New potential for composite technologies in buildings and infrastructure

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The building & infrastructure market provides various opportunities and potential applications for composite components. The AZL Aachen GmbH initiated a joint market and technology study entitled "New Potentials for Composite Technologies in Buildings & Infrastructure" to investigate market conditions, technology specifications and production improvements. A consortium gathering more than 25 companies and the researchers of the Aachen Centre for Integrative Lightweight Production (AZL) of RWTH Aachen University are working hand in hand to identify future drivers and business opportunities for composite applications as part of a proven and systematic study structure.

The general perception of composite applications is focused on the replacement of metal structures in the mobility-driven markets of automotive and aerospace. The key incentives for the development and usage of composite components in these fields are the reduction of weight and higher specific material strength and stiffness in order to improve vehicle characteristics and save fuel, and thus help reduce costs and comply with legal regulations. But a high strength-to-weight ratio is not the only potential benefit promised by the usage of composites. The diverse advantages beyond lightweight design, for example chemical resistance and low thermal expansion, in combination with traditional benefits, offer fascinating opportunities for additional markets.

Significance of the B&I market

The construction of buildings and infrastructure offers high potential to identify systems and components for a novel usage of composite structures. The construction sector is already a major sales market for the present fibre production. In 2014, buildings and infrastructure accounted for one third of the European glass fibre market and nearly one fourth of the global carbon fibre market. Furthermore, the market will benefit from a two-way development in the future: On the one hand, the accelerated development of production and material solutions (technology push) and on the other hand, a global change of market requirements and a growing demand for innovative solutions (market pull).
According to the Construction Intelligence Centre, in addition to the growing market share of composite applications, the entire B&I market expects continuous growth based on the megatrends of a growing global population, ageing buildings and infrastructure in developed countries and a major demand for new structures in developing and emerging countries. These potential applications provide a broad field of future opportunities for composite technologies in the building & infrastructure market.

The AZL study's approach

In order to implement a systemat-

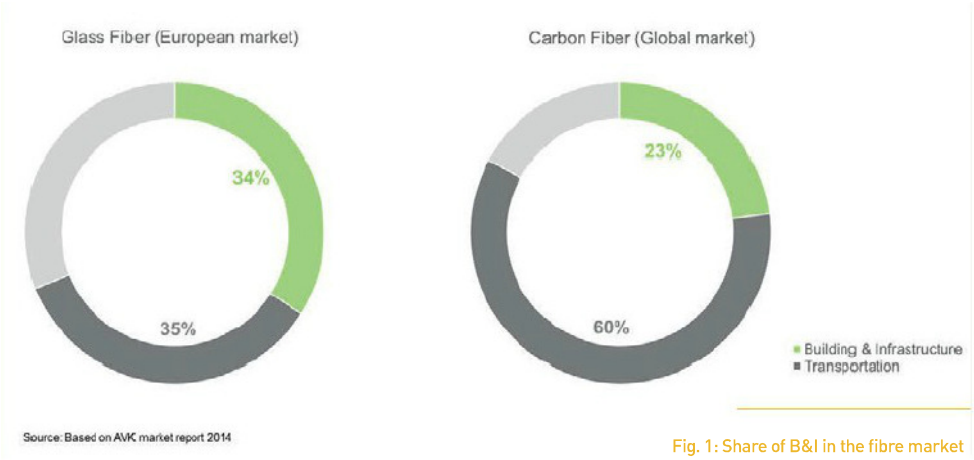

Fig. 1: Share of B&I in the fibre market

Fig. 2: Technology push and market pull

ic approach to identify the future business opportunities and current drawbacks of the considered industries, AZL Aachen GmbH designed a joint market and technology study with a project duration of six months. To involve various perspectives, different views will influence how the study is designed.

First, AZL's expertise in lightweight production was the basis for further investigations, representing the research perspective of the study's approach. The structural proceeding was proven in previous studies and is continuously developed by the researchers, based on participant feedback. Secondly, the AZL network partners and external industry partners provide industry-based input and discuss the opportunities and challenges during study meetings with the researchers in charge. Third, external experts are involved in every stage of the study's procedure, giving keynote speeches and participating in the meeting discussions.

The objective of the study is to establish a wide-ranging overview of market opportunities and a theoretical evaluation of composite applications from market and technology perspectives. For a selection of composite components, detailed business cases are handed over to the participants regarding market opportunities, technology specifications and production possibilities. To face one of the next vital challenges for composites in construction, it is necessary to find mass production opportunities compared to the common pilot or lighthouse projects.

To get a differentiated picture of such a broad field of topics and perspectives, the most promising approach is, according to AZL's experience in research and industry-driven projects, to design a consortium study in order to include various know-how and requirements. Additionally, the participants share the research and investigation costs, so that the cost per participant remains at a decent level. The consortium structure provides diverse networking opportunities, in addition to the booked study content, in every meeting during the different stages.

General structure of the study

The study includes three main phases. The first phase, the pilot study, is a large-scale analysis of the markets of interest. It describes the entire inspection area and contains a market segmentation and a market breakdown, down to the component and application level. In the next phase, a detailed analysis of selected components is compiled, considering the technological and market perspectives. The last stage provides detailed business cases of high-potential components, analyzing the value chain and the cost structure of the production process.

Pilot phase

The study started with a kick-off meeting in November 2016. It was the first meeting of the consortium, introducing the study's approach. The participants had the opportunity to influence the results directly using a questionnaire. At the beginning of the pilot phase, the two main markets were segmented into 20 different market segments. Each market segment was investigated as a segment profile and was subdivided into specific sub-segments. The result was a collection of 66 different sub-segments. To focus on the most promising parts, a transparent and comprehensive selection method and scoring tool were used, which evaluated and selected the sub-segments with the highest potential. For the chosen 27 sub-segments, the current and future applications and components were documented in a so called "technology tree" for each sub-segment. A "technology tree" includes a visualization of the main specific challenges, systems and components. At the end of

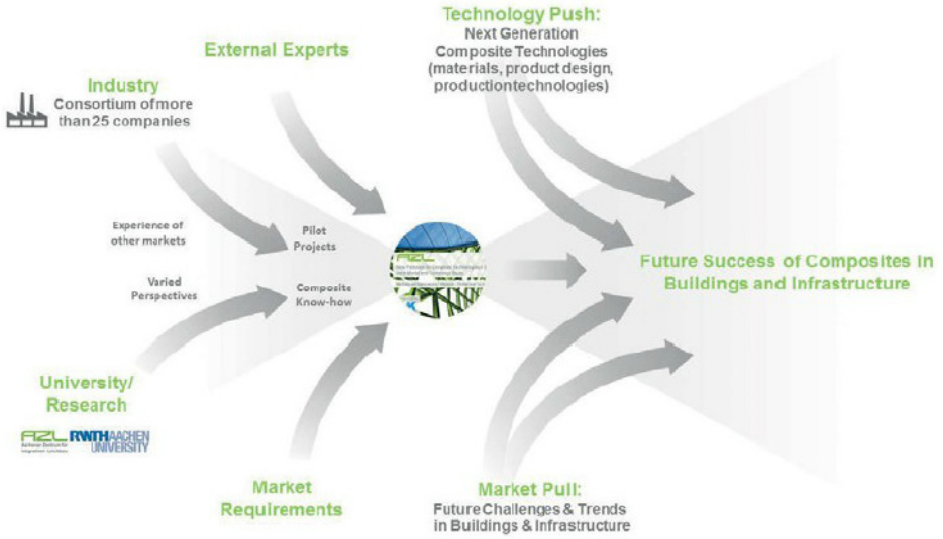

Fig. 3: A systematic study approach

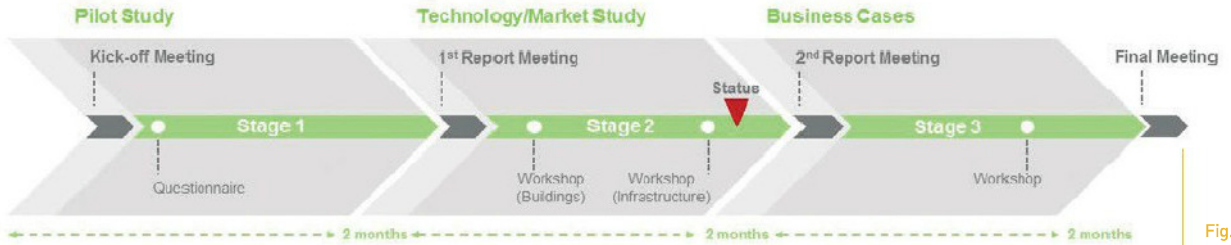

Fig. 4: Study proceeding

the pilot phase, 438 applications and components and a catalogue of 40 main challenges were presented to the participants. During the first report meeting, the participants had the opportunity to vote, after the presentation and discussions with the researcher in charge, for the components and applications of their personal interest. The vote resulted in a selection of 25 high-ranked components, which were qualified for the next stages of investigation in the subsequent phases.

Market and technology analysis

The second project phase is currently in process. It started with two workshop meetings to discuss the selected components within the consortium and to record and document participants' input. During the workshops, external experts will be included to provide additional expertise in the market-specific meetings. They will give keynote presentations and answer the questions of the consortium members. To document the results of the second project phase, an evaluation of the selected components will be compiled based on market-and technology-driven criteria. To start the detailed analysis, component information such as geometrical dimensions, norms and standards as well as a description of the value chain will be specified. During the second report meeting, the participants will have the opportunity to vote again for their favourite components. During this selection period, the number of components will be reduced from 25 to 10.

Business cases

The last stage of investigation is based on the business cases of the 10 highest ranked composite components. Through the different stages, information will be collected regarding the individual components and the following business cases will be built on this database. A final business case will contain a market summary, an overview of the potential critical technological requirements and a documentation of competitive technologies and materials. Furthermore, an analysis of the properties of the current production process, a recommendation for future process improvements and a calculation of the cost structure will be documented. At the end of the study, the participants will have a systematic and structured overview of market conditions and technological opportunities. In addition to the documentation, they will benefit from the experience gained from the discussions and the expert input they get during the different stages.

The future of composites in B&I

Composite components have been used in construction for years, but they are still niche products, rarely used in a market traditionally dominated by wood, steel and concrete. Only in minor segments, such as concrete strengthening or sewer renovation, are composites the current state of the art. But if the specific advantages of composite products are worked out, standards and regulations are established and the required customer confidence is created, the construction sector can provide diverse business opportunities for composite materials and components. Especially considering the current development of market conditions and technological opportunities, composite solutions can increase their market share and widen their field of application.
With time still remaining to join AZL's joint market study on New Potentials for Composite Technologies in Buildings & Infrastructure, this could be the start for further industrial project partners. ❑

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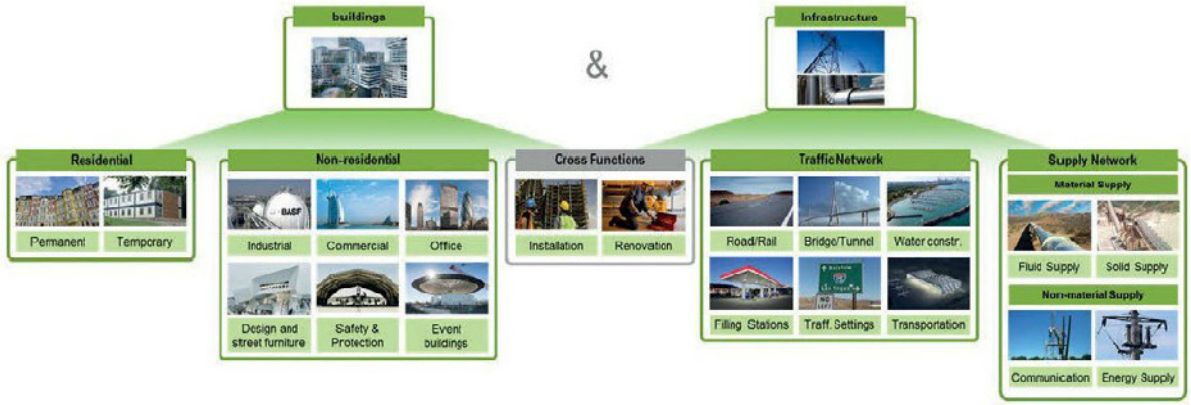

Fig. 5: Market segmentation