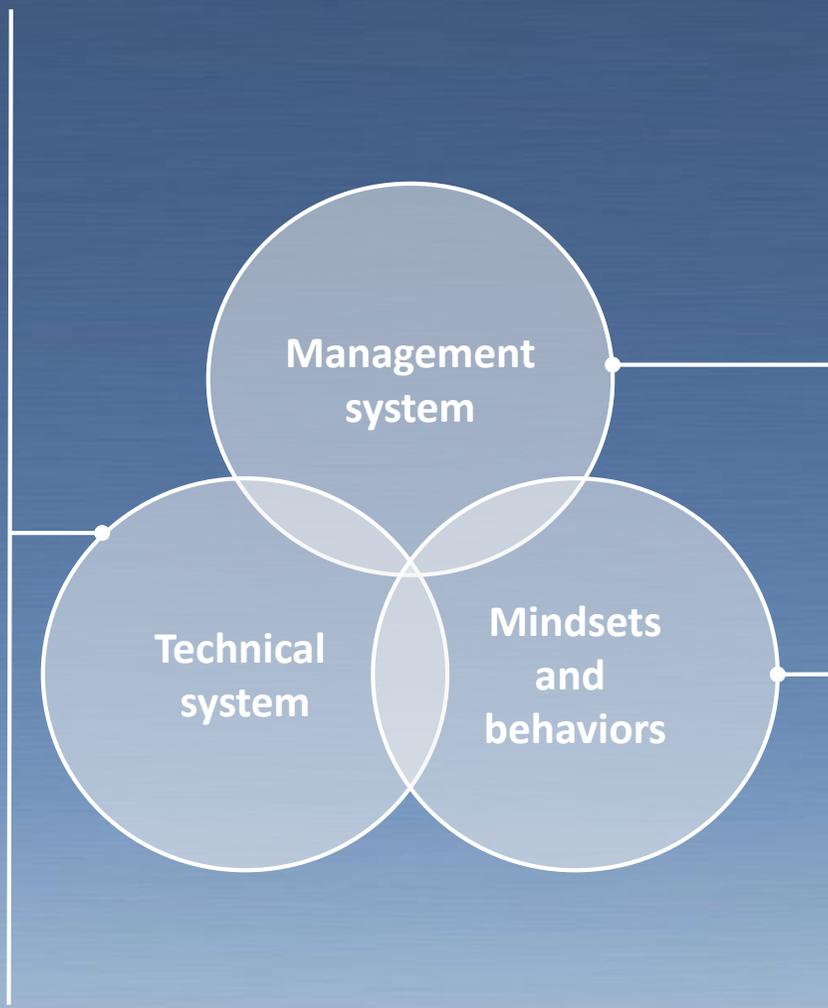
- Organizational structure
- Processes and procedures (including performance management/KPIs)
- Staffing levels & talent
- Roles & responsibilities
- Incentives

The way people think, feel, and conduct themselves on the project

- Shared values
- Alignment to overall direction and values
- Openness and candor
- Personal motivations
- Management behaviors

A new project “operating system” is needed to achieve a step change in predictability, productivity and performance

- **Treat performance like you treat safety:** Everyone should understand the project operating system
- **Cross-contractor Control Tower ‘war-rooms’** used to ensure rigorous problem solving, visual management & performance dialogues
- **Project production system in place with “gold standard” project controls** and a project production management system (e.g., Last Planner[®])
- **Employ technological innovation as practicable, but not as a panacea** (e.g., automated work packaging, big data analysis to predict productivity, cost & schedule)



- **Comprehensive KPIs in place to track both project outcomes and planning efficacy** (e.g., PPC)
- **Contracting strategy aligning commercial interests of all stakeholders to overall project success** (relational vs. transactional, Integrated Project Delivery)
- **Cloud-based data hub** (Control Tower) to manage performance
- **Stakeholders embrace roles as part of an integrated project team**
- **Capability building programs for the next generation of project managers foremen and craft** (use train-the-trainer on site)
- **Root cause analysis in place that focuses on improving, not on pointing the blame arrow**

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Session participant bios

Filipe Barbosa

Senior Partner, Houston, North America



Core sectors

- Mining
- Steel
- Oil & Gas
- Aluminum
- FMCG

Core topics

- Project execution & construction
- Value Optimization
- Capital organization design
- Capital strategy
- Small Capex/Portfolio optimization

Pre McKinsey Experience

- Filipe was a lecturer in the School of Mechanical Engineering, University of the Witwatersrand, South Africa

Education

- PhD in Aeronautical Engineering from the University of the Witwatersrand, South Africa

Filipe Barbosa is a Director (Senior Partner) in the Houston office of McKinsey & Co, with 17 years of experience in the Firm. Filipe's work is focused on Energy, Oil & Gas, Petrochemicals, Mining and Metals sectors - where he serves several of the world's preeminent institutions. His expertise is in the areas of capital projects/capital productivity, performance transformation and growth strategy. Filipe leads McKinsey's Capital Projects and Infrastructure practice and has served clients on mega-projects extensively across industries (e.g., Utilities, Oil & Gas, E&C, Petrochemicals, Agriculture, FMCG, Metals & Mining)

Filipe is a founding member of McKinsey's Capital Projects & Infrastructure Practice and leads it globally. He is also a part of McKinsey's Global Energy & Materials leadership, McKinsey's Strategy practice and has co-authored articles and research on global shaping forces and strategy formulation. Before moving to Houston in 2012, Filipe was part of McKinsey & Co's Johannesburg practice where he led the Global Energy & Materials practice in Africa as well as the Capital Productivity practice in Europe, Middle East & Africa. Additionally he is part of McKinsey's PRC committee, where he helps to evaluate and develop partners.

Prior to joining McKinsey & Co, Filipe was a tenured lecturer in the School of Mechanical Engineering, University of the Witwatersrand, South Africa. He taught courses in gas dynamics, control theory and flight dynamics. He conducted research and consulting activities in the fields of shockwave physics, shockwave-vortex interactions and high speed flow visualization techniques (e.g., high speed holographic interferometry and computational data visualization). He holds a PhD in Aeronautical Engineering and has published widely.

Filipe lives in Houston and is married with 3 children. He is passionate about his family, current affairs, history, science & technology, camping & outdoors and sport (rugby, fly fishing, tennis, skiing & cricket). His current projects include learning how to grow a good lawn in Houston, understanding the finer points of American Football and the nuances of American culture. As part of his service to the Houston community, Filipe is on the Board of the Houston Technology Center – named by Forbes' as one of "Ten Technology Incubators Changing the World"

Manuel Junco

Senior Vice President, Jacobs



Manuel Junco serves as Senior Vice President and General Manager for Refining and Americas of Jacobs Engineering Group Inc. (NYSE: JEC), a technical, professional construction services company. The firm was founded in 1947.

Mr. Junco has 40 years of experience in the oil, gas and chemical industries. He started his career in maintenance and operations at Monsanto Chemicals before joining the EPC industry as a process engineer, progressively moving to field engineer, engineering manager, project director and global operations. He joined Jacobs in 2012 as Vice President – Houston Operations.

As Senior Vice President, Mr. Junco has overall business responsibility for our EPC delivery offices located in the U.S., Canada, and Latin America. These offices service the hydrocarbon business sector.

He holds a degree in Mechanical Engineering from the Georgia Institute of Technology.

Judd Kuehn

Project Manager (Ret.), Chevron



Judd Kuehn retired after 37 years with the Chevron. At the time of his retirement, Judd was the Project Manager for the Loran-Manatee Field which sits on the border between Trinidad & Tobago and Venezuela.

During his tenure at Chevron, he worked on projects throughout the world including Australia, Canada, China, Indonesia, Kazakhstan, Papua New Guinea, Spain, Venezuela, and throughout the United States.

Judd was also one of the primary architects of the Chevron Project Management System. He spent over 15 years helping develop and deploy CPDEP and the other key elements of Chevron's Project Management System across Chevron's projects.

He is now working as a Project Management Consultant helping other companies improve and effectively deploy their own Project Management Systems.

He holds a degree in Electrical Engineering from the University of Colorado.

Matt Parsons

Partner



- MBA, University of Pennsylvania's Wharton School, Palmer Scholar
- Control Systems Engineer from United States Naval Academy
- Matt is a Partner in McKinsey's Philadelphia Office who leads the Americas Capital Productivity and Infrastructure Practices
- Matt has extensive experience in the Global Energy and Materials Sector, including Electric Power and Natural Gas, Oil and Gas, Chemicals, and Basic Materials

Broader Practice Leadership

- Leader and convener of the Americas Capital Projects and Infrastructure Practices
- Formerly led and convened McKinsey's Nuclear Power Service Line

Capital Productivity experience

- Has support project recoveries with multiple owners, operators, and EPC firms on distressed large projects ranging in investment level from \$300M to \$20B
- Led a comprehensive capital projects and engineering transformation for a leading global chemicals manufacturer, who spends \$2B a year in capital across a range of projects and business units
- Supporting the development and implementation of a corrective action plan related to the major cost and schedule overrun of a reactor plant new build – the TVA WBN2 project
- Developed a contracting strategy for a European JV seeking to develop a technologically-complex, major offshore natural gas deposit
- Supported the precommissioning, commissioning and ramp-up planning for a \$10B iron ore mine in South America
- Coordinated the systematic de-risking of two multi-billion dollar materials mines in remote geographies confronted with substantial cost and schedule overruns or development challenges
- Conducted due diligence on several EPC firms and guiding the award process and follow-on terms and conditions negotiation for the EPC contract for a \$6B project
- Led confirmatory due diligence for a major Energy and Oil & Gas acquisition in the EPC space
- Helped devise a go to market, development, and execution strategy for an engineering services firm in the nuclear power space
- Led a regulatory risk improvement effort related to utility sector investment in carbon capture and sequestration technologies for fossil generation plants, including technological, commodity, and infrastructure risk assessment

Prior Experience

- Spent ten years in the Nuclear Navy, where he held various responsibilities related to the construction, operations, and maintenance of nuclear powered submarines, including three years forward deployed in Guam as the plant manager of a 165MW reactor plant on USS San Francisco
- Spent two years in the Pentagon on the Chief of Naval Operations Staff in the Planning, Programming, and Budgeting office where he coordinated \$13B of annual capital investment in naval shipbuilding

Jose Luis Blanco

Associate Partner



- **MBA, Stanford** Graduate School of Business
- **MSc / BSc** in Civil Engineering in **Civil Engineering** from Barcelona Tech (UPC)
- Jose is an **Associate Partner in the Philadelphia Office** and helps lead the Engineering & Construction service line in the Infrastructure Practice. He is also an active member of the Electric Power and Natural Gas Practice / Capital Productivity service line
- Jose has **extensive experience in the Engineering & Construction** sector, where he worked for almost 10 years

Broader Practice Leadership

- Leadership of the Engineering & Construction service line for the Infrastructure Practice

Projects Experience

- Supported one of the largest E&C firms in Latam improve their Project Delivery, with specific focus on lean construction and Design to Value in their Engineering function
- Led a **benchmarking effort for ~40 leading E&C firms worldwide**, analyzing their financial and operating metrics (including procurement), as well as their strategic positioning
- Conducted an **infrastructure project operational assessment** for a \$20Bn Conglomerate. Defined impact areas and applied different levers to improve operational efficiency leading to 5% direct and 7% potential savings, mostly from procurement levers
- Supported one of the **largest federal agencies** on a **complete assessment** of their **Capital Program** (Capital allocation, design & construction, leasing & maintenance processes)
- Developed a **capex investment prioritization procedure** for a **leading European utility** leading to a €1Bn cash cost optimization. Conducted large scale project scrubbing sessions that led to improved IRRs and reduced CapEx.
- Led a **confirmatory Due Diligence** for two of the leading E&C firms worldwide with strong footprint in Power and Oil & Gas, studying in detail their global portfolio, risks, footprint and the potential opportunities for them going forward, which included a complete assessment of their procurement function.
- Supported a 2Bn **Merger Integration in the E&C space**, with strong focus on devising and implementing procurement levers for a complement transformation of the procurement function (~50% of overall synergies)
- Supported **diverse PE firms in multiple DDs** in the E&C space over the last two years, including detailed diagnostic of their procurement functions.

Prior Experience

- Prior to McKinsey, Jose Luis worked with Grupo ACS as a **Senior Project Manager** in the **E&C Division** (Dragados)
- As a Senior PM, planned, budgeted and led the execution of multi-million dollar singular projects with full P&L responsibility, including designing, modeling and executing a turnaround in a \$150m project resulting in \$18m EBIT improvement. Responsible for Direct procurement of over ~\$80M, directly negotiating and closing key contracts, leveraging DtV, minimal technical solutions and commercial levers

Mike Tecza

Vice President, Atlanta, North America



Core sectors

- Oil & Gas
- Power
- Rail
- Highway
- Mining
- Government

Core topics

- Project Controls / Data Integration

Pre McKinsey Experience

- **Shaw Group** – Director of Program & Construction Management
- **Bechtel** – Manager of Project Controls

Education

- Mechanical Engineering degree from Triangle Institute of Technology in Pennsylvania

Michael is a Vice President in McKinsey & Company's Capital Projects and Infrastructure Practice. Bringing more than three decades of Program and Construction Management experience on foreign and domestic mega projects, he advises clients across the globe in the oil and gas, chemical, mining and power industries. He has supported a variety of projects, including a \$15B bitumen mine and processing plant, \$3.4B copper mine and concentrate facility, and a \$14B, six-800-megawatt super critical coal-fired generating units.

Along with his extensive experience in program and construction management and his institutional knowledge in project controls, he is able to assist clients worldwide in solving some of their most challenging issues they face in completing their projects on time.

Prior to joining McKinsey, he was with The Shaw Group, as Director of Program & Construction Management. He led a diversified portfolio of signature projects including: \$1.3B Inner Harbor Navigation Canal, the largest design build contract ever awarded by the USACE; The Deep Water Horizon Oil Spill, construction of oil containment berms in order to protect Louisiana estuaries and New York City's Sandy Storm Recovery Projects, across its five boroughs and New Jersey.

Before joining The Shaw Group, Michael was with Bechtel Corporation on a variety of high profile projects and leadership roles including: Manager of Program Scheduling for the \$12.3B Hanford Nuclear Waste Treatment Plant; Ground Based Missile Defense Cost / Schedule Integration Manager, advised the integration of the U.S. Ground Based Mid-Course Defense sites and assets. During Michael's tenure with Bechtel Corporation, he also held various leadership positions on foreign assignments in Power, Rail, Highway Infrastructure and Oil and Gas projects.

John Levene, P.E.

Engagement Manager



- John Levene is an Engagement Manager in the Philadelphia Office of McKinsey and Company where he is a member of the Capital Productivity Practice
- Mr. Levene has experience working on large capital programs and engineering & construction corporate strategy in oil & gas, chemicals, utilities and infrastructure with both public and private entities
- He has functional expertise in contracting strategy, portfolio management / optimization, risk mitigation and pricing, fabrication and modularization, constrained labor market management, capital program acceleration

Projects Experience

- Developed contractual risk assessment, pricing, and mitigation plans for a \$60B nuclear power facility refurbishment and PPA
- Helped a major utility develop an efficient capital project portfolio execution and contracting strategy in a constrained, unionized labor market across \$1B+ of annual spend
- Led a collaborative effort to revamp a major utility's capital project execution infrastructure drastically reducing change order volumes and contract leakage while optimizing project overheads
- Assisted regulated utility with development of multi-tiered energy efficiency credit program, implementation plan and contracting strategy
- optimized drill rig manufacturing, staffing and placement for a major oil field driller during both market upturn and recent downturn (accelerated and pared back program)
- Helped streamline delivery of \$3.5B in government aid to natural disaster victims
- Led the development of a five year growth strategy for a major US E&C firm
- Developed 5 year growth strategy for a \$1B+/year scaffold, insulation and paint company across both commercial and industrial US segments

Prior Experience

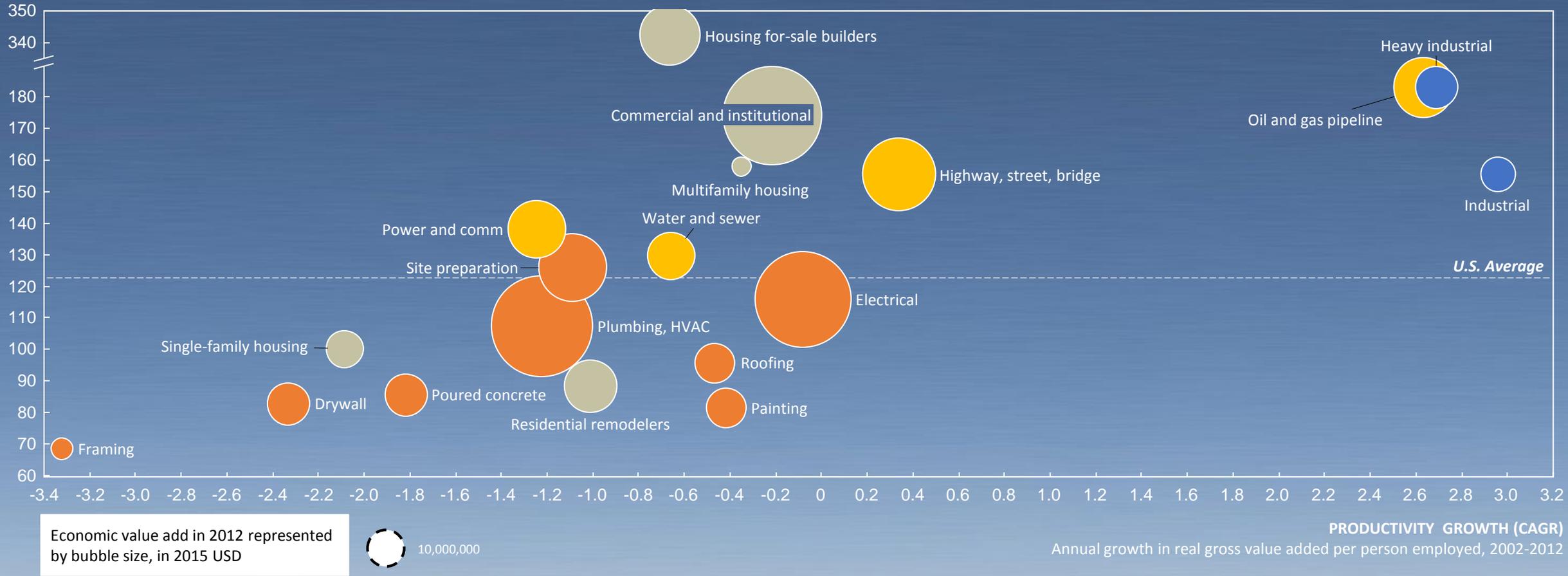
- Prior to joining McKinsey, Mr. Levene acted as Interim Program Director for a \$750 million LEAN scaffolding program along the U.S. Gulf Coast and as the Global Lead for Construction Commercial and Market Strategy at Fluor (FLR).
- While at Fluor, Mr. Levene focused on optimizing execution and commercial success of Fluor's U.S. Gulf Coast construction portfolio. Additionally, he developed and launched multiple standalone construction business entities; scaffolding, commissioning & turnover, orbital welding, and onsite concrete production. He also worked extensively to reduce Fluor's global labor market risk via global fabrication and modularization strategy development, driving innovation in procurement and execution.
- Prior to these roles, Mr. Levene was in the Global Estimating and Controls Group of Fluor's Energy and Chemicals business unit. Prior to Fluor, Mr. Levene worked at Moretrench American Corporation leading industrial and high-end geotechnical projects in roles ranging from foreman / superintendent to project engineering and manager.

Within asset classes productivity trends can be vastly different, depending on the type of construction

Productivity and growth by type of construction (2002-2012)

Real Estate Civil Specialty Industrial

PRODUCTIVITY LEVEL (2012)
(\$000s) per person employed, 2015 USD



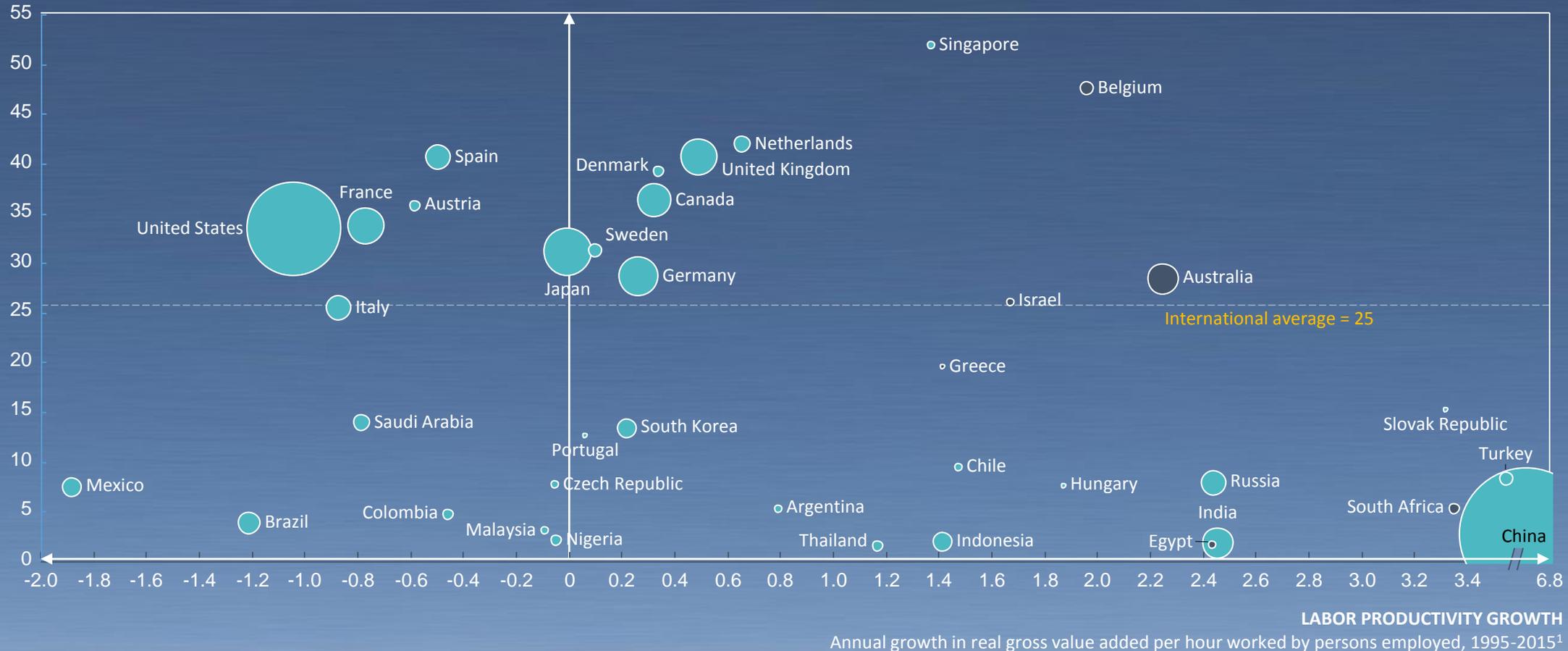
SOURCE: United States Economic Census

The US started from a position of leadership – this advantage is eroding



PRODUCTIVITY (2015)
2005 USD per hour worked by persons employed, not PPP adjusted³

Sized to total country construction investment in 2015 USD M



1 Countries with a shorter times series due to data availability: France, Israel, Czech Republic, Malaysia, Russia (1995-2014), Australia, Japan, Argentina, Brazil, Chile, Mexico, South Africa, Nigeria, Ethiopia (1995-2011), Belgium (1995-2014), Turkey (2005-2015), Colombia (1995-2010), Egypt (1995-2012), China (1999-2014), Thailand (2001-2015), Singapore (2001-2014), Saudi Arabia (1999-2015), Indonesia (2000-2014)

2 Only "persons employed" data available – assumed each person worked 35 hours per week, 48 weeks per year

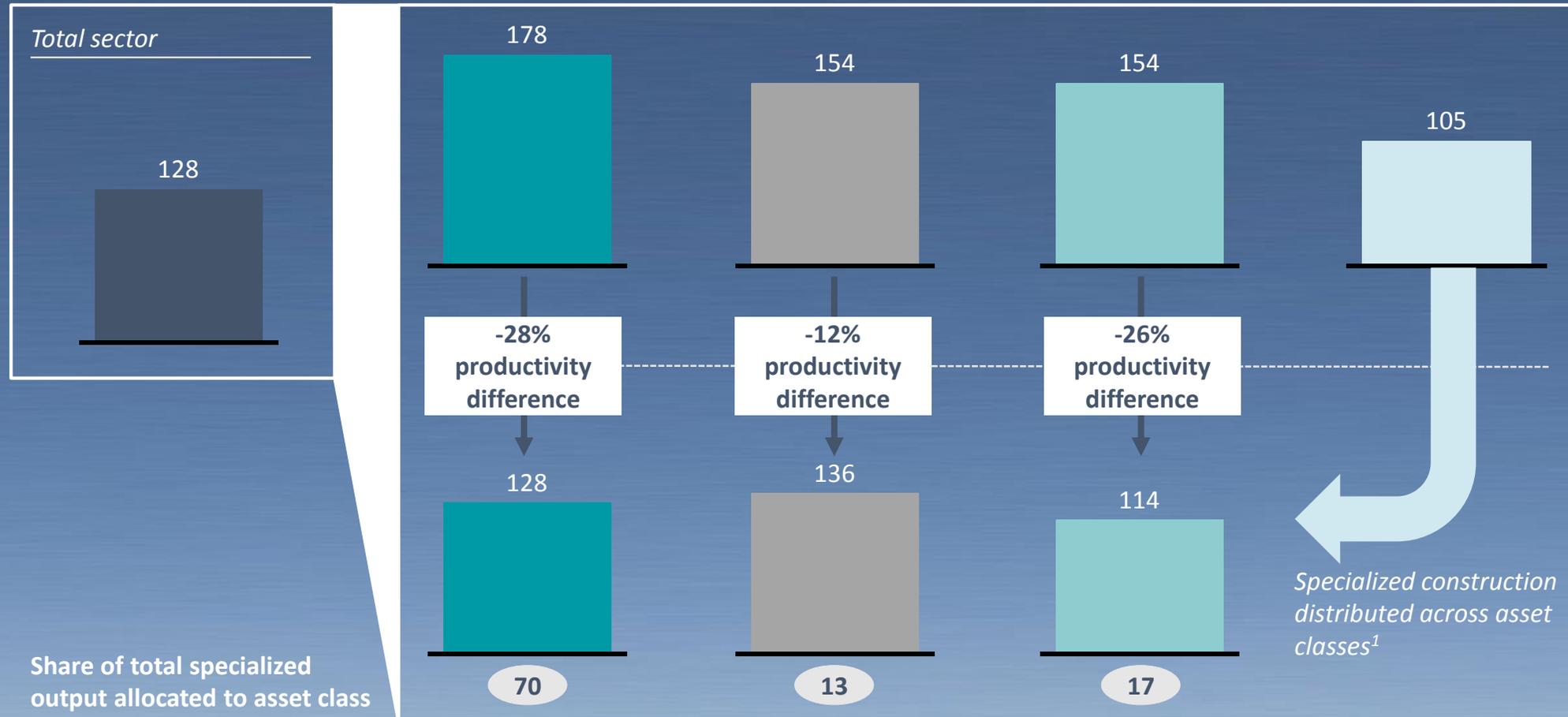
3 3 Published PPPs are either not applicable (i.e., are not for the construction sector specifically or not for a value-added metric) or vary too widely in their conclusions to lend any additional confidence to the analysis

SOURCE: OECD Stat; EU KLEMS; Asia KLEMS; World KLEMS; KSA CDSI; KSA MoL, Absolute productivity: WIOD Socioeconomic accounts, GGDC-10, Oanda, IHS GlobalInsight, ITF, GWI, McKinsey Global Institute Analysis

Low productivity specialized contracting most significantly impacts the building and industrial asset classes

- Building
- Civil
- Industrial
- Specialized

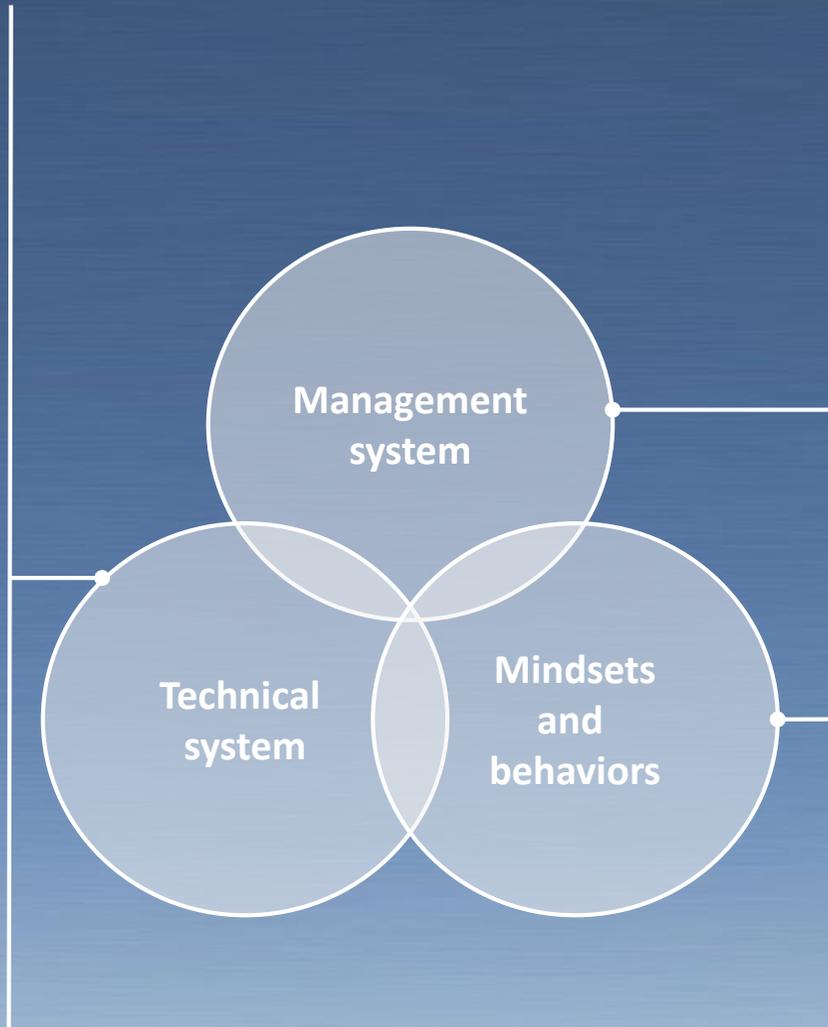
Construction labor productivity by asset class in the United States, Annual real value added, (000s) per employee, 2015 USD



1 Specialty contracting activity apportioned to each sub-sector on the basis of 2012 share of type of construction

A new project “operating system” is needed to achieve a step change in predictability, productivity and performance

- **Treat performance like you treat safety:** Every person should understand the project operating system and **cross-contractor Control Tower ‘war-rooms’ used to ensure rigorous problem solving, visual management & transparent performance dialogues** (requires specific resourcing)
- **Project production system in place with “gold standard” project controls AND a project production management system to enable continuous improvement at the workplace** (e.g., Last Planner[®] System of Production Control)
- **Lean management methods driven throughout the supply chain and across the front-line** (use SWAT teams)
- **Employ technological innovation as practicable, but not as a panacea** (e.g., automated work packaging, 5D BIM, SCRUM methodology, big data analysis in FEL to predict productivity, cost & schedule accurately)



- **Comprehensive KPIs in place to track both project outcomes and planning efficacy (PPC, TMR, TA and Pareto of Breakdowns)¹**; combined with rigorous root cause problem solving (Lean Six Sigma)
- **Cloud-based data hub (Control Tower)** to provide one source of the truth for critical KPIs – especially leading indicators for performance & predictability
- **Incentive systems to promote the right behaviors and tie all involved to overall project outcome. Contracting strategy aligns commercial interests of all stakeholders tied to overall project success** (relational v. transactional contracting: gain-share, strategic partnering, Integrated Project Delivery)
- **All stakeholders embrace roles as members of an integrated project team**, rather than fragmented organizations
- **Deliberate capability planning programs to train and develop the next generation of project professionals, foremen and craft labor** (use train-the-trainer on site)
- **Root cause analysis in place that focuses on improving, not on pointing the blame arrow, imposing punishment**