

Emerging Construction Technologies

Understanding state-of-the-art through patent analytics

Urban Sustainability R&D e-Symposia 2021

IPOS and IPOS International



- Government agency under Ministry of Law
- Statutory board for IP laws and infrastructure
- Registry for trade marks, patents and designs



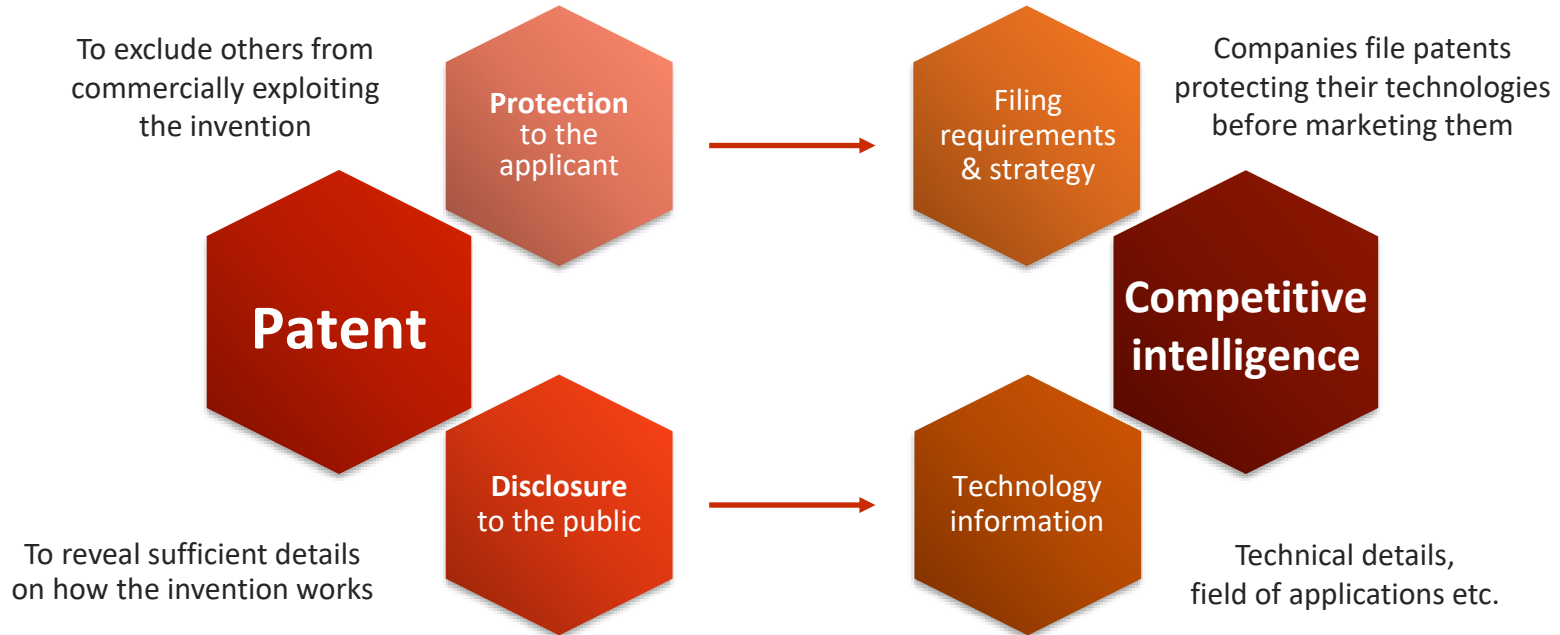
A Joint Vision

A Singapore where innovative enterprises use intellectual property (IP) and intangible assets (IA) to grow.



- Wholly owned subsidiary of IPOS
- Expertise and enterprise engagement arm of IPOS
- Over 100 IP & technology experts under one roof

Patent: Competitive Intelligence Hidden In Plain Sight



*88% of U.S., European, and Japanese businesses **rely upon patent information** to keep up with technology advances and direct their R&D efforts.*

- François Lévêque and Yann Ménière, *“Patents and Innovation: Friends or Foes?”*, 2006

Digital Transformation of Construction Industry

Publication trend of digitalisation innovations of different construction technologies

Number in the table denotes the no. of inventions published worldwide in 2008-2017

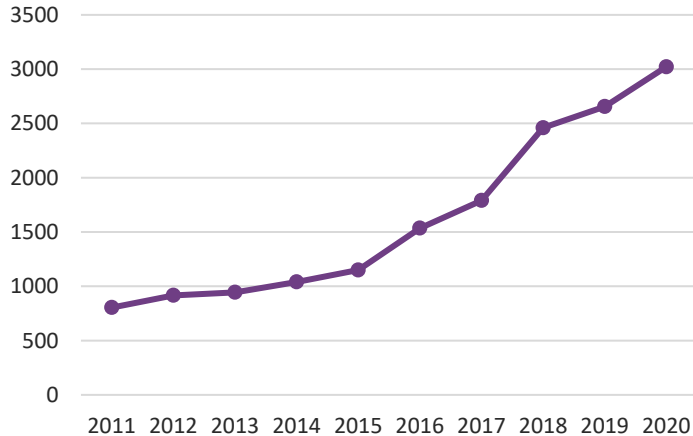
		Earliest publication year										Total
		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	
Digitalisation	Crane	42	54	65	55	77	97	111	170	176	166	1273
	Finishing	11	6	3	5	6	10	20	45	39	90	270
	Inspection	11	8	7	6	21	18	16	24	25	41	228
Smartness	Crane	5	9	9	8	24	25	30	55	65	53	300
	Finishing	1	1	1	1	1	4	13	19	14	36	94
	Inspection	0	1	1	1	5	5	3	5	3	11	39

Source: internal study on Robotics & Automation for Building Construction

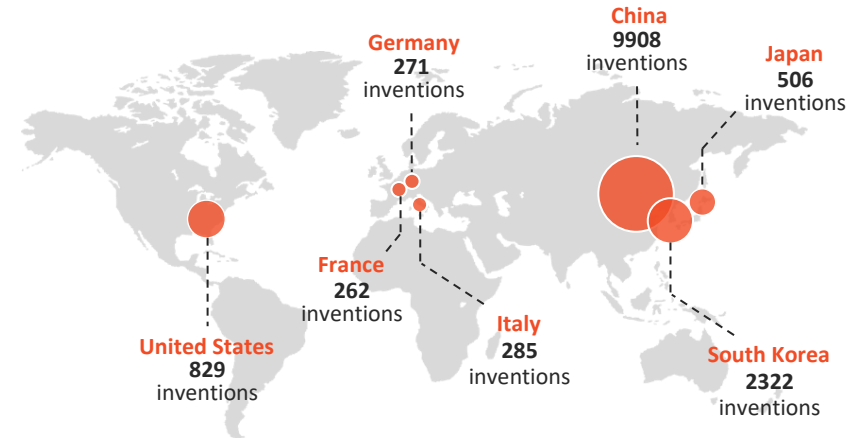
- *Digitalisation as a key enabler of robotics & automation*
- *Data increasingly used to enable system smartness, i.e., from automation to autonomous*

Modular Construction Gaining Strong Traction

Global publication trend of modular construction innovations
No. of inventions based on unique patent families published worldwide

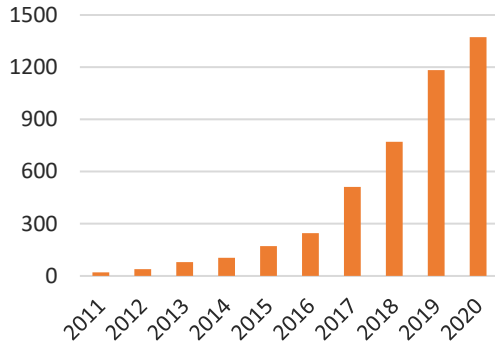


Global leaders in modular construction innovations
Invention origins approximated by the earliest priority country of patent filing



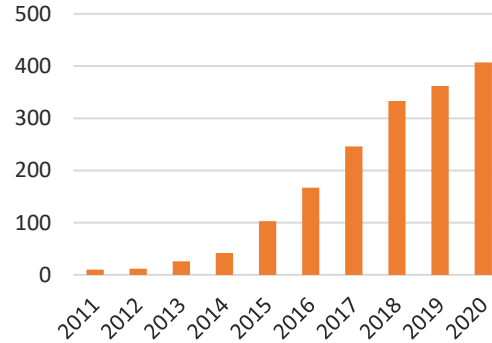
BIM, 3D Printing, and Drones Fast Emerging

Building information modelling



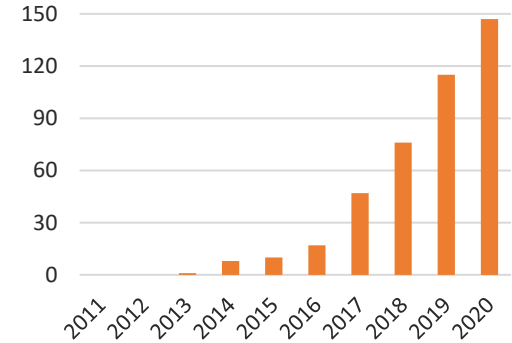
- *BIM increasingly applied across all three stages*
 - Pre-construction
 - During construction
 - Post-construction

3D Printing



- *Research focus*
 - Printer instrumentation
 - New materials

Drones

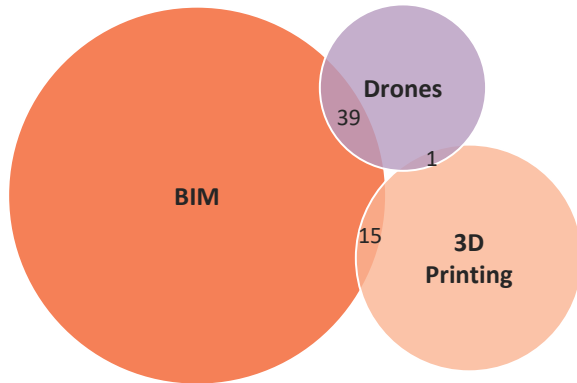


- *Drones increasingly used for site surveying, onsite supervision, monitoring and inspection, cleaning, and painting*

Cross-domain Integration of Emerging Technologies

Total no. of inventions published '11-'20

- BIM: 4496
- 3D Printing: 1708
- Drones: 421



Notable examples

• **BIM + Drones (39 inventions)**

1. *POSCO Engineering & Construction*
Construction site management system through 3D-mapping from unmanned aerial vehicle and BIM design data
2. *China MCC 17 (中国十七冶集团)*
Asymmetric suspension bridge construction management and control method based on UAV photography and BIM

• **BIM + 3D Printing (15 inventions)**

1. *China MCC 17 (中国十七冶集团)*
BIM-based bridge construction process simulation and risk control method using 3D-printed models
2. *Shanghai Civil Engineering (中铁上海工程局集团)*
Construction method of special-shaped concrete structure bar using BIM and 3D printing

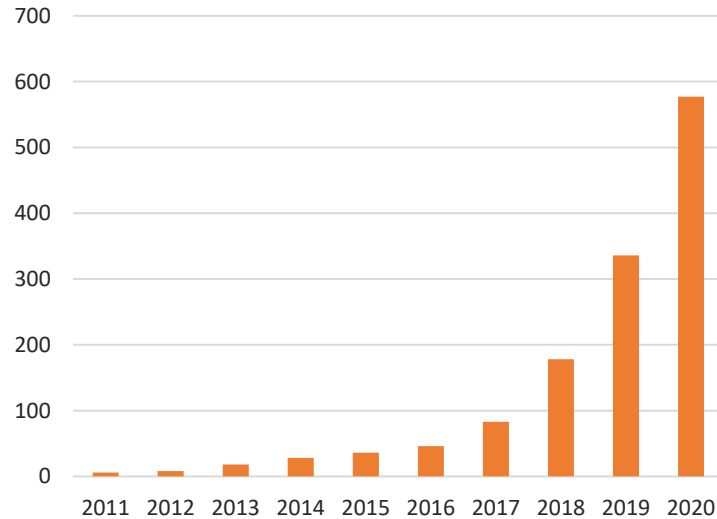
• **Drones + 3D Printing (1 invention)**

1. *Dongguan University of Technology*
Unmanned aerial vehicle having a 3d printing function for building construction

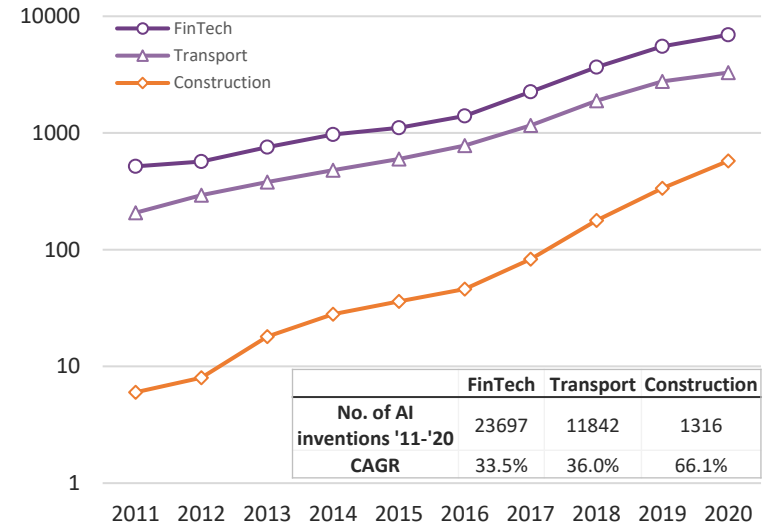
Artificial Intelligence

The Technology Frontier of Construction Industry

Global publication innovation trend of AI for construction



AI innovations for constructions vs. selected industries



Artificial Intelligence

Shaping the Future of Construction Industry



Pre-construction

- Planning
- Generative design to identify and mitigate clashes of different designs and the sequence of activities

During construction

- Offsite/onsite productivity improvement
 - AI for construction safety
 - Progress monitoring



Post-construction

- Building operation automation and performance improvement
- Preventive maintenance

A panoramic view of the Singapore skyline at dusk, with the city lights reflecting on the water. The Marina Bay Sands hotel is prominent in the center, and the Esplanade - Theatres on the Bay is visible to its right. The sky is a mix of blue and orange, indicating sunset or sunrise.

Thank You!

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enquiry@iposinternational.com

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