

33 YEARS OF LEAN CONSTRUCTION RESEARCH: COMMUNITY EVOLUTION AND AUTHORSHIP PATTERNS

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ABSTRACT

This paper presents a quantitative analysis of Lean Construction (LC) research contributions at the International Group for Lean Construction (IGLC) conferences over a 33-year period (1993–2025). Based on a dataset of 2,413 conference papers and 2,846 authors, the study examines authorship patterns, collaboration structures, and the involvement of students in order to describe how participation in the IGLC community has evolved. The results show that IGLC has developed into a well-established and still expanding research community, with sustained publication activity averaging over 100 papers per year. A relatively small but persistent core of authors (15%) accounts for over 86% of all papers, indicating a strong concentration of research output. At the same time, the number of contributing authors has continued to increase, while the size of the recurring core has remained comparatively stable. Collaboration has intensified steadily, reflected in a rise in the average number of authors per paper to more than 3.5. Also, student involvement is substantial: PhD students contribute to one-third to one-half of annual publications, with Bachelor/Master students also increasingly represented. Overall, the study provides a descriptive baseline of authorship and participation patterns at IGLC, supporting further reflection on the structure and evolution of LC research.

KEYWORDS

Research, publications, core authors, students, community.

INTRODUCTION

The International Group for Lean Construction (IGLC) conference has played a central role in Lean Construction (LC) research since its inception in 1993. Each year, the conference brings together researchers and practitioners from around the world to present and discuss the latest developments in LC. Because a substantial share of research in this field is presented at IGLC, the conference provides a particularly rich source for understanding who contributes to LC

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research worldwide, how knowledge is produced, and how the LC community has evolved. While journals (e.g. LCJ) and regional conferences (e.g. EGLC) also contribute to LC research, they do not provide the same continuity, scope, and global representation as IGLC. Therefore, for reasons of analytical clarity and comparability, this study focuses exclusively on the IGLC.

Over its 33-year history (1993–2025), the conference has hosted thousands of presentations, reflecting the field's growth. This development, along with the increasing diversity of topics, highlights the IGLC's role in consolidating LC as a research field and in providing a platform where responses to broader challenges faced by the construction industry are discussed.

Despite the central role of IGLC in contributing to the discourse on LC, there is no updated comprehensive analysis of the conference's publication record. Such an overview could provide the community with a better understanding of the structure and dynamics of the research field and its different streams of work, while also offering a basis for reflecting on its own evolution and for adjusting how research is organised, disseminated, and carried forward.

This paper addresses this gap by focusing on community evolution and authorship patterns in LC research at IGLC. More specifically, it examines how publication activity has evolved, how participation is distributed, how co-authorship structures have developed, and to what extent students are involved. On this basis, its contribution can be seen in several respects. First, it increases transparency regarding who has shaped the field and who currently contributes most visibly to its development. Second, it provides a baseline for reflecting on the evolution and strategic orientation of the IGLC community. Third, it highlights how student research is embedded, offering insight into how the next generation is integrated into the LC community.

In a complementary paper published alongside this one (John et al., 2026), further analyses are presented on institutional, country-level contributions, and on the extent of academia-industry collaboration. While this paper focuses on community evolution and authorship patterns, including recurring contributors, collaboration patterns, and student involvement, the companion paper examines from which organisational and national contexts the IGLC body of knowledge primarily originates and how collaboration is reflected. Together, the two studies provide the first systematic mapping of LC research as reflected in 33 years of IGLC. Through this effort, we aim to provide a foundation for advancing LC research, while at the same time supporting strategic efforts to expand the reach and long-term impact of the Lean approach.

RESEARCH ON LEAN CONSTRUCTION RESEARCH

This section reviews previous research that has, in one or another way, examined LC research. Over the past three decades, LC has evolved into a consistent and substantially expanded research field. However, understanding the quantitative structure of LC research has received limited systematic attention. Existing meta-studies can broadly be divided into two categories: (1) those that directly analyse LC literature and (2) those that examine connections with related fields such as supply-chain management, sustainability, and leadership.

Several studies have traced the evolution of LC research within the IGLC community. Early efforts to synthesise LC research (1) were largely qualitative in nature. Alves and Tsao (2007) provided one of the first structured examinations of IGLC papers to define dominant topics and practices in the field. Building on this, Jacobs (2010) and Etges et al. (2012) categorised LC research outputs to trace the field's development. Later on, more data-driven approaches were introduced, which enabled broader and more systematic insights into the development of LC research. For instance, Engebø et al. (2017) mapped the geographical distribution of LC publications from 1996 to 2016. In addition, Saygili et al. (2019) provided a bibliometric overview of the Lean Construction Journal (2004–2018), describing publication trends, co-authorship structures, and thematic shifts over time. However, the study covers a comparatively limited number of papers and a shorter time span, and the continuity of the LCJ is considerably lower than that of the IGLC. In more thematic depth, Li et al. (2019) used a scientometric

approach to analyse 370 LC publications and identify future knowledge bases. Mano et al. (2021) analysed 686 IGLC papers (2010–2016) and reported that 87% were not aligned with the Toyota Production System (TPS) principles, indicating that LC has developed a distinct theoretical identity. Finally, León and Guevara (2023) analysed 500 LC-related papers and mapped conceptual relationships between LC and broader management topics.

Alongside these general analyses, there is also a growing stream of theme-specific reviews presented at IGLC, focusing on synthesising research within LC subtopics. Examples include reviews on project culture (Zuo & Zillante, 2005), waste (Viana et al., 2012), trust (Smith & Rybkowski, 2012), Virtual Design and Construction (VDC) (Alarcón et al., 2013), the Last Planner System (Lappalainen et al., 2023), value (Salvatierra-Garrido et al., 2012), and takt production (Andreassen & Drevland, 2023; Power et al., 2023; Munkvold & Drevland, 2024), among others. This list is not exhaustive, but it illustrates that as the research corpus expands, there seems to be an increasing need for reviews to refine specific thematic areas of LC.

A second group (2) of meta-studies has examined related topics that intersect with or extend into adjacent research areas. Osunsanmi et al. (2019), for example, conducted a bibliometric analysis of LC supply chain literature, while Sarhan et al. (2019) explored the intersection of LC and sustainability. Daniel et al. (2024) later examined links between LC and offsite construction, and Santos et al. (2024) looked at Lean leadership in construction. At a broader scale, Wibowo and Ammar (2025) reviewed 4,905 documents from the past two decades and identified strong links between LC, sustainability, and BIM, while Garcés et al. (2025) confirmed growing global interest in sustainability through a systematic review of LC research.

Together, these meta-studies confirm that LC research has expanded considerably in scope and thematic diversity. Yet most of the efforts focus on the content of research rather than the structure – and mostly just on specific subdomains, thereby offering only fragmented insights into the field. So, although LC has grown into a globally active research field, its developmental dynamics have not yet been examined holistically. Addressing this gap, the present study shifts the perspective from thematic content to structural characteristics, offering the first systematic mapping of community evolution and authorship patterns across the full history of IGLC.

METHODOLOGY

This study follows a descriptive quantitative research design based on a longitudinal publication analysis of the IGLC proceedings (1993–2025). The dataset was created in a multi-step process combining automated data extraction, manual data entry, and extensive additional research to ensure completeness and consistency. For the years 1996–2025, reference data were downloaded from the IGLC repository (www.iglc.net/papers), which provides basic bibliographic metadata. For the years 1993–1995, which are not available digitally, information was manually extracted from the printed proceedings compiled by Alarcón (1997).

The initial dataset was transferred into a structured database containing the following attributes for each paper: author names, year, title, and information on the academic status of the authors. To improve data quality and completeness, missing information on academic status (Bachelor, Master, or PhD student) at the time of publication was manually researched. This was done using institutional websites, professional networks (e.g., LinkedIn and ResearchGate), and other online sources to reconstruct the academic status of the respective authors. All author names were then manually harmonised to account for spelling variations (e.g., “Glenn Ballard” vs. “G. Ballard”). The coding and harmonisation were undertaken by the first and second author and were iteratively checked for consistency and accuracy. These quality checks included manual review of harmonised names, joint discussion of coding decisions, random cross-checks of selected papers, and verification of ambiguous cases. Such cases were uncommon and mostly concerned the classification of academic status. In these instances, additional desk research was conducted to verify the respective status, allowing all ambiguous cases to be classified.

After completing data collection, enrichment, and cleaning, the final dataset comprised 2,413 papers. Descriptive statistical analyses were then conducted to identify trends, distributions, and rankings related to community evolution and authorship patterns. The analyses were based on a full-count approach: a paper was assigned to an author if that person was listed as an author on the paper, and papers involving one or more Bachelor, Master, or PhD students were counted once as papers with student involvement, regardless of the number of student co-authors. All analyses covered the full dataset across the 33-year period.

RESULTS AND DISCUSSION

CONFERENCE CONTRIBUTIONS OVER TIME (1/5)

Figure 1 illustrates the number of papers per year presented at IGLC conferences from 1993 to 2025, revealing an overall upward trend despite temporary fluctuations, as indicated by the red trend line⁷. To support interpretation, four qualitatively defined phases are distinguished. These phases were identified interpretively through joint visual inspection of the developments in paper output and participating authors (Figure 1 & 2), with phase boundaries placed where both series show noticeable shifts. While the Phases 1–3 reflect periods with comparatively distinct activity, Phase 4 is characterised by fluctuations, likely related to the COVID-19 pandemic.

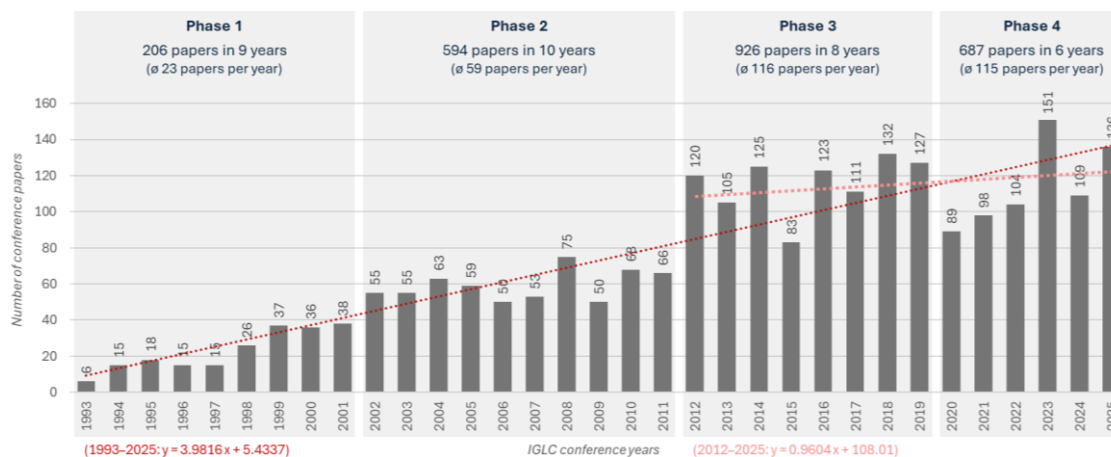


Figure 1: Number of conference papers per conference year (N=2,413)

Phase 1 (1993–2001) was characterised by comparatively modest contributions, averaging 23 papers per year, and reflects the formative stage of the IGLC community, when LC was still emerging as a research field. Phase 2 (2002–2011) rose to 59 papers per year on average, indicating steady growth. A more marked shift occurred in Phase 3 (2012–2019), when output nearly doubled to 116 papers annually. During this period, annual output first exceeded 100 papers (in 2012) and, except for 2015, remained above that threshold. Phase 4 (2020–2025) stayed at a similar level, averaging 115 papers per year, but showed stronger fluctuations, including a drop to 89 papers in 2020 (likely related to the COVID-19 pandemic) and a peak of 151 papers in 2023. Cumulative counts further illustrate this growth: the 1,000-paper mark was passed in 2013 and the 2,000-paper mark in 2022. Overall, these figures document a substantial long-term increase in publication activity.

⁷ The dotted red line represents a linear trend calculated across the entire period using ordinary least squares regression (OLS), corresponding to an average increase of about 4 papers per year. While this provides a general picture of long-term growth, it does not account for structural breaks in the data. In particular, a marked increase occurred in 2012, after which the average annual number of papers nearly doubled compared to the previous phase. To reflect this change, an additional linear trendline has been included starting from 2012. This line corresponds to an average increase of about 1 paper per year, illustrating a relative stability since 2012.

EVOLUTION OF THE IGLC COMMUNITY AND ITS CORE AUTHOR BASE (2/5)

Figure 2 illustrates the number of unique authors (in total: 2,846) contributing to IGLC papers between 1993 and 2025. The overall trajectory indicates a steady long-term increase of roughly 11 additional authors per year⁸, though with notable fluctuations. To support interpretation, the same four interpretively defined phases are distinguished as in Figure 1. In addition to total contributors (whole bar), the green segments indicate how many of these belonged to the *core* of recurring authors (hereafter referred to as *core authors*), defined as individuals who published in at least three conference years across the entire 1993–2025 period.

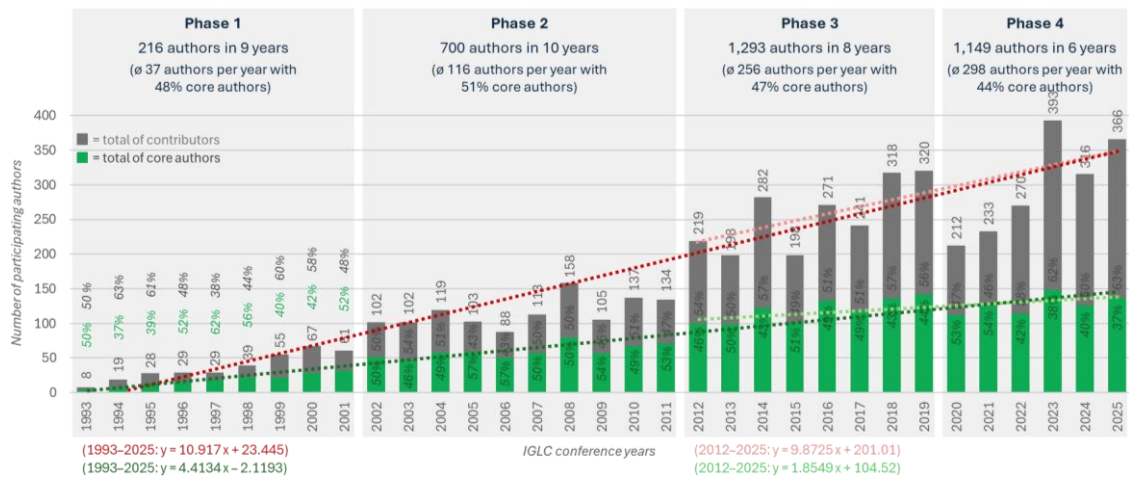


Figure 2: Number of participating authors per conference year (N=2,846)

Phase 1 (1993–2001) involved comparatively small groups of contributors, averaging 37 authors yearly, and reflects the early stage of IGLC, when participation was limited to a relatively small circle. Across this phase, 216 authors contributed at least one paper, of whom only 58 (27%) published in three or more years (overall). The annual share of these core authors varied considerably, ranging from 37% to 62% and averaging 48% per year. Year-to-year fluctuations were also comparatively strong, reflecting the still limited contributor base.

In Phase 2 (2002–2011), author numbers rose substantially, averaging 116 per year and indicating a broader contributor base. Across this decade, 700 authors were active, including 199 core authors (28%). The share of core authors per year stabilised at a comparatively higher level, ranging from 46% to 57% and averaging 51%, suggesting more consistent participation.

A stronger shift occurred in Phase 3 (2012–2019), when the number of participating authors more than doubled to an average of 256. Annual participation exceeded 200 authors throughout this period, apart from minor fluctuations in 2013 and 2015. 2018 was the first year with more than 300 contributors. In total, 1,293 authors contributed in this phase, of whom 314 (24%) participated actively in at least three IGLC conferences. The share of core authors varied within a narrower range (43%–51%), averaging 47% annually. Thus, although participation increased strongly in absolute terms, the relative share of core authors was slightly lower than in Phase 2.

Phase 4 (2020–2025) reached the highest annual participation levels, averaging around 300 authors, but also showed stronger fluctuations, ranging from 212 authors in 2020 (likely affected by COVID-19) to a peak of 393 in 2023. Across this phase, 1,149 authors contributed, including 258 core authors (22%). Core-author shares ranged from 37% to 53%, averaging 44%, indicating that despite continued overall growth, the share of core authors has declined.

A noteworthy observation is that since 2012, the red trendline indicates an average annual increase of 10 authors overall, whereas the number of core authors (green line) has grown much more modestly, by only around two per year. This suggests that although the number of new

⁸ The red dotted line represents the linear trend (OLS) across the entire period (1993–2025).

contributors continues to rise, the size of the *IGLC core* has remained comparatively stable relative to the broader growth of the community. Overall, the *IGLC core* comprises 427 authors who have published in at least three conference years (around 15% of all IGLC contributors; see Figure 3). Together, they account for 86% of all IGLC papers. When the threshold is raised to four active conference participations, the core narrows to 276 authors (around 10% of all contributors), who still account for 80% of all IGLC papers, underlining their strong quantitative influence on knowledge production within the community over time.

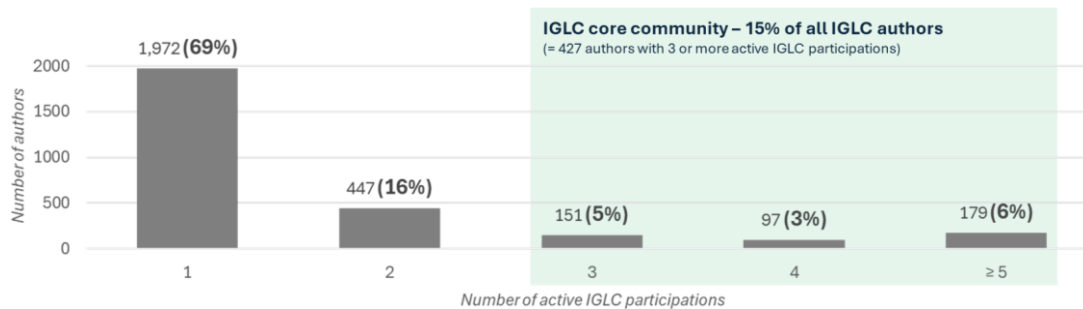


Figure 3: Number (and share) of authors by number of active IGLC participations (N=2,846)

Although the conference has expanded substantially, a comparatively small core accounts for a disproportionate share of papers, indicating dependence on a limited number of contributors. As long-standing authors gradually withdraw, the resilience of IGLC may increasingly depend on how successfully newer participants are integrated into this core. Strengthening pathways from occasional participation to sustained engagement may therefore be important.

MOST CONTRIBUTING AUTHORS: OVER TIME AND MOST RECENT (3/5)

To provide a more concrete picture of who has been most active and visible within the field, Table 1 presents the 20 most contributing authors across the entire history of the IGLC, ranked by the total number of authored IGLC papers.

Table 1: The 20 most contributing authors in 33 years of the IGLC conference

Rank	Author (country)	IGLC papers all-time	Active at IGLC between	Active IGLC participations	First author (quota)	Last author (quota)	IGLC papers since 2016 (rank)	Change in rank vs. 2016–2025
1	Koskela, Lauri (Estonia)	154	1993–2025	33	34 (22.1%)	57 (37.0%)	57 (3)	↓ - 2
2	Ballard, Glenn (USA)	124	1993–2025	32	26 (21.0%)	69 (55.6%)	26 (12)	↓ - 10
3	Tommelein, Iris (USA)	112	1997–2025	28	17 (15.2%)	51 (45.5%)	36 (8)	↓ - 5
4	Formoso, Carlos (Brazil)	110	1996–2025	29	9 (8.2%)	55 (50.0%)	39 (5)	↓ - 1
5	Alarcón, Luis (Chile)	98	1993–2025	32	21 (21.4%)	44 (44.9%)	38 (7)	↓ - 2
6	Hamzeh, Farook (Canada)	81	2007–2025	18	9 (11.1%)	61 (75.3%)	62 (1)	↑ + 5
7	Seppänen, Olli (Finland)	80	2003–2025	18	12 (15.0%)	30 (37.5%)	61 (2)	↑ + 5
8	Tzortzopoulos, Patricia (UK)	72	1998–2025	27	6 (8.3%)	29 (40.3%)	39 (5)	↑ + 3
9	Howell, Gregory (USA)	59	1994–2022	21	17 (28.8%)	33 (55.9%)	2 (317)	↓ - 308
10	Lædre, Ola (Norway)	58	2014–2025	12	0 (0.0%)	35 (60.3%)	48 (4)	↑ + 6
11	Alves, Thais (USA)	48	2000–2025	20	15 (31.3%)	17 (35.4%)	18 (23)	↓ - 12
12	Gonzalez, Vicente (Canada)	46	2006–2025	18	8 (17.4%)	17 (37.0%)	26 (12)	→ 0
13	Pasquire, Christine (UK)	44	2002–2020	19	10 (22.7%)	8 (18.2%)	16 (31)	↓ - 18
14	Neto, José (Brazil)	42	2002–2022	18	3 (7.1%)	34 (81.0%)	17 (28)	↓ - 14
	Sacks, Rafael (Israel)	42	2003–2025	22	8 (19.0%)	16 (38.1%)	18 (23)	↓ - 9
16	Arroyo, Paz (USA)	39	2012–2025	14	15 (38.5%)	7 (17.9%)	34 (9)	↑ + 7
17	Rybkowski, Zofia (USA)	38	2008–2025	16	10 (26.3%)	11 (28.9%)	25 (14)	↑ + 3
18	Haghsheeno, Shervin (Germany)	37	2014–2025	12	2 (5.4%)	31 (83.8%)	34 (9)	↑ + 9
19	Peltokorpi, Antti (Finland)	34	2015–2025	11	3 (8.8%)	21 (61.8%)	33 (11)	↑ + 8
20	Kalsaas, Bo Terje (Norway)	32	2009–2025	15	17 (53.1%)	12 (37.5%)	13 (42)	↓ - 22

The list highlights key contributors such as *Lauri Koskela* (Estonia; 1.), *Glenn Ballard* (USA; 2.), *Iris Tommelein* (USA; 3.), *Carlos Formoso* (Brazil; 4.), and *Luis Alarcón* (Chile; 5.) who

have been active since the early years. Together, these five scholars (0.2% of all IGLC authors) contributed to 539 (22%) of the 2,413 papers analysed, highlighting their presence within the IGLC body of knowledge and indicating a substantial influence in shaping the field. Furthermore, the top-20 (0.7% of all) account for nearly half of IGLC's papers (1,109; 46%).

To better understand the role of these core authors in knowledge generation, Table 1 complements overall output with additional indicators. The First Authorship quota indicates how often an author served as the primary contributor, while the Last Authorship quota indicates how often an author occupied the last-author position, which in many research traditions is associated with leadership of the research group (Abramo et al., 2013). However, conventions vary, and the last-author position may also reflect a comparatively minor rather than a leading contribution. This indicator should therefore be interpreted with caution. Among the top-20, First Authorship ranges from 0% to 53% of total contributions (average: 19%), while Last Authorship ranges from 18% to 84% (average: 47%). This variation highlights the heterogeneity of contributing roles. Some of the most prolific contributors show comparatively low First or Last Authorship quotas, suggesting stronger collaborative engagement rather than consistently occupying leading positions. To complement this long-term perspective, Table 2 presents the 20 most active authors in the most recent decade (2016–2025).

Table 2: The 20 most contributing authors of the last 10 years of the IGLC conference

Rank	Author (country)	IGLC papers since 2016	Active at IGLC between	Active IGLC participations	First author (quota)	Last author (quota)	IGLC papers all-time (rank)	Change in rank vs. all-time
1	Hamzeh, Farook (Canada)	62	2007–2025	18	9 (11.1%)	61 (75.3%)	81 (6)	↑ + 5
2	Seppänen, Olli (Finland)	61	2003–2025	18	12 (15.0%)	30 (37.5%)	80 (7)	↑ + 5
3	Koskela, Lauri (Estonia)	57	1993–2025	33	34 (22.1%)	57 (37.0%)	154 (1)	↓ - 2
4	Lædre, Ola (Norway)	48	2014–2025	12	0 (0.0%)	35 (60.3%)	58 (10)	↑ + 6
5	Formoso, Carlos (Brazil)	39	1996–2025	29	9 (8.2%)	55 (50.0%)	110 (4)	↓ - 1
	Tzortzopoulos, Patrícia (UK)	39	1998–2025	27	6 (8.3%)	29 (40.3%)	72 (8)	↑ + 3
7	Alarcón, Luis (Chile)	38	1993–2025	32	21 (21.4%)	44 (44.9%)	98 (5)	↓ - 2
8	Tommelein, Iris (USA)	36	1997–2025	28	17 (15.2%)	51 (45.5%)	112 (3)	↓ - 5
9	Arroyo, Paz (USA)	34	2012–2025	14	15 (38.5%)	7 (17.9%)	39 (16)	↑ + 7
	Haghsheno, Shervin (Germany)	34	2014–2025	12	2 (5.4%)	31 (83.8%)	37 (18)	↑ + 9
11	Peltokorpi, Antti (Finland)	33	2015–2025	11	3 (8.8%)	21 (61.8%)	34 (19)	↑ + 8
12	Ballard, Glenn (USA)	26	1993–2025	32	26 (21.0%)	69 (55.6%)	124 (2)	↓ - 10
	Gonzalez, Vicente (Canada)	26	2006–2025	18	8 (17.4%)	17 (37.0%)	46 (12)	→ 0
14	Rybkowski, Zofia (USA)	25	2008–2025	16	10 (26.3%)	11 (28.9%)	38 (17)	↑ + 3
15	Lehtovaara, Joonas (Finland)	23	2019–2025	7	6 (26.1%)	3 (13.0%)	23 (33)	↑ + 18
16	Schöttle, Annett (Germany)	22	2012–2025	14	18 (69.2%)	3 (11.5%)	26 (24)	↑ + 8
17	Etges, Bernardo (Brazil)	21	2012–2025	9	7 (30.4%)	4 (17.4%)	23 (33)	↑ + 16
	Poshdar, Mani (New Zealand)	21	2015–2025	10	5 (21.7%)	6 (26.1%)	23 (33)	↑ + 16
	Herrera, Rodrigo (Chile)	21	2017–2025	8	2 (9.5%)	4 (19.0%)	21 (40)	↑ + 23
20	Lohne, Jardar (Norway)	20	2014–2025	10	2 (7.1%)	13 (46.4%)	28 (22)	↑ + 2
	Wandahl, Søren (Denmark)	20	2003–2025	11	6 (23.1%)	17 (65.4%)	26 (24)	↑ + 4

Some of the early contributors remain active and visible, while others have published less in recent years. At the same time, several authors who also appear in the all-time top-20 have risen to prominent positions, such as *Ola Lædre* (Norway; 4.), *Paz Arroyo* (USA; 9.), *Shervin Haghsheno* (Germany; 9.), and *Antti Peltokorpi* (Finland; 11.). Notably, these four authors entered the community since 2012. This indicates that the community not only retains a group of long-standing contributors, providing stability, but also continues to integrate participants at a higher level of activity, reflecting renewal. Identifying the most active contributors therefore offers insight into who currently shape publication activity at IGLC and gives orientation for researchers seeking to navigate the community.

These findings suggest that the transition between established and newer contributors appears to function relatively well. To sustain the community over time, it may be useful to support succession more consciously by helping to develop the next generation of contributors.

CO-AUTHORSHIP PATTERNS (4/5)

To gain insight into how knowledge is co-produced within the community, beyond the top-20, we also examined the collaboration patterns. Figure 4 illustrates the trends in the number of co-authors per paper across conference years. The trendlines (OLS) indicate a shift from single authorship to multi-author collaborations. In the early years, single- and pair-authored papers predominated, but over time the share of single-authored papers has steadily declined, falling below 10% in the recent decade. In contrast, papers with three or more authors have seen continuous growth, rising from under 30% in the early 1990s to 78% since 2024.

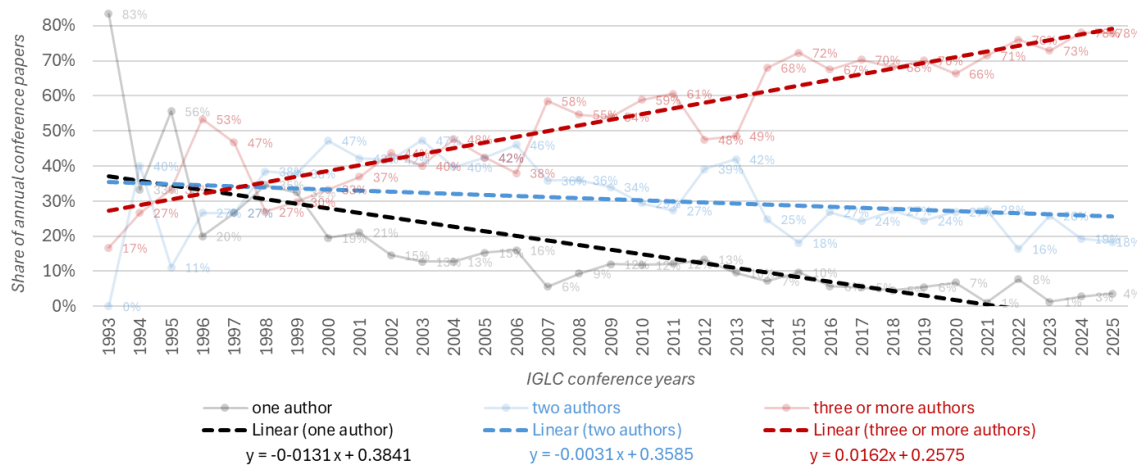


Figure 4: Share of annual conference papers by number of authors per conference year

The overall distribution of papers by number of authors is summarised in Figure 5. Out of the 2,413 analysed papers, just 9%⁹ were sole-authored (since 2016: 4%), while most contributions were collaborative efforts. Papers with two authors and three authors are the most common, accounting for 30% each (since 2016: 24% and 29%). Four-author papers represent 18% of the total (since 2016: 22%), while contributions with five authors (9%; since 2016: 13%) and six or more authors (5%; since 2016: 7%) are less frequent. This distribution shows a shift toward larger teams that could suggest a tendency toward collaborative research within the community.

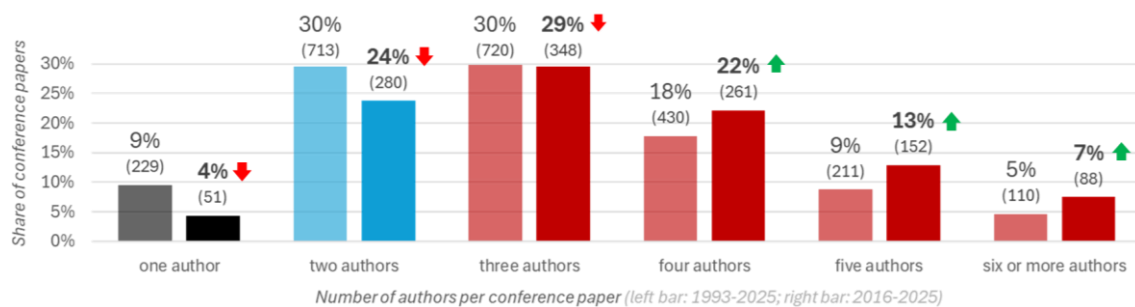


Figure 5: Number (and share) of papers by number of authors per paper (N=2,413)

Figure 6 further supports the trend towards increasing collaboration within the IGLC community by showing the development of the average number of authors per paper. In the early years, papers typically involved fewer contributors, with the average remaining below 2.5 until 2006 (except in 2002 and 2004). Since then, a gradual and continuous increase can be observed. In the most recent five-year period, the average ranged from 3.46 to 3.83 authors per paper. This steady rise indicates that IGLC research contributions are increasingly produced in larger teams, in line with the broader pattern of multi-author collaboration across the dataset.

⁹ Absolute numbers of papers are shown in parentheses below the respective percentages in Figure 5.

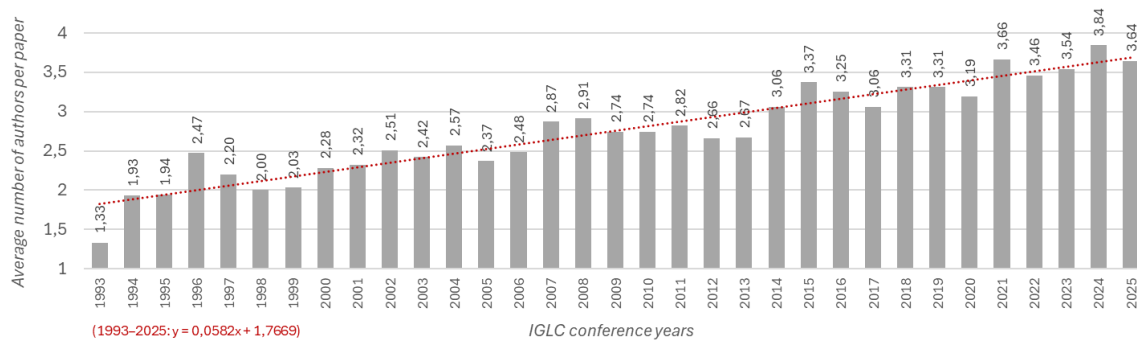


Figure 6: Average number of authors per paper per conference year

INVOLVEMENT OF STUDENT RESEARCH (5/5)

The participation of Bachelor, Master, and PhD students in IGLC papers provides insight into the extent to which emerging researchers and practitioners are included in the community's outputs. It also indicates whether knowledge production is driven primarily by established scholars or also involves student research. Between 1993 and 2025, 1,406 papers (58%) involved Bachelor, Master, and/or PhD students as co-authors, suggesting that a substantial share of the field's research has either originated from or been significantly supported by student work. Figure 7 shows the temporal development of student involvement, distinguishing between papers with PhD students, Bachelor/Master students, and no student participation.

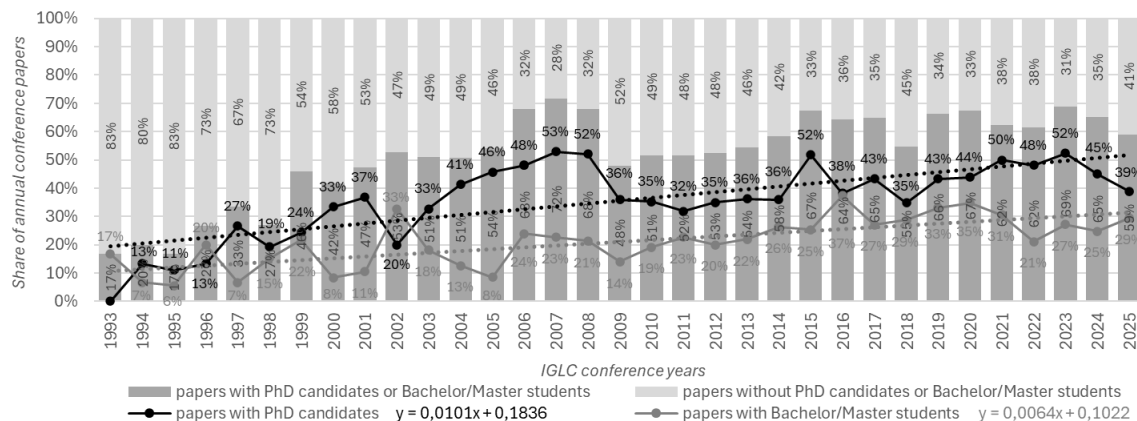


Figure 7: Share of annual conference papers with students as (co-)authors per conference year

In the early years of IGLC, student involvement was relatively limited, with only sporadic contributions from PhD students and very few from Bachelor or Master students. PhD student involvement began to increase from around 2000 onward and, apart from a temporary decline in 2002, has since remained between 32% and 53% of annual papers.

The involvement of Bachelor/Master students follows a somewhat different trajectory. Although their participation remains lower than that of PhD students, it has also increased gradually over time. Since 2006, except for 2009 and 2010, their share of papers has remained above 20%, reaching a peak of 37% in 2016. This indicates that undergraduate and graduate students have also been integrated into the community's research to a noticeable extent.

Conversely, the share of papers without any student involvement has gradually declined, falling below 50% for the first time in 2002 and stabilising between 30% and 45% in recent years. One possible explanation is the broadening of academic mentorship and greater efforts to involve students; another is the growing “publish or perish” dynamic, which may incentivise wider use of student research. While the present data do not allow firm conclusions, they show that student participation in IGLC has increased over time.

The growing involvement of students further suggests that IGLC increasingly serves as an entry point for future researchers and practitioners into the LC community and may thereby indirectly support the further dissemination of LC in industry. This underlines the importance of student participation for the longer-term continuity and renewal of the field. At the same time, it remains important that such involvement supports meaningful academic development and sustained future engagement, rather than contributing only to publication output.

CONCLUSION

This study provides a quantitative overview of community evolution and authorship patterns at the IGLC conference over a 33-year period (1993–2025). By analysing 2,413 papers and 2,846 contributors, we offer a descriptive perspective on how the community has evolved in terms of participation, collaboration, and student involvement.

Six key insights can be drawn: (1) By participation and research output, IGLC has grown into a well-established research community, with sustained and continuing publication activity averaging over 100 papers per year since 2012. (2) A relatively small but persistent core of 427 authors ($\approx 15\%$ of all IGLC contributors) accounts for more than 86% of all publications, and the 20 most active authors have contributed to nearly half of all papers (46%), indicating strong concentration in the field's knowledge production. These 'champions' provide stability but also reveal a dependence on a limited number of highly active contributors. (3) At the same time, the number of new authors has continued to rise, especially since 2012, signalling ongoing expansion and openness to new participants. The field thus combines continuity with a steady inflow of new contributors. (4) Despite overall growth, the number of recurring "core authors" has not expanded proportionally. This implies that while participation has broadened, the inner circle of consistently contributing scholars has remained relatively stable in size. (5) Collaboration intensity indicated by the average number of authors per paper has increased steadily from below 2 in the early years to over 3.5 in recent years. Multi-author papers have become dominant, suggesting more collaborative research practices. (6) PhD students now contribute to between one-third and one-half of papers annually, showing that doctoral research has become one of the main drivers of LC scholarship. Bachelor/Master students also participate more frequently, demonstrating stronger integration of student research.

Beyond documenting these patterns, the findings also have practical implications for the further development of the IGLC community. They highlight the importance of supporting newcomer integration, mentoring, and succession in order to strengthen the recurring core of contributors and maintain continuity over time. For industry, the results indicate that IGLC can serve as a potential access point to relevant research networks, while at the same time pointing to the value of creating more direct channels for practitioner participation. For future IGLC authors, the study provides orientation regarding the community's structure and its collaboration patterns. In this sense, the data can inform both strategic reflection within IGLC and more conscious participation by researchers and practitioners.

However, the analysis is limited in scope. It is restricted to IGLC proceedings and focuses on structural metrics such as number of authors, co-authorship patterns, and student involvement. It does not examine paper content, disciplinary backgrounds, or citation impact, and while care was taken to harmonise names and affiliations, residual inconsistencies cannot be excluded. A complementary paper published in parallel therefore addresses institutional and country-level contributions, as well as academia-industry and international collaboration.

Future studies will extend this work in two directions: one mapping co-authorship and citation networks, and another analysing thematic trends and research topics. Together, this series aims to provide a more comprehensive structural mapping of LC research as reflected in IGLC, supporting the community in strategically shaping its future trajectory and strengthening the long-term diffusion and impact of LC in the construction industry.

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