

A holistic approach for industrializing timber construction

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13 Sept 2019

A holistic approach for industrializing timber construction

1. Motivation and strategy
2. Background and foundations
3. Empirical Study
4. Case Studies
5. Conclusions

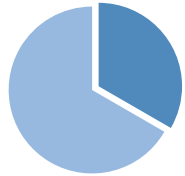
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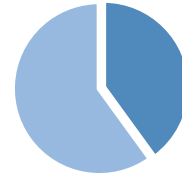
1. Motivation and strategy

Environmental Assessment



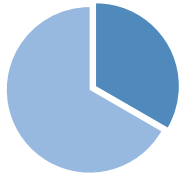
33% global CO2 emissions

Urbanization



40% global population will need new buildings

Resource Use



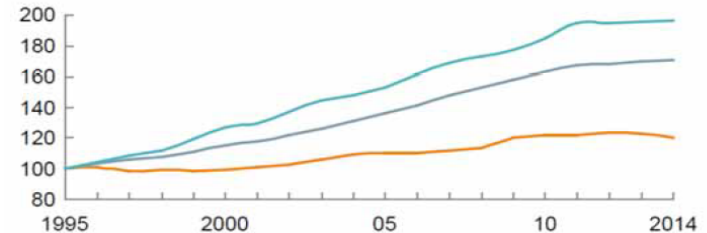
30% EU waste annually



40% Global resource use

Global productivity growth trends¹

Real gross value added per hour worked
by persons engaged, 2005 \$
Index: 100 = 1995



1. Motivation and strategy

Environmental Assessment



GlueLam



CLT



Hybrid

Urbanization



Columbia

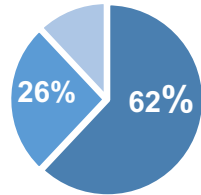


Via Cenni

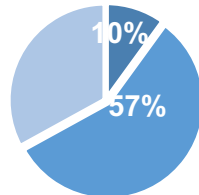


Puukuokka

Resource Use



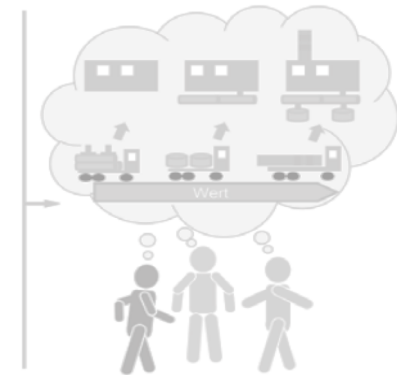
62% Value
26% Waste
12% Supporting activities



10% Value
57% Waste
33% Supporting activities

The chronic problems of construction are well known:

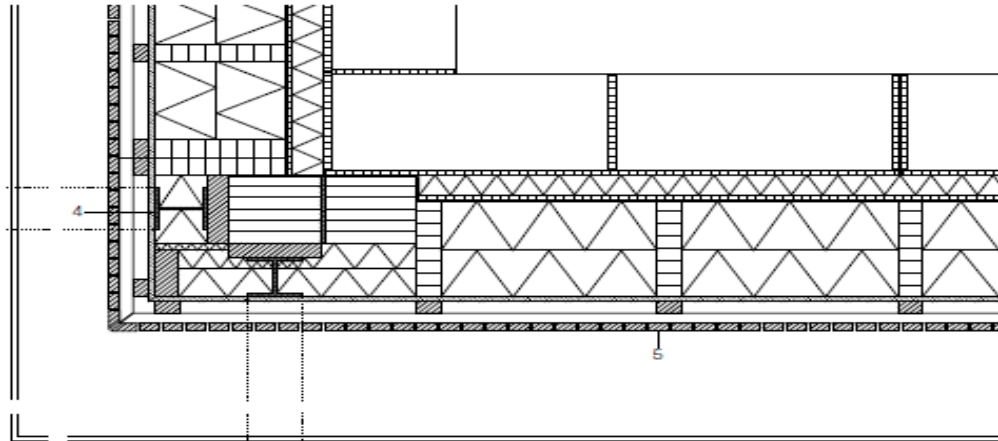
- Low productivity
- Poor safety
- Inferior working conditions
- Insufficient quality



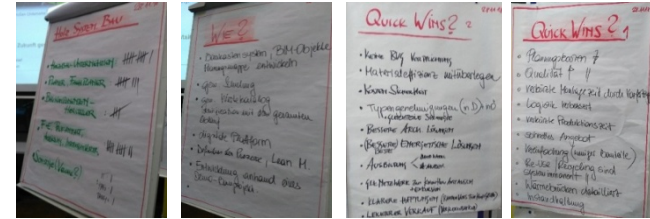
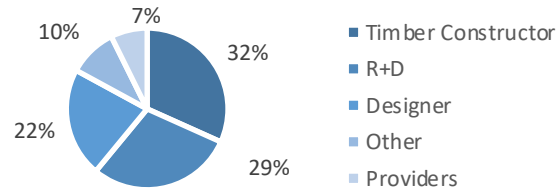
2. Background and foundation

Why timber?

- ✓ Engineering performance
- ✓ Effective off-site construction (Local factories)
- ✓ Resources Management
- ✓ High Prefabrication Grade
- ✓ Dry Construction – Plug&Play
- ✓ Just in Time Delivery
- ✓ Expertise – Know-how
- ✓ Thermal Capabilities, Fire Resistance...

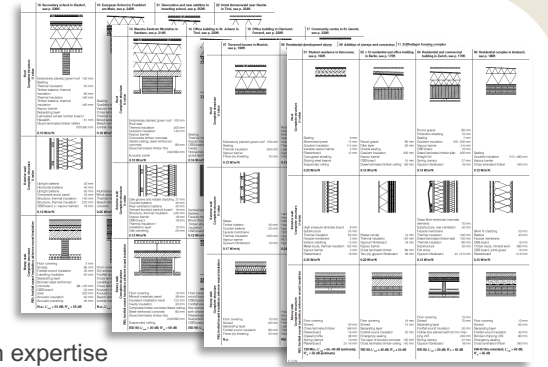
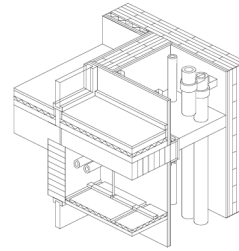
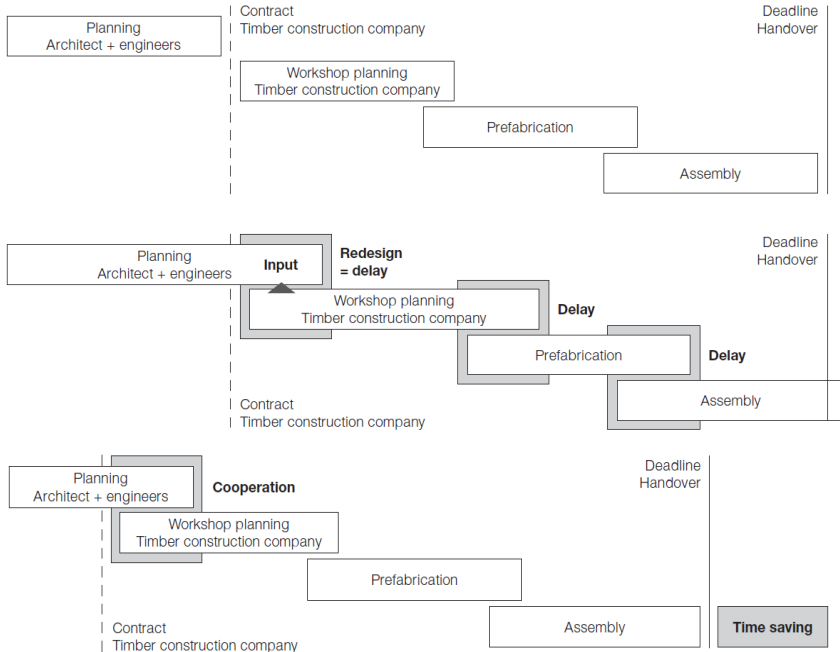


3. Empirical study Holz.System.Bau

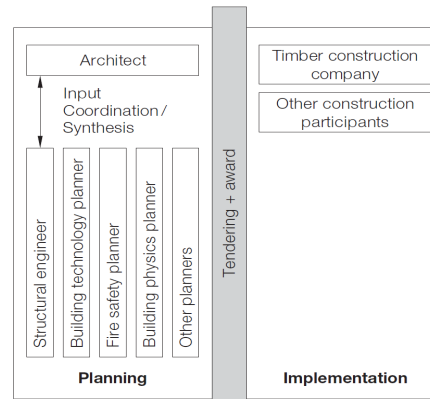


	Urgent value-adding goals	Strategies
DESIGN	<ul style="list-style-type: none"> Extended knowledge in architectural design Know-how exchange platform Specific academic training Energy and material efficient concepts Less constructive elements, joints and details 	<ul style="list-style-type: none"> Define a reactive and adaptive modular system with standard assemblies from already existing components
PRODUCTION	<ul style="list-style-type: none"> Optimized logistic and coordination Competent handcraft Shorter production time in factory 	<ul style="list-style-type: none"> Develop an integral catalog with all load-bearing and not load-bearing modular system elements
ERECTION	<ul style="list-style-type: none"> Faster assembly through higher prefabrication grade (plug-and-play) Better performance on site against weather detriments Optimized logistic and coordination Null-error performance 	<ul style="list-style-type: none"> Use rainproof constructive elements Spread the solutions through a BIM library as an open source
Cost-time	<ul style="list-style-type: none"> Refinement of planning costs Reliable cost and time plans Faster offers and lighter comparability 	<ul style="list-style-type: none"> Advance a collective value-adding actions catalog throughout the whole process Implement a crossed specific training
End-product	<ul style="list-style-type: none"> Cradle-to-cradle Improved end-product quality 	<ul style="list-style-type: none"> Improve efficiency through Lean Management Promote reliable cost and time plans by implementing Lean Construction

3. Empirical study Lean Design



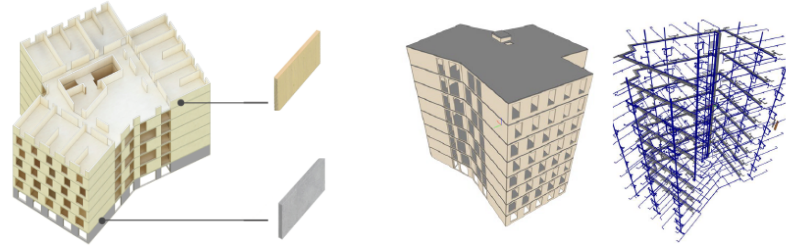
Specific timber construction expertise



Implementable planning

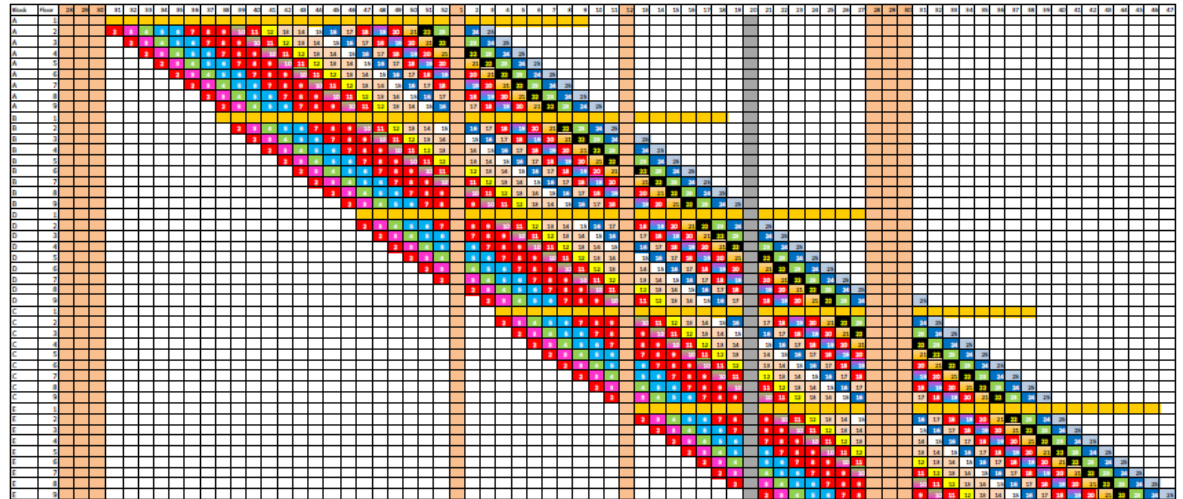
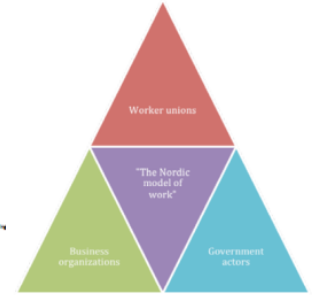
- Open System**
- Erne
 - Cree
 - Kaufmann Bausysteme
 - Elk Fertighaus
 - Binderholz
 - Storaenso
 - Dataholz
 - Baubook
 - Lignum Bauteil Katalog

4. Case studies Moholt 50|50, Norway



Timberable housing blocks from SIKKIS, internal works (translation from Norwegian)

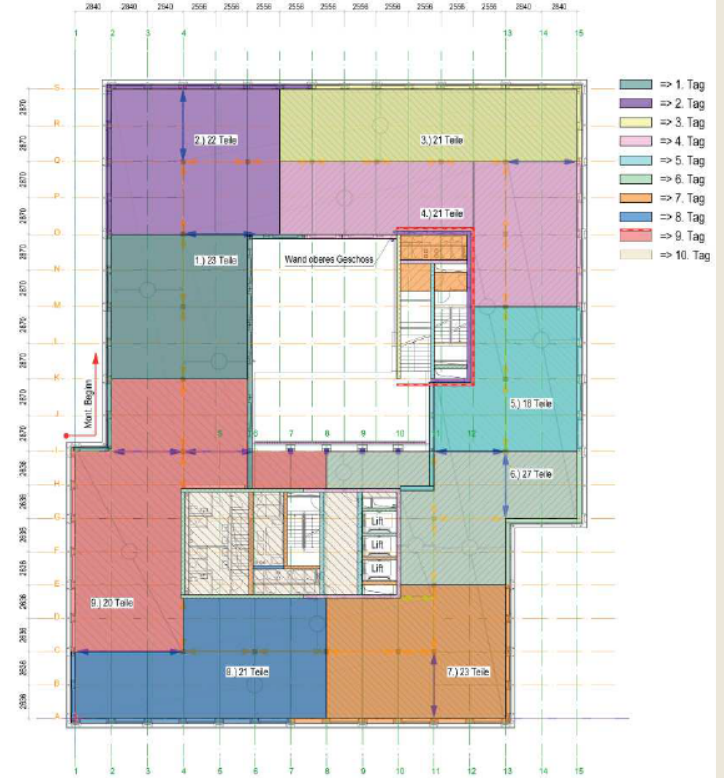
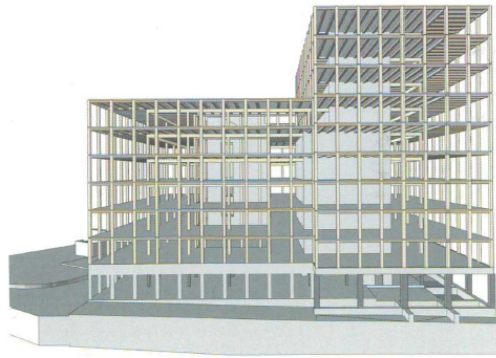
1	Building wall	16	Window	31	Roof	46	General: Ceiling cladding the ceiling
2	Window	17	Thicker walls	32	Roof	47	General: Final inspection and applying
3	Roofwork	18	Internal insulation Co, the kitchen	33	Ventilation	48	General: Final inspection and applying
4	Roofwork	19	Internal insulation Co, the kitchen	34	Roofwork	49	General: Final inspection and applying
5	Roofwork	20	Internal insulation Co, the kitchen	35	Roofwork	50	General: Final inspection and applying
6	Roofwork	21	Internal insulation Co, the kitchen	36	Roofwork	51	General: Final inspection and applying
7	Roofwork	22	Internal insulation Co, the kitchen	37	Roofwork	52	General: Final inspection and applying
8	Roofwork	23	Internal insulation Co, the kitchen	38	Roofwork	53	General: Final inspection and applying
9	Roofwork	24	Internal insulation Co, the kitchen	39	Roofwork	54	General: Final inspection and applying
10	Roofwork	25	Internal insulation Co, the kitchen	40	Roofwork	55	General: Final inspection and applying
11	Roofwork	26	Internal insulation Co, the kitchen	41	Roofwork	56	General: Final inspection and applying
12	Roofwork	27	Internal insulation Co, the kitchen	42	Roofwork	57	General: Final inspection and applying
13	Roofwork	28	Internal insulation Co, the kitchen	43	Roofwork	58	General: Final inspection and applying
14	Roofwork	29	Internal insulation Co, the kitchen	44	Roofwork	59	General: Final inspection and applying
15	Roofwork	30	Internal insulation Co, the kitchen	45	Roofwork	60	General: Final inspection and applying
16	Roofwork	31	Internal insulation Co, the kitchen	46	Roofwork	61	General: Final inspection and applying
17	Roofwork	32	Internal insulation Co, the kitchen	47	Roofwork	62	General: Final inspection and applying
18	Roofwork	33	Internal insulation Co, the kitchen	48	Roofwork	63	General: Final inspection and applying
19	Roofwork	34	Internal insulation Co, the kitchen	49	Roofwork	64	General: Final inspection and applying
20	Roofwork	35	Internal insulation Co, the kitchen	50	Roofwork	65	General: Final inspection and applying
21	Roofwork	36	Internal insulation Co, the kitchen	51	Roofwork	66	General: Final inspection and applying
22	Roofwork	37	Internal insulation Co, the kitchen	52	Roofwork	67	General: Final inspection and applying
23	Roofwork	38	Internal insulation Co, the kitchen	53	Roofwork	68	General: Final inspection and applying
24	Roofwork	39	Internal insulation Co, the kitchen	54	Roofwork	69	General: Final inspection and applying
25	Roofwork	40	Internal insulation Co, the kitchen	55	Roofwork	70	General: Final inspection and applying
26	Roofwork	41	Internal insulation Co, the kitchen	56	Roofwork	71	General: Final inspection and applying
27	Roofwork	42	Internal insulation Co, the kitchen	57	Roofwork	72	General: Final inspection and applying
28	Roofwork	43	Internal insulation Co, the kitchen	58	Roofwork	73	General: Final inspection and applying
29	Roofwork	44	Internal insulation Co, the kitchen	59	Roofwork	74	General: Final inspection and applying
30	Roofwork	45	Internal insulation Co, the kitchen	60	Roofwork	75	General: Final inspection and applying
31	Roofwork	46	Internal insulation Co, the kitchen	61	Roofwork	76	General: Final inspection and applying
32	Roofwork	47	Internal insulation Co, the kitchen	62	Roofwork	77	General: Final inspection and applying
33	Roofwork	48	Internal insulation Co, the kitchen	63	Roofwork	78	General: Final inspection and applying
34	Roofwork	49	Internal insulation Co, the kitchen	64	Roofwork	79	General: Final inspection and applying
35	Roofwork	50	Internal insulation Co, the kitchen	65	Roofwork	80	General: Final inspection and applying
36	Roofwork	51	Internal insulation Co, the kitchen	66	Roofwork	81	General: Final inspection and applying
37	Roofwork	52	Internal insulation Co, the kitchen	67	Roofwork	82	General: Final inspection and applying
38	Roofwork	53	Internal insulation Co, the kitchen	68	Roofwork	83	General: Final inspection and applying
39	Roofwork	54	Internal insulation Co, the kitchen	69	Roofwork	84	General: Final inspection and applying
40	Roofwork	55	Internal insulation Co, the kitchen	70	Roofwork	85	General: Final inspection and applying
41	Roofwork	56	Internal insulation Co, the kitchen	71	Roofwork	86	General: Final inspection and applying
42	Roofwork	57	Internal insulation Co, the kitchen	72	Roofwork	87	General: Final inspection and applying
43	Roofwork	58	Internal insulation Co, the kitchen	73	Roofwork	88	General: Final inspection and applying
44	Roofwork	59	Internal insulation Co, the kitchen	74	Roofwork	89	General: Final inspection and applying
45	Roofwork	60	Internal insulation Co, the kitchen	75	Roofwork	90	General: Final inspection and applying
46	Roofwork	61	Internal insulation Co, the kitchen	76	Roofwork	91	General: Final inspection and applying
47	Roofwork	62	Internal insulation Co, the kitchen	77	Roofwork	92	General: Final inspection and applying
48	Roofwork	63	Internal insulation Co, the kitchen	78	Roofwork	93	General: Final inspection and applying
49	Roofwork	64	Internal insulation Co, the kitchen	79	Roofwork	94	General: Final inspection and applying
50	Roofwork	65	Internal insulation Co, the kitchen	80	Roofwork	95	General: Final inspection and applying
51	Roofwork	66	Internal insulation Co, the kitchen	81	Roofwork	96	General: Final inspection and applying
52	Roofwork	67	Internal insulation Co, the kitchen	82	Roofwork	97	General: Final inspection and applying
53	Roofwork	68	Internal insulation Co, the kitchen	83	Roofwork	98	General: Final inspection and applying
54	Roofwork	69	Internal insulation Co, the kitchen	84	Roofwork	99	General: Final inspection and applying
55	Roofwork	70	Internal insulation Co, the kitchen	85	Roofwork	100	General: Final inspection and applying



4. Case studies

Risch Rotkreuz, Switzerland

Suurstoffi 22



5. Conclusions

HSB-Urgent value-adding goals	HSB-Strategies	Take-home-Strategies	Moholt 50 50	S22 + Arbo
DESIGN <ul style="list-style-type: none"> • Specific knowledge in design • Know-how exchange platform • Less constructive elements and details 	<ul style="list-style-type: none"> • Adaptive modular system • Open BIM • Integral catalog with all standard elements and assemblies (BIM library) 	<ul style="list-style-type: none"> • Early key decisions • BIM • Early involvement of the construction company 	<ul style="list-style-type: none"> ✗ From brick to CLT ✓ BIM model ✓ Vaidekke 	<ul style="list-style-type: none"> ✓ ERNE ✓ BIM model ✓ ERNE Building set libraries
PRODUCTION <ul style="list-style-type: none"> • Optimized logistic and coordination • Shorter production time 	<ul style="list-style-type: none"> • Lean Management • Competent handcraft 	<ul style="list-style-type: none"> • Lean Production • Kaizen. Jidoka 	<ul style="list-style-type: none"> ✓ Stora Enso 	<ul style="list-style-type: none"> ✓ ERNE
ERECTION <ul style="list-style-type: none"> • Faster assembly on site • Independence of weather • Optimized logistic and coordination • Null-error performance 	<ul style="list-style-type: none"> • Higher prefabrication grade • Use rainproof elements • Collective value-adding actions catalog • Shared and crossed specific training 	<ul style="list-style-type: none"> • Higher prefab grade • Concrete or surface • TTP • LPS 	<ul style="list-style-type: none"> ✗ CLT ✗ JIT (4days/floor) ✓ TTP for internal work ✓ Involved Planning 	<ul style="list-style-type: none"> ✓ Building blocks ✓ Concrete layer ✓ TTP ✓ LPS
COST-TIME <ul style="list-style-type: none"> • Reliable cost/time plans • Faster offers and comparability 	<ul style="list-style-type: none"> • Lean Construction 	<ul style="list-style-type: none"> • Off-site+4D+Libraries • Design-Bid-Build 	<ul style="list-style-type: none"> ✓ Preconstruction ✗ Rework / Redesign 	<ul style="list-style-type: none"> ✓ Preconstruction ✗ No comparable offers

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