

# *EPC Capabilities of German Companies in Construction and in Mechanical and Plant Engineering Industries*

## **Summary of the Study**

*On behalf of the German Federal Ministry for Economic Affairs and Energy*



**EPC Capabilities of German Companies in Construction and in Mechanical and Plant Engineering Industries**  
Published by PricewaterhouseCoopers GmbH Wirtschaftsprüfungsgesellschaft (PwC)

July 2017, 40 pages, 20 figures, softcover

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# List of abbreviations

ARGE	Working group (Arbeitsgemeinschaft)
ASEAN	Association of South East Asian Nations
BIM	Building information modelling
BMUB	Federal Ministry for Environment, Nature Conservation, Building and Nuclear Safety
BMVI	Federal Ministry of Transport and Digital Infrastructure
BMWi	Federal Ministry for Economic Affairs and Energy
BOT	Build operate transfer
BOOT	Build own operate transfer
BRICS	Brazil, Russia, India, China, South Africa
CAPEX	Capital expenditure
CIRR	Commercial Interest Reference Rates
CP&I	Capital Projects and Infrastructure
e.g.	For example
ECA	Export Credit Agency
EPC	Engineering procurement construction
etc.	et cetera
EU	European Union
Fig.	Figure
G20	Group of the Twenty Largest Industrialised and Emerging Economies
GII	Global Innovation Index
GDP	Gross domestic product
GTAI	German Trade and Invest
HDB	Hauptverband der Deutschen Bauindustrie e.V.
IPEX	International Project and Export Financing
KfW	Kreditanstalt für Wiederaufbau
KPI	Key performance indicator
M&A	Mergers and acquisitions
OECD	Organisation for Economic Co-operation and Development
PBC	Performance-based contracting
PBL	Performance-based logistics
PPP	Private public partnership
PwC	PricewaterhouseCoopers GmbH Wirtschaftsprüfungsgesellschaft
R&D	Research and development
SME	Small and medium-sized enterprises
TCO	Total cost of ownership
TICAD	Tokyo International Conference of African Development
TML	Transmanch Link
UFK	Untied loan guarantee scheme
UKEF	United Kingdom Export Finance
USA	United States of America
VBI	Verband Beratender Ingenieure
VDB	Verband der Bahnindustrie in Deutschland e.V.
VDMA	Verband Deutscher Maschinen- und Anlagenbauer e.V.
ZVEI	Zentralverband Elektrotechnik- und Elektronikindustrie e.V.



# Executive summary



analysis  
covering  
**75%**  
of the EPC  
market in  
Germany

**40**  
experts were  
interviewed

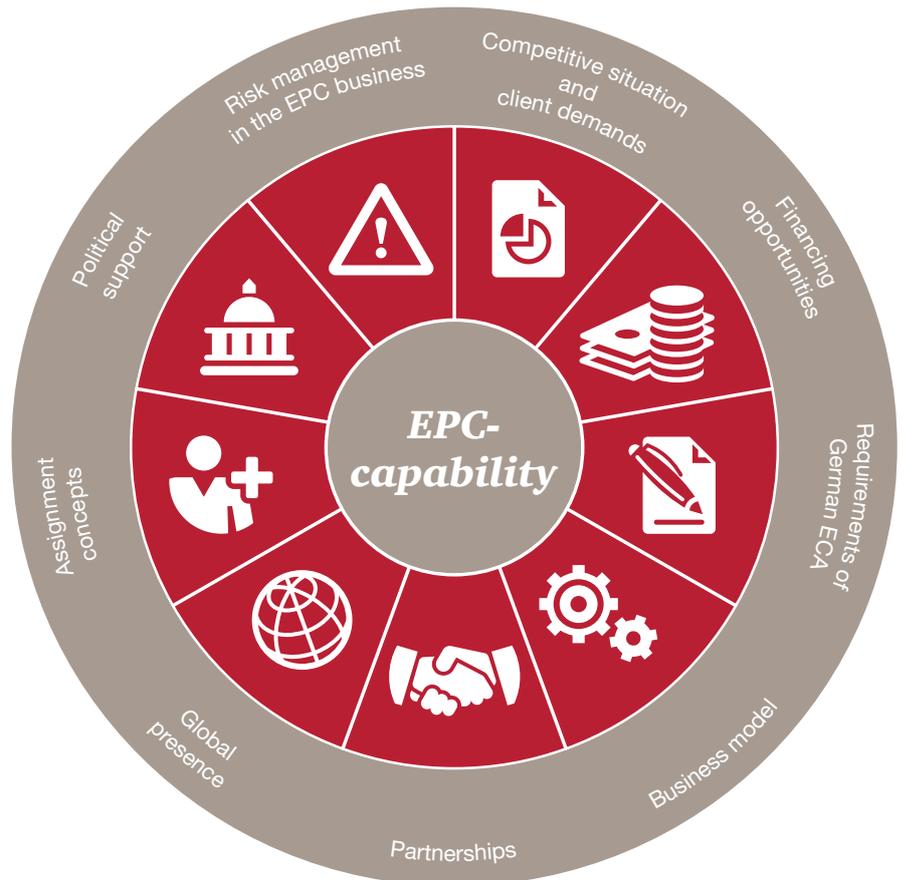
Major international projects in the German construction industry and mechanical and plant engineering sectors play an integral role in establishing and maintaining economic relationships between Germany and other countries. These projects ensure that “made in Germany” continues to be perceived as a mark of quality, reliability and innovation. Against this backdrop, the decline in order intake for turnkey EPC projects<sup>1</sup> for large-scale plant construction<sup>2</sup> and the loss of market share for German companies on the international stage causes some concern. EPC business is turning into a buyers’ market, with clients gaining greater influence resulting in tender conditions having to be accepted unconditionally by contractors, including state-imposed or client-defined local content or nominated sub-suppliers. In addition, EPC providers are also being called upon to offer attractive financing packages.

<sup>1</sup> EPC refers to engineering, procurement and construction projects provided by a general contractor or a group of companies providing individual parts of the project and services (known as second- and third-tier EPC companies).

<sup>2</sup> “Large-scale plant construction” refers to companies providing industrial plants and systems worth at least EUR 25 million.

The aim of this study is to strengthen the competitiveness of EPC providers in Germany. To do so, we have analysed the strengths and weaknesses of German EPC providers against international peers and developed recommended courses of action in the areas of politics, industry and science and research. This study contains a representative quantitative and qualitative analysis covering 75% of the EPC market<sup>3</sup> in Germany. A total of 40 experts were interviewed to validate the identified focal points, including high-profile executives from the industrial sector and representatives of organisations promoting foreign trade. A standardised evaluation was conducted of German EPC providers' EPC capabilities using the nine identified critical success factors (see also Fig. 1). The evaluation of the nine success factors provided varied results. In terms of global presence, German EPC providers enjoy an advantage over their competitors. German SMEs especially have a significantly stronger global presence than their competitors, particularly those from Asia. The four success factors with the greatest difference between German providers and international competitors or rather influence on EPC capabilities are financing opportunities, political support, business model and partnerships.

**Fig. 1 Overview of the nine critical success factors**



Source: PwC

<sup>3</sup> In terms of revenue.

German EPC providers are extremely cautious when it comes to financing, with only 6% of surveyed companies offering such services on a regular basis. However, an increasing number of clients expect EPC providers to also offer some form of financing. Some international competitors have greater state support or also offer equity in some cases. Targeted political support of EPC providers in establishing business relations is becoming increasingly important in the international EPC market. Asian providers, and also those from Southern Europe, are tending to leverage the scope afforded by political support in their home countries.

SMEs in particular are not satisfied with the level of political support offered at the moment, even if a variety of initiatives and measures have been initiated by politicians and associations. Client requirements when it comes to EPC business models now extend beyond the classic EPC project framework and include elements such as operation and financing services. German EPC providers are not yet able to meet these requirements in full. The integration of a cooperation partner at an early stage of the project was also identified as a success factor. German EPC providers are very willing to enter into partnerships, however only a small number of these partnerships ever come to fruition. Germany lags behind its competitors (particularly Spain, Japan and South Korea) when it comes to national cooperation.

The six fields of action consist of specific recommended courses of action prioritised according to their implementation time and effect on EPC capabilities. The courses of recommended action with the highest priority are “Establish a digital cooperation platform,” “Competency centre: digital project management”, “Strengthen market development” and “Develop financing opportunities”. The benefit of a digital cooperation platform is that it can act as a central platform for EPC business in Germany. It leverages efficiencies by reducing administrative workload, promoting cross-industry dialogue and acting as a medium for communication between the worlds of politics, industry and science and research. Establishing a competency centre for digital project management would allow innovators, start-ups, scientists, researchers and EPC providers to pool their competencies and pave the way for cooperation on a variety of new and innovative solutions in a test environment.

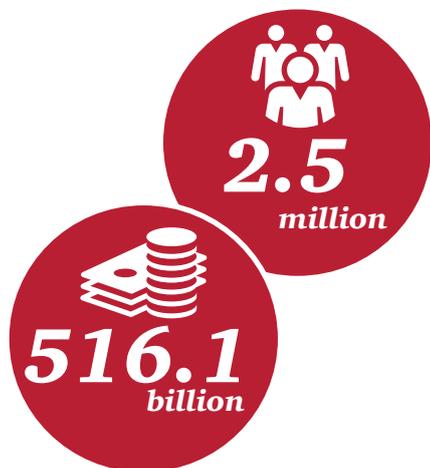
Digital competency centres are one way of achieving this; this model has already been implemented in other sectors and is being contemplated in the case of the potential BIM competency centre. Existing initiatives to strengthen German SMEs' presence in international markets could be promoted with more vigour in order to realise the potential of initiated programmes and initiatives geared towards to the SME market. Growing demand for financing (client requirement) and existing offers from competitors can be taken into consideration by expanding state export support. This way, state-financed support programmes could be developed with long-term lending at discounted terms. This includes the CIRR ERP Export Financing Program, which is run by KfW IPEX Bank on behalf of the German federal government, and increasing the flexibility of the untied loan guarantee scheme (UfK).

**Fig. 2 Overview of six courses of recommended action**



Source: PwC

# Starting point



## **Background and aims**

Major international projects in the German construction industry and mechanical and plant engineering sectors play an integral role in establishing and maintaining economic relationships between Germany and other countries. These projects ensure that “made in Germany” continues to be perceived as a mark of quality, reliability and innovation. By building advanced infrastructure all over the world, German construction and mechanical and plant engineering firms lay the foundations for future trade relations and exports of German companies.

Major international projects are predominantly focused in five sectors (see also Fig. 3), which, with just under 2.5 million employees<sup>4</sup>, generate annual revenue totalling around EUR 516.1 billion<sup>5,6</sup>, and contribute some 19%<sup>7</sup> of gross value creation in Germany. They are a key driving force of the German economy and the prosperity of the country as a whole.

**Fig. 3 Industry overview**



Source: PwC

Against this backdrop, the decline in order intake for turnkey EPC projects<sup>8</sup> for large-scale plant constructions<sup>9</sup> and the loss of market share for German companies on the international stage causes some concern. Over the past few years, an increasing number of high-profile public-sector and industrial EPC projects have hit the headlines due to significant cost and schedule overruns. This has resulted in some supervisory boards changing their focuses and attitudes towards EPC business. In addition, pressure is rising on German companies in a competitive market due to an increasing number of international competitors. A number of important economic development indicators point to reticence in terms of investment worldwide. The decline in demand and the rise in the number of suppliers around the world means that the global EPC market has become a buyers' market. Requirements in terms of the flexibility and scope of services offered by construction and systems engineering companies are therefore becoming increasingly varied. Sometimes these requirements even come in the form of tender terms that contractors must accept unconditionally (known as clean bids). State-ordered local content or sub-suppliers nominated by the client are also an expression of the power wielded on the client side. Last but not least, the provision of appealing financing packages is becoming increasingly important in attracting future projects.<sup>10</sup> Our study was geared towards taking a closer look at these developments and observations. To do so, we scheduled a nine-month study period with a four-phase approach (see also Fig. 4).

<sup>4</sup> Around 800,000 employees in the construction industry according to Hauptverband der Deutschen Bauindustrie (HDB) and, according to the Verband Deutscher Maschinen- und Anlagenbau (VDMA), around 1 million employees in the mechanical and plant engineering industry.

<sup>5</sup> See also HDB Baudatenkarte 2016, EUR 101 billion attributable to the construction industry

<sup>6</sup> See also the Cologne Institute for Economic Research, Die Industrie ist Deutschlands Standbein 2016. EUR 235 billion attributable to the mechanical and plant engineering industry, EUR 167 billion to the electronics industry, EUR 12.3 billion to the rail industry and EUR 0.8 billion to the planning and consultancy industry.

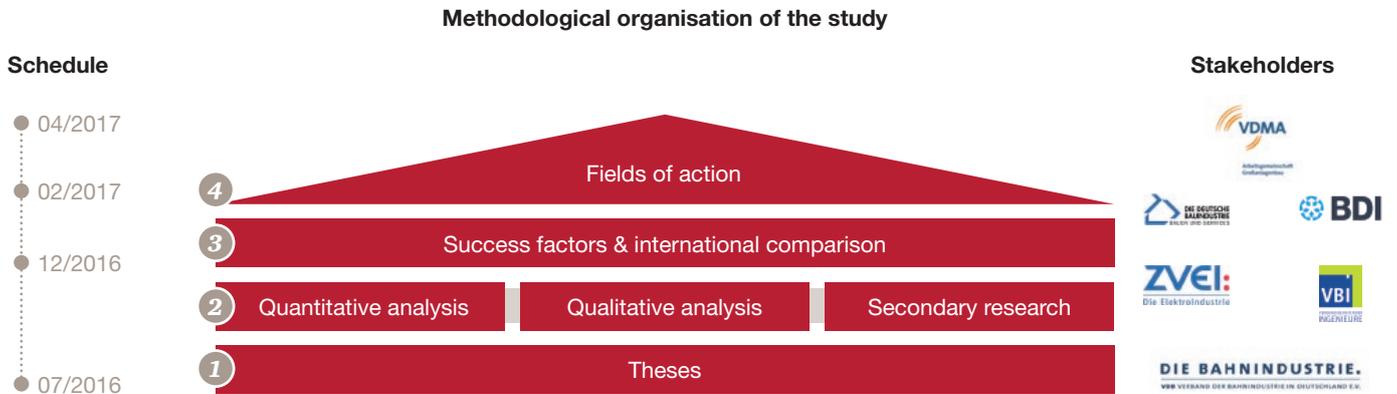
<sup>7</sup> Calculation: EUR 516.1 billion / EUR 2,722.5 billion (reference figure for gross value creation); PwC calculation of gross value creation on factor costs on the basis of data provided by the Federal Statistical Office (Destatis).

<sup>8</sup> EPC refers to engineering, procurement and construction projects provided by a general contractor or a group of companies providing individual parts of the project and services (known as second- and third-tier EPC companies).

<sup>9</sup> "Large-scale plant construction" refers to companies providing industrial plants and systems worth at least EUR 25 million.

<sup>10</sup> See also Willershausen et al. 2014

**Fig. 4 From theory to courses of recommended action**



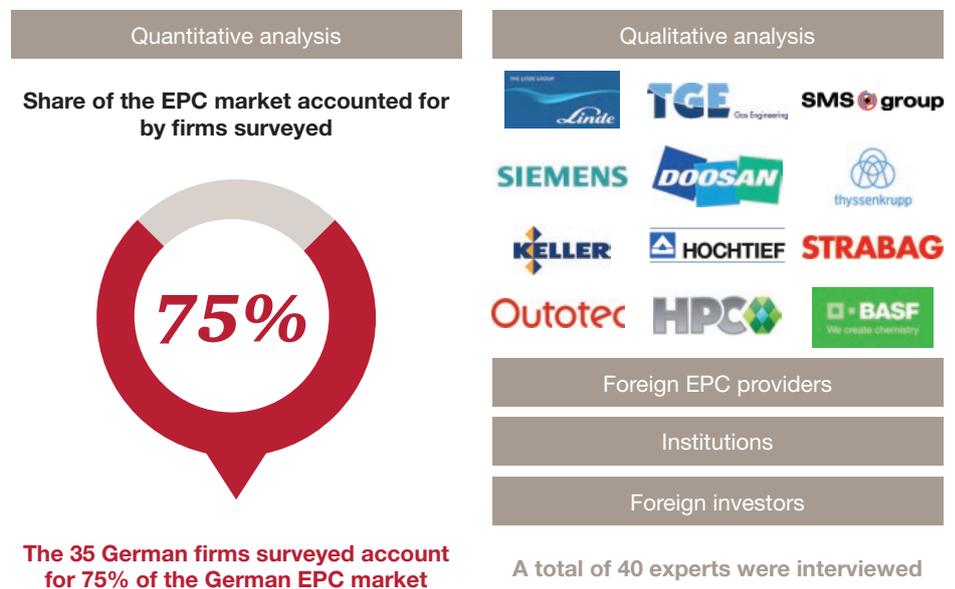
Source: PwC

Industry associations provided support in the study from Phase 1 – Theses to Phase 4 – Deriving recommended fields of Action in order to ensure that their interests were taken into consideration in the best possible manner. In addition, key stakeholders in the EPC market were also questioned as part of a quantitative and qualitative analysis. In total, 35 firms participated in the quantitative analysis.



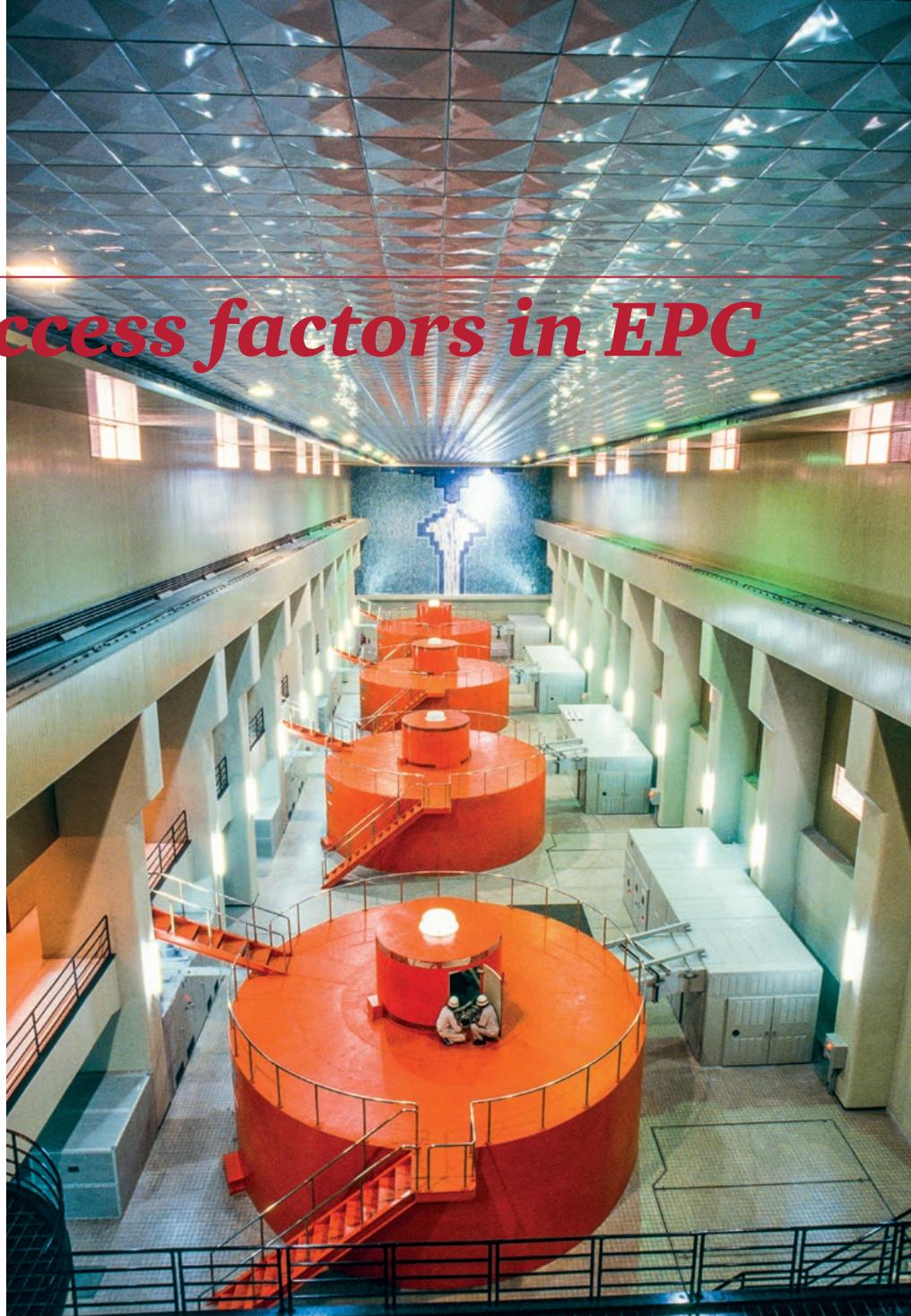
One positive element in this regard was that the participating firms accounted for a share of over 75% of the German EPC market (see also Fig. 5). The international comparison was a key factor in deriving the strengths and weaknesses of German EPC providers. The US, Japan, Spain, South Korea, China and Turkey were highlighted as the most important comparison and competition countries. Together with Germany, they are responsible for 65.4% of global international revenue generated by the world's 250 largest construction companies. This selection combines established industrialised economies (the US and Japan), economies that have developed consistently over the past 30 years (Spain and South Korea) and emerging nations with extremely dynamic economic growth (Turkey and China). This group enables a comprehensive comparison to be made, which constitutes one of the pillars in the process of deriving courses of recommended action.

**Fig. 5 Coverage of the EPC market by the quantitative and qualitative analysis**



Source: PwC

# *Critical success factors in EPC business*



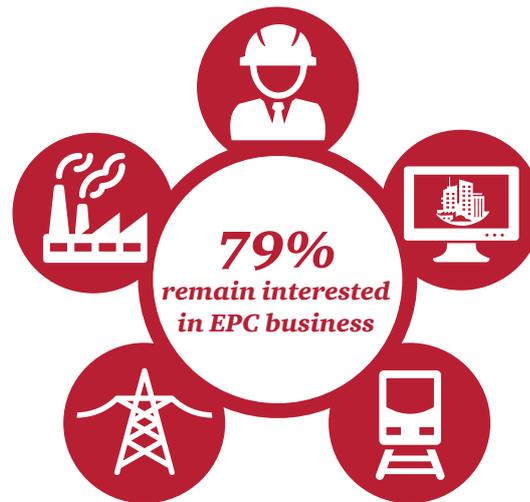
**79%**  
*remain interested  
in EPC business*

Due to the significant (technical) complexity of EPC business, EPC providers' risk profiles go far beyond the scope of normal supply business. In addition, project volumes are so high that individual projects and associated risks can jeopardise a company's existence and so each project is approved or rejected on a case-by-case basis.

Striking a balance between taking sufficient financial account of risks and offering competitive prices in a price-sensitive market poses a further challenge. This has resulted in supervisory boards changing their focuses and attitudes towards EPC business. Companies and supervisory boards are viewing the decision as to whether or to what extent companies conduct EPC business with increasing scepticism.

In the quantitative analysis, it was found that 79% of companies surveyed remain interested in EPC business. In fact, 44% of companies declared that their interest in EPC business had increased. That is why EPC capabilities are to be analysed, in addition to interest in EPC projects, so that the reasons for falling revenue and market shares of German EPC providers can be identified.

**Fig. 6 Interest of German companies in EPC business**



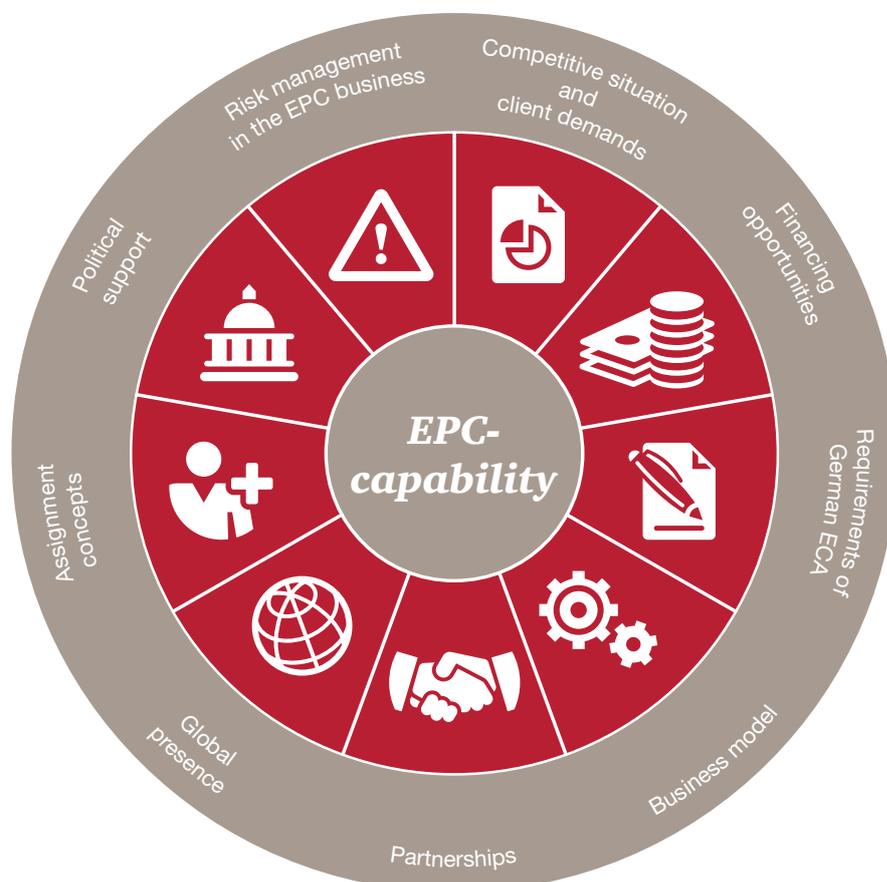
Source: PwC analysis, assessment of company survey

German construction and mechanical and plant engineering companies' capabilities are primarily dependant on the nine critical success factors (see also Fig. 7). An analogue procedure was chosen for the evaluation, in which a quantitative analysis was conducted to determine focal points and a qualitative analysis then performed to dive deeper into the focal points and identify other relevant issues. The international comparison was conducted to identify the strengths and weaknesses of German EPC providers, present the need for action and derive recommended courses of action. The nine success factors show mixed trends for EPC providers, from advantages to disadvantages, or a balanced picture. In terms of global presence, German EPC providers enjoy an advantage over their competitors. The difference was particularly large in the SME sector. This is particularly due to the fact that German SMEs act independently and without any ties to major EPC providers, unlike international competitors (particularly Japan and South Korea).

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**Fig. 7 Overview of the nine critical success factors in EPC business**


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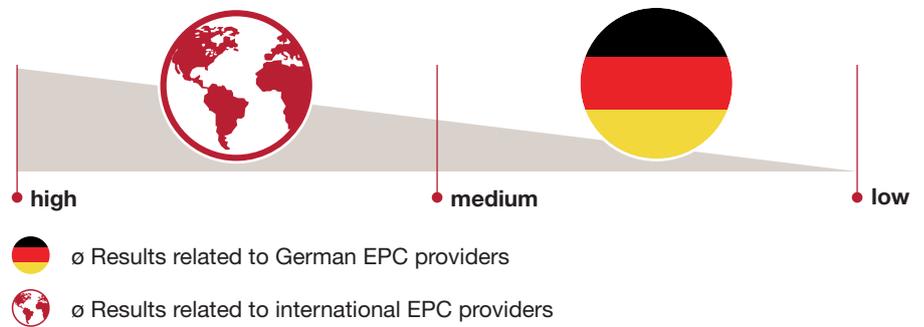
Source: PwC

Overarching developments, such as the emergence of a buyers' market, have a variety of implications that affect EPC capabilities. The buyers' market means that potential clients and investors are attempting to push larger risk profiles onto EPC providers. The study found that German EPC providers have not become more risk-averse over the past five years. They have, however, begun to assume larger risk profiles due to the increasing transfer of risks from client to EPC provider. In spite of this, the international comparison shows that competitors have a greater risk appetite. This risk appetite has fallen over the past few years, which can especially be seen in the case of South Korean competitors. Local content is another expression of market power; this has a huge influence on procurement management, the global project management concept and local costs eligible for export credit insurance. The success factors showing the greatest differences or rather influence on EPC capabilities are shown in detail as follows.

### Financing opportunities

Banks are finding it increasingly difficult to finance long-term projects due to stricter regulation of the financial sector (through Basel III and Basel IV, among other regulations). Regulatory requirements, particularly those concerning equity underpinning, mean that banks are less willing to provide long-term, capital-intensive loans to finance EPC projects. In addition, market conditions can impact the profitability of projects and make them more difficult to finance. For instance, in the case of raw material extraction projects, a fall in prices for the end product lead to reduced project revenue with no reduction in costs, therefore meaning that less cash flow is available to repay funding.

**Fig. 8 International comparison of financing opportunities**

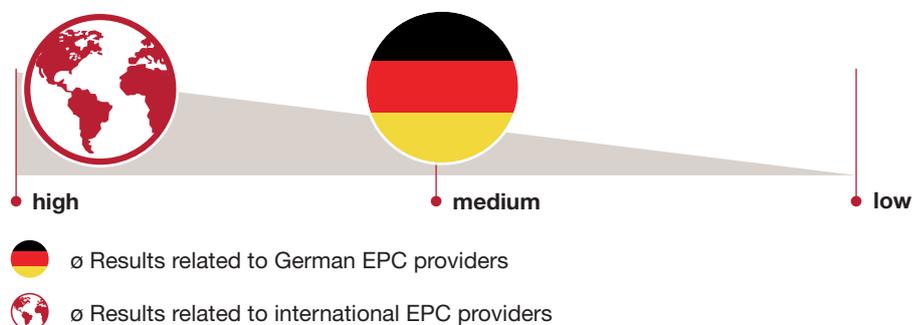


Source: PwC analysis, assessment of company survey

Industrial stakeholders believe that restrictive framework conditions are lowering banks' willingness to lend. Due to international economic sanctions, banks cannot grant loans for EPC projects in sanction-affected countries. This analysis leads us to draw the following conclusions: German EPC providers are extremely cautious when it comes to financing, with only 6% of surveyed companies regularly offering such services. However, an increasing number of clients expect EPC providers to also offer some form of financing. Some international competitors have greater state support or also offer equity to finance projects in some cases.

### Political support

Targeted political support of EPC providers in establishing business relations is becoming increasingly important in the international EPC market. Asian providers in particular, but also those from Southern Europe, are tending to leverage the scope afforded by political support in their home countries. In doing so, they draw on established business relationships that go back many years and intensify high-profile political contacts in target markets relevant to them. Germany pursues the tried-and-tested three-pillar model when it comes to promoting foreign trade. Calls for greater political support are nothing new in Germany, however the issue is taking on a different dimension due to the fact that an increasing number of clients expect political support, while competitor countries are even more active in their project acquisition policies.

**Fig. 9 International comparison of political support**

Source: PwC analysis, assessment of company survey

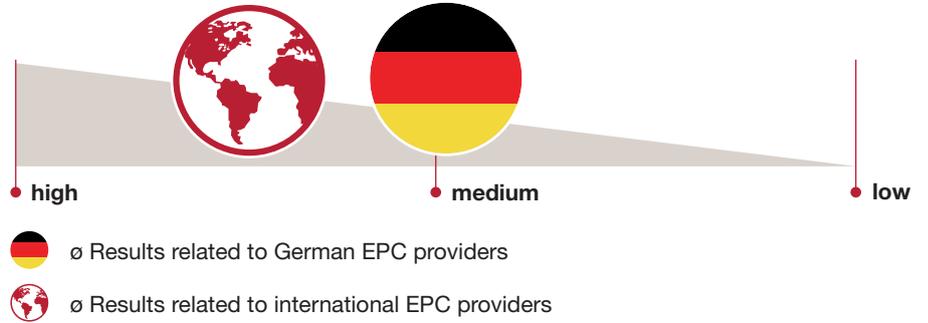
More and more major projects are being initiated in target markets through political influence. The quantitative analysis shows that more than half of companies surveyed (53%) feel that they do not receive enough political support. It is particularly striking that SMEs in particular are not satisfied with the level of political support. However, it should be noted in this respect that foreign trade promotion instruments (such as the German Chambers of Commerce Abroad and Germany Trade and Invest) are used in extremely different ways and a higher percentage of industrial firms (32% of those surveyed) said that they were satisfied with the level of political support.

### **Business model**

In determining the breadth of value creation, there is friction between standardising and differentiating products and services. In this respect, a broad range of products and services is suited to providing the “one-stop solutions” an increasing number of clients demand. However, companies also find it challenging to establish these competencies or to acquire them by entering into targeted partnerships. On the other hand, a narrower range of products and services opens up the opportunity to leverage risk-mitigation and cost-cutting potential through standardisation and repetition, but is also linked with the risk of not being able to cover all client requirements.

Client requirements now extend beyond the classic EPC project framework and include elements such as operation and financing services. German EPC providers have significantly expanded their service business over the past five years, despite the ongoing reticence in terms of financing and operational services. Besides the breadth of value creation on offer, the assessment of a company’s own capabilities and changes in client requirements was another focus of the quantitative and qualitative analysis. Digital project management is particularly noteworthy in this case.

**Fig. 10 International comparison of breath of value creation**



Source: PwC analysis, assessment of company survey

40% of German EPC providers believe that they do not meet or do not sufficiently meet clients' requirements for digital project management. In addition, 50% of surveyed firms stated that competitive pressure in the area of digital project management had increased (47%) or increased significantly (3%) (see also Fig. 11). This viewpoint of the potential implications of digitalisation is worth noting. Digitalisation has a disruptive effect, with the potential to make business models obsolete or pave the way for new strategies. As a result, German EPC providers must re-evaluate their own business models against the backdrop of digitalisation and make use of new, digital opportunities. In the qualitative analysis, it was found that companies feel that predictive maintenance, 3D printing and building information models (BIM) create the greatest added value for EPC business.

**Fig. 11 Digital project management is in need of development**

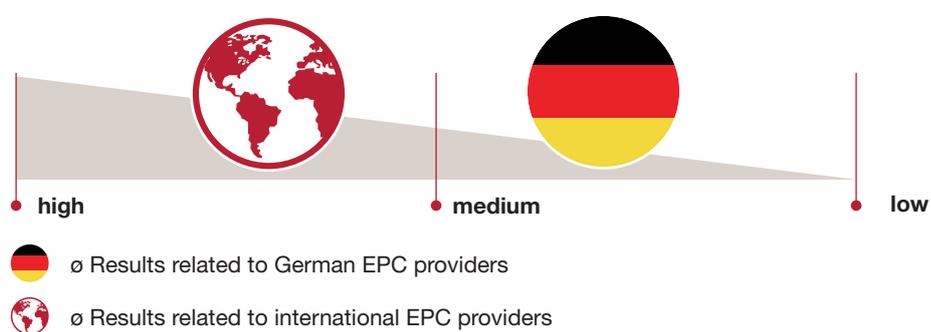


Source: PwC analysis, assessment of company survey

### Partnerships

Partnerships are an effective means for German EPC providers to expand their project portfolio, technical capabilities and local expertise while cutting costs and sharing potential risks. The mega-project trend is reinforcing the need for partnerships. Potential for cost optimisation can be leveraged along the entire value chain and originate from traditional savings in terms of wages (e.g. through partnerships with firms in low-wage countries) or from improving efficiency (e.g. shorter project durations).

**Fig. 12 International comparison of the number of national partnerships**



Source: PwC analysis, assessment of company survey

Integrating partners at an early stage was identified as a success factor in the quantitative analysis. German EPC providers are very willing to enter into partnerships, however only a small number (<25%) of these partnerships ever come to fruition. Germany lags behind its competitors (particularly Spain, Japan and South Korea) when it comes to national cooperation. The construction sector in particular has made a special effort to increase the number of national partnerships.





## ***Market potential and trends in EPC business***

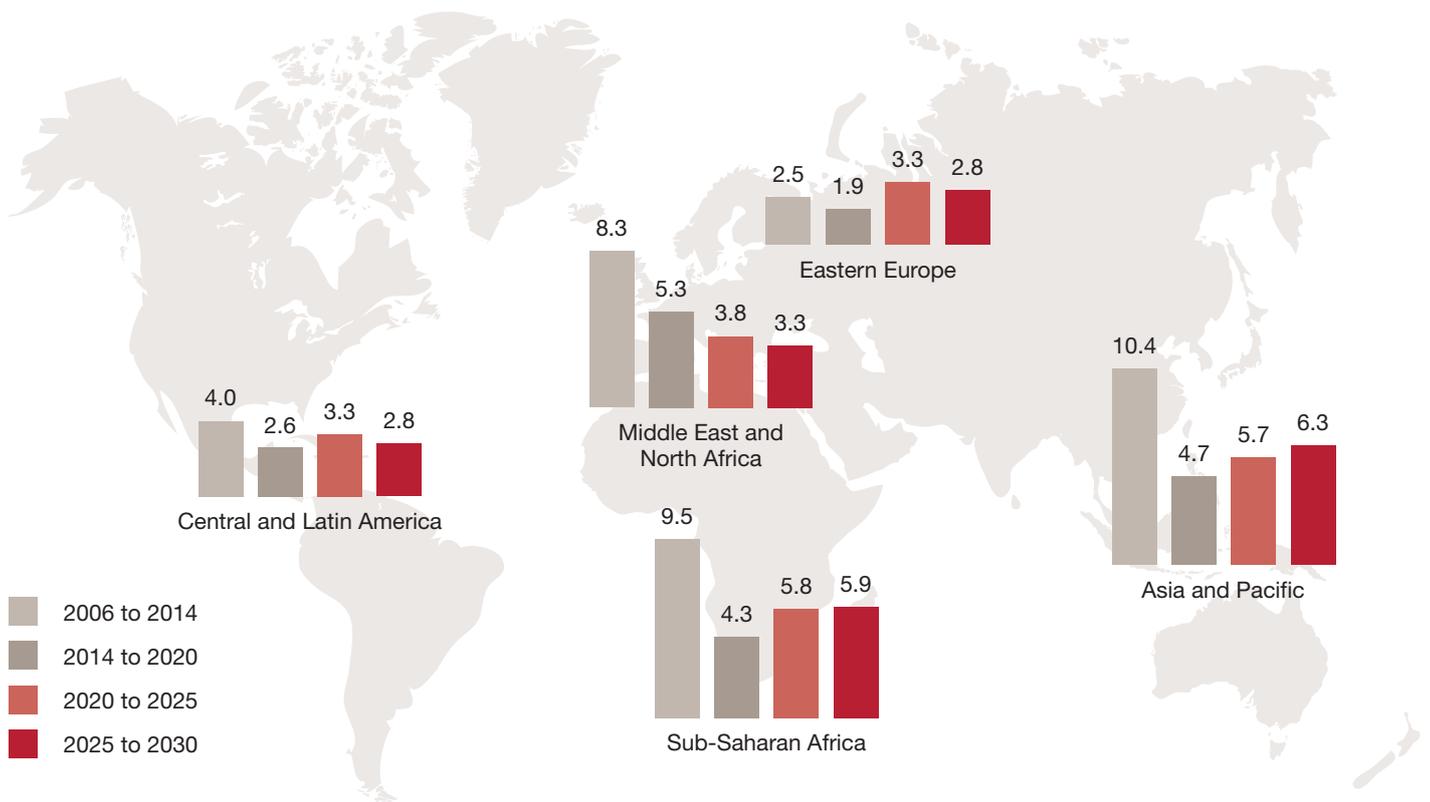
### ***EPC market potential***

The EPC market is slowly becoming a buyers' market. A buyers' market develops either as a result of a drop in demand or a rise in supply, or if both of these elements combine. Over the past ten years both effects have been registered, meaning supply has indeed risen while demand has fallen. New supply capacities have entered the market over the past decade, with the majority of new competitors emerging from China, Turkey and South Korea. Companies from these countries pursue a strong international approach and are systematically expanding their competencies from the low-tech segment to taking on complex and challenging projects.

Their gains in market share have outstripped the growth of the market as a whole. There has been a significant decline in demand over the past few years. The implications of the financial and sovereign debt crisis remain a factor. National budgets are under strain in many countries, while the requirements when it comes to project financing have risen. What’s more, demand for large-scale plant construction has also dipped in many commodity-exporting emerging markets. As a result, it is important that markets offering the greatest growth potential are identified. These markets are located in higher-risk emerging and developing countries.

The potential of the EPC market is based on three key macroeconomic factors: population growth, economic growth and price stability in sales markets. Furthermore, political stability and (legal) security also play a key role. Market analysis shows that markets have transferred to BRICS countries over the past decade and EPC markets in ASEAN states and in Africa have gained momentum. These regions also boast the fastest and largest population and economic growth and, as a consequence, also the greatest demand for residential, transportation, industrial and energy infrastructure.

**Fig. 13 Growth in construction activities in emerging and developing markets in %**



Source: Global Construction Perspective and Oxford Economics, Global Construction 2030

### **Trends in EPC business**

Due to a variety of trends, the EPC market finds itself in a constant state of flux and must be analysed closely to determine how German EPC providers are positioned to tackle future market challenges.

Six key trends in EPC business were identified in the study (see also Fig. 14). The study is particularly focused on the influence of the six factors on the EPC capabilities of German EPC providers.

**Fig. 14 Overview of the six trends in EPC business**



Source: PwC

### **1. Mega-projects**

Mega-projects are EPC projects with a volume > EUR 0.5 billion or > USD 1 billion. Increases in project volumes mean that guarantees to hedge project risks are also rising and, as a result, the financing potential of specialist firms is soon exhausted. Simply from a commercial perspective, mega-projects require the burden to be shared across several project stakeholders. Besides project volume, the complexity of modern technology is also a reason for the greater need for partnerships. Technology always requires a certain degree of specialisation. Taken as a whole, the specialist skills required for modern projects can no longer be provided by a single party.

### **2. Manage contractual models**

Performance-based contracting (PBC) and pay-per-use are particularly important among the “new” contractual models. These models not only represent a new type of contract, they are also based on a brand-new business model.<sup>11</sup> These models can be understood as a concept in which the client only pays for services on a time and materials basis (per megawatt, tonne, hour, etc.). This resembles a form of leasing agreement in which the client pays for the agreed usage. Differences in the two new contractual models come in the form of payment, usage or key performance indicator-defined (KPIs) earnings dependence. In these models, the provider relieves the owner/investor of a number of major burdens and is responsible for financing and/or efficient operation, for instance.

### **3. Raising efficiency through digitalisation**

Progress in the areas of measurement technology, IT and production technology will, in the future, enable projects to be completed that were inconceivable in the past. Case in point: the marriage of “generative design”<sup>12</sup> and 3D printing. Intelligent algorithms have learned to construct highly efficient and completely revolutionary structures, which can be printed in situ in a real-world environment using mobile robots. Formwork or reinforcement structures are no longer required thanks to the use of new materials or brand-new organic constructions.

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<sup>11</sup> Das Unternehmerhandbuch; Fachmagazin für Unternehmer, Selbständige & Existenzgründer; 3 February, 2015

<sup>12</sup> See also methods applied in industry: Dreamcatcher by Autodesk <https://autodeskresearch.com/blog/dreamcatcher-bridge>

#### 4. China's internationalisation strategy through acquisitions

There has been a notable rise in investments from Chinese firms in Germany over the past few years. The takeover of machinery and robot manufacturer Kuka AG by the Chinese household goods and air conditioning corporation Midea is just one example of this. German industries must rise to the challenge of launching their highly complex products in new markets. Through acquisitions, Chinese firms tap into international markets with established products and are able to generate further growth through the purchased technology in line with the rising demands of their domestic market. By deploying this strategy, Chinese firms can gain market share in a competitive market with low-price “good-enough” products before launching higher-quality products with acquired product expertise after a certain period of time. German firms can only generate large volumes of business in international growth markets with genuine innovations or by diversifying products and production and developing “good-enough” products.

#### 5. Interest in financing solutions

Given that a high number of major infrastructure projects are put out for tender by public-sector institutions, these institutions seek alternative sources of financing necessary projects at times of high debt levels. Available global project data shows that the number of projects that require financing is rising in many foreign markets. The qualitative assessment by the interviewed experts can therefore be backed up with quantitative evidence. There will be projects that will not come to fruition due to a lack of financing and reticence among private investors. Brazil, where many infrastructure projects were not completed in spite of the 2016 Olympic Games due to a lack of funding, is a perfect example in this regard.<sup>13</sup>

#### 6. China's role as a genuine innovator

The latest data shows<sup>14</sup> that China has become the world's second-largest investor in research and development, investing EUR 324 billion compared to the US's EUR 407 billion. By way of comparison, the 28 European Union member states invest EUR 311 billion. It is clear that the level of Chinese investment, measured by the percentage of its GDP, offers potential for further growth. According to the study, China (seventh) is ahead of Germany (ninth) in terms of innovation efficiency and is therefore the only country in the upper-mid GDP tier that is also among the world's top 10 efficient innovators. The pressure on German EPC providers to demonstrate their technology leadership is therefore rising.

<sup>13</sup> Kreditgeber gesucht!; Der Tagesspiegel; <http://www.tagesspiegel.de/themen/freie-universitaet-berlin/forschung-am-lateinamerika-institut-kreditgeber-gesucht/19404902.html>; 21 February 2017

<sup>14</sup> See also The 2016 edition of Research and Development Statistics (RDS); OECD; <http://www.oecd.org/innovation/inno/research-handdevelopmentstatisticsrds.htm>; April 2016





## *Recommended courses of action*

The recommended courses of action in this study reinforce the EPC capabilities of German companies and are geared towards industry, politics and science and research. Courses of recommended action are derived from the critical success factors, the international comparison and trends in EPC business. A total of six specific fields of action (see also Fig. 15) have been identified. Each field of action comprises individual courses of recommended action.

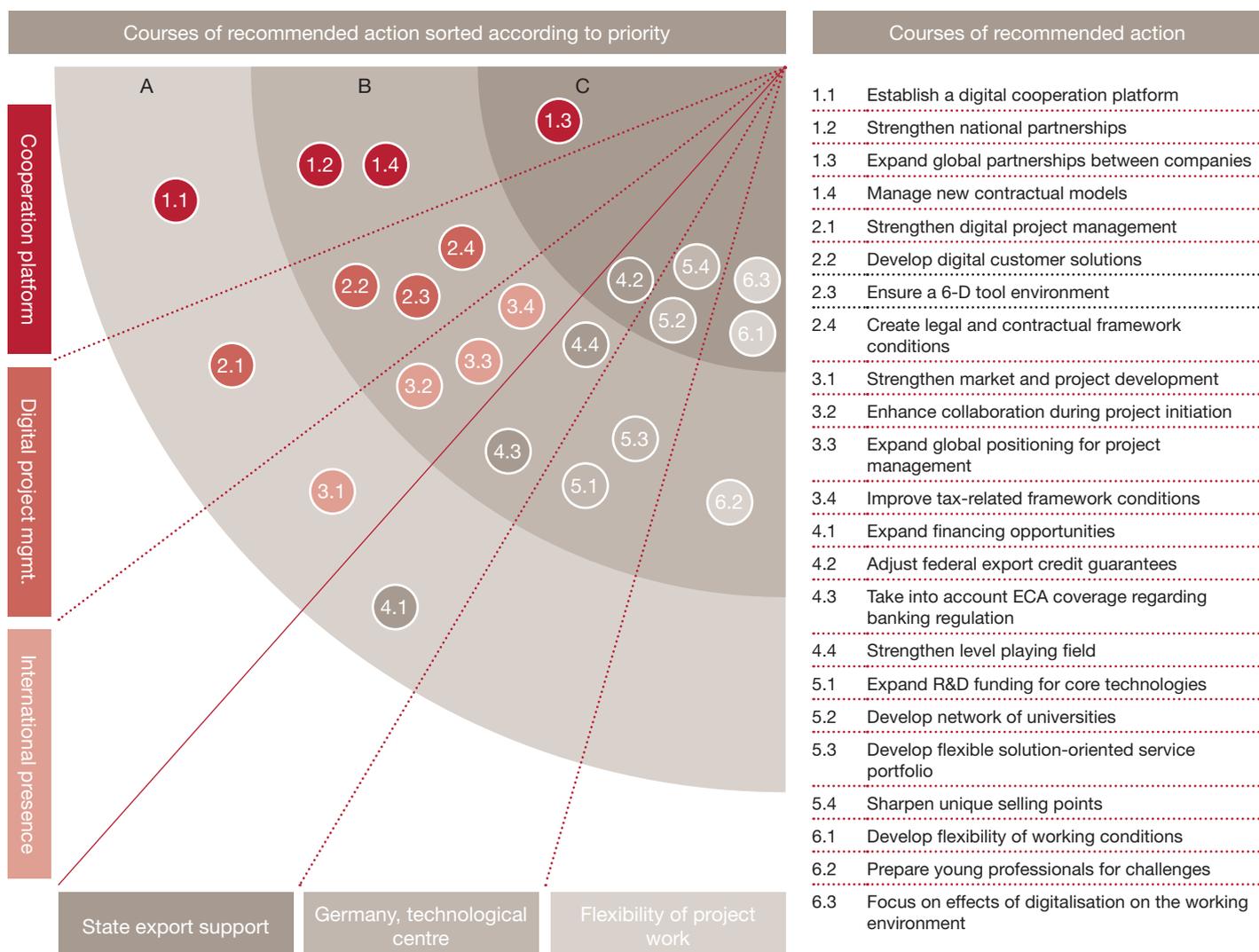
**Fig. 15 Overview of six identified fields of action**



Source: PwC

The recommended fields of action vary in terms of their positive impact on EPC capabilities and the necessary implementation workload. For this reason, the recommended courses of action are prioritised according to these two criteria (see also Fig. 16). The courses of recommended action with the highest priority are: “1.1 Establish a digital cooperation platform”, “2.1 Strengthen digital project management”, “3.1 Strengthen market and project development” and “4.1 Expand financing opportunities”. At their core, the recommended courses of action require long-term implementation and follow-up if the desired improvements to the EPC capabilities of German EPC providers are to be achieved. This is due to the general complexity of EPC business and the level of development of German EPC providers, as well as the corresponding environment and measures that have already been implemented (on the political stage and in science and research).

Fig. 16 Recommended courses of action sorted by priority



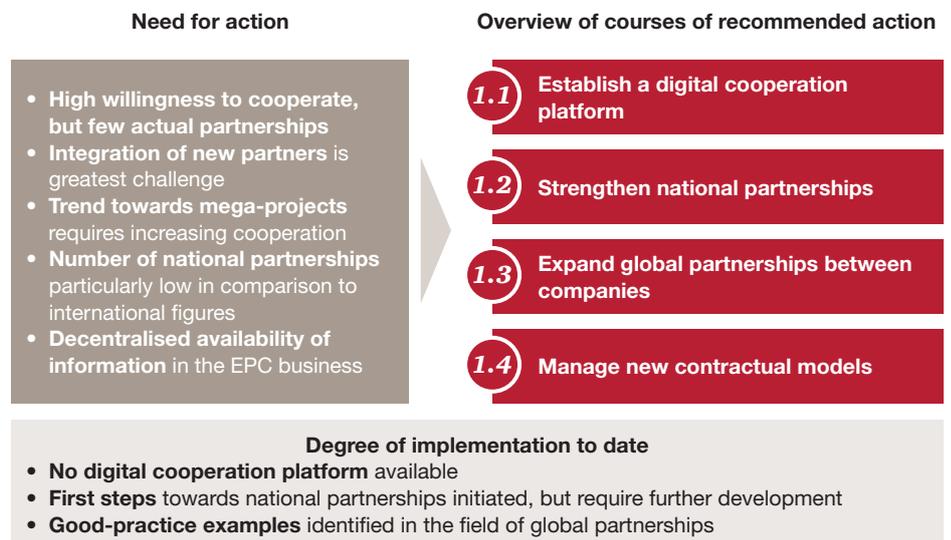
Source: PwC

The four recommended courses of action with the highest priority are presented in detail as follows. The recommended course of action is presented in the context of the corresponding field of action.

**Field of action 1: Cooperation platform for EPC ecosystem**

In a highly complex and globalised business environment, which is subject to constant change and rising competitive pressure, German EPC providers can usually only enjoy success if companies form partnerships in and outside of Germany. The implementation of a digital cooperation platform is recommended to foster cooperation and strengthen stakeholders’ positions, particularly those from the EPC ecosystem. The advantages of this course of action lie in the efficient identification of a suitable partner in a dialogue medium with clear roles and responsibilities, which can ultimately lead to a reduction in administrative workload. A core element of this is creating a cross-industry directory of companies operating in the EPC ecosystem detailing the skills they offer. At the moment, this kind of database of contacts is lacking. This results in EPC firms spending time and money establishing specific networks with potential partners.

**Fig. 17 Cooperation platform for EPC ecosystem**



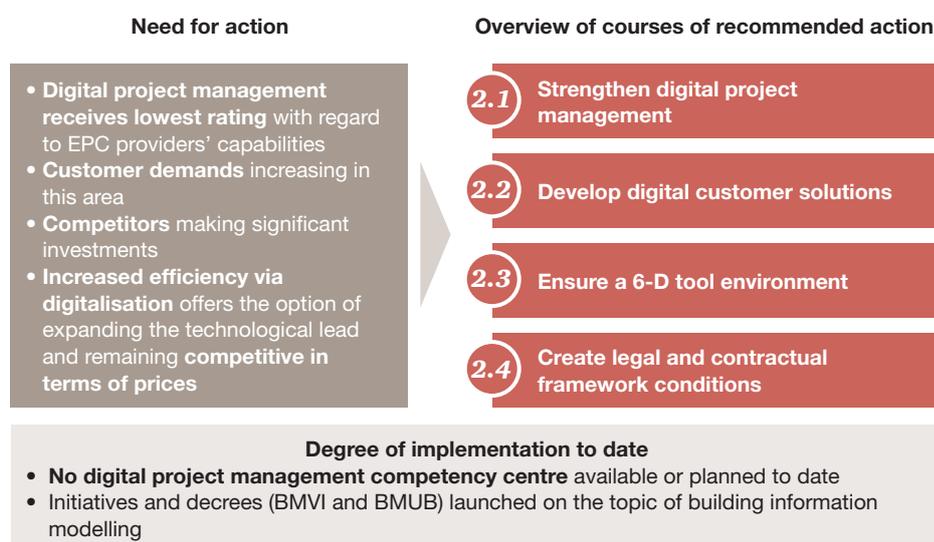
Source: PwC

In addition, the platform is geared towards fostering (expert) dialogue between companies, policymakers, scientists and researchers in different industries and competency clusters. This expert dialogue can include important experiences from specific projects (lessons learned) in individual countries or for various clients. This cross-industry dialogue can result in valuable business relationships being established and developed to serve as a long-term basis for partnerships. The inclusion of policymakers in this process is a key element besides dialogue between companies. At this point, this concerns the nomination of contact persons in EPC business and the centralised publication of information for EPC business. This information can include specialist information provided by the German Chambers of Commerce Abroad and Germany Trade and Invest or information concerning delegate trips and relevant trade fairs. The centralised publication of this information reduces the administrative workload, as all relevant information is pooled together in one place. A key factor in the success of such a platform is its widespread distribution and acceptance. Industry associations should therefore function as distributors and play a key role in ensuring that the cooperation platform is well-received and used (e.g. by reviewing the information provided on the platform).

### **Field of action 2: Competency centre: digital project management**

An increasing number of clients require digital project management services. In addition, German EPC providers delivered the lowest figure in the survey when it comes to their own assessment of their capacity to meet these requirements (40% of those surveyed said that they do not meet or do not sufficiently meet these requirements). Digitalisation therefore represents a key selling point on the market. We recommend establishing a competency centre for digital project management. This offers the critical advantage of pooling the competencies of innovators, start-ups, scientists and researchers under one roof and allowing new and innovative solutions to be developed collectively. Digital competency centres are one way of achieving this; this model has already been implemented in other sectors and is being contemplated in the case of the potential BIM competency centre. They also allow the inclusion of existing and positively received initiatives and decrees to be pooled together and specified further with EPC business in mind.

**Fig. 18 Competency centre: digital project management**

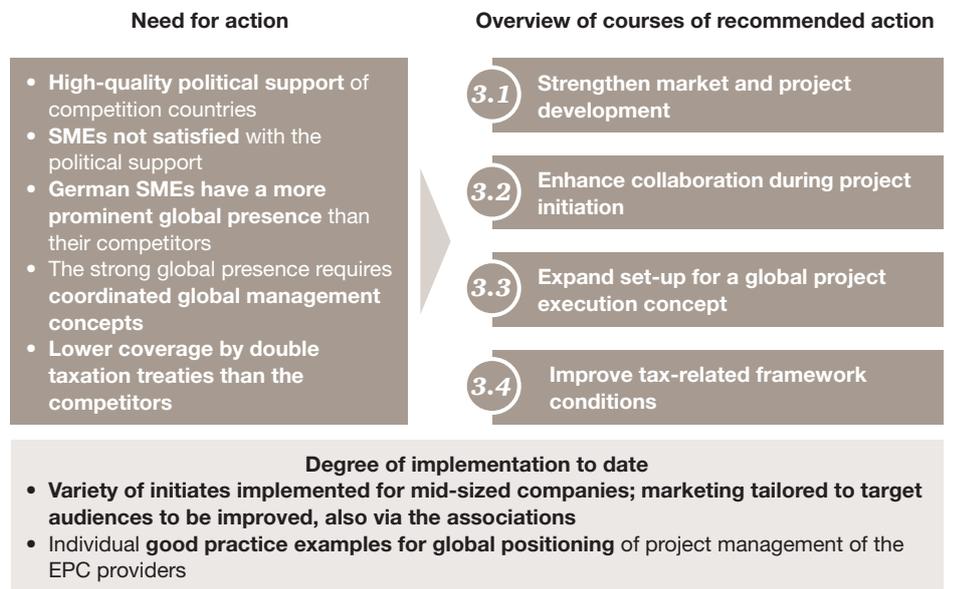


Source: PwC

**Field of action 3: Collective international presence of politics and industry**

German SMEs enjoy an excellent reputation (e.g. through customer proximity and high quality) abroad, and their strong global presence is considered to be a key competitive advantage that must be strengthened over the long term. That being said, SMEs in particular are dissatisfied with the level of political support, even though policymakers and associations have already launched a variety of programmes and initiatives to reinforce the SME segment. As a result, we recommend communicating and advertising existing programmes with greater vigour. In addition, collaboration between the worlds of politics and industry must be intensified during the initial stages of a project through high-quality political support and, in doing so, reducing the disadvantage to international competitors.

**Fig. 19 Collective international presence of politics and industry**



Source: PwC

### Field of action 4: Expansion of state export support

The German federal government's promotion of foreign trade is an important tool for supporting German industry in international projects. In public requests for tender, EPC contractors are increasingly required by international buyers to offer potential financing options with their tender offer. Expanding financing opportunities and adjusting the framework for state export loan guarantees are therefore considered vital to ensuring the competitiveness of German industry on the international stage. We therefore recommend that a broader and more varied range of financing options be provided for implementing major international projects. State-financed support programmes offering long-term lending at discounted terms could be expanded. This includes the CIRR ERP Export Financing Program, which is run by KfW IPEX Bank on behalf of the German federal government, and increasing the flexibility of the untied loan guarantee scheme (UFG). With the aim of creating a level playing field, we recommend a sector agreement for the mechanical and plant engineering industry and the construction industry to increase local costs and extend project durations.

Fig. 20 Expansion of state export support



Source: PwC

# References

Bauknecht et al., Maschinenbau und Investitionsgüterindustrie – weiter auf Erfolgskurs, 2013.

Bent Flyvbjerg, “What You Should Know about Megaprojects and Why: An Overview,” In *Project Management Journal*, vol. 45, no. 2 (April-May): 6-19. DOI: 10.1002/pmj.21409.

Berlin Institut für Bevölkerung und Entwicklung, 17 March 2017, <http://www.berlin-institut.org/?id=15>.

“Chemieanlagenbau boomt - Großprojekte im Trend 29.01.2015,” 27 February 2017, [www.chemanager-online.com/themen/anlagenbau-komponenten/chemieanlagenbau-boomt-grossprojekte-im-trend](http://www.chemanager-online.com/themen/anlagenbau-komponenten/chemieanlagenbau-boomt-grossprojekte-im-trend).

Commodity Markets Outlook, “Resource development in an era of cheap commodities April 2016, A World Bank Report”.

“Das Unternehmerhandbuch,” Fachmagazin für Unternehmer, Selbständige & Existenzgründer, 3 February 2015.

ENR (2016). The top 250 global contractors.

ENR (2015). The Top 250 global contractors.

“Global forecast for the construction industry to 2030,” Global Construction Perspective and Oxford Economics, Global Construction 2030, 10 September 2015.

Global Innovation Index 2016; Soumitra Dutta, Rafael Escalona Reynoso, and Jordan Litner, Cornell University; Bruno Lanvin, INSEAD; Sacha Wunsch-Vincent and Kritika Saxena, WIPO; 2016

Hannemann, Thilo and Mikko Huotari, “Eine neue Ära Chinesischen Kapitals, Chinesische Direktinvestitionen in Europa,” Mercator Institute for China Studies, Rhodium Group LLC, 2015.

IJGlobal Database, [www.ijglobal.com](http://www.ijglobal.com), 23 February 2017.

KfW Research Fokus Volkswirtschaft, no. 123, 26 April 2016.

“Kreditgeber gesucht!” *Der Tagesspiegel*; <http://www.tagesspiegel.de/themen/freie-universitaet-berlin/forschung-am-lateinamerika-institut-kreditgeber-gesucht/19404902.html>; 21 February 2017.

PwC Strategy&Studie, “Global Innovation 1000”, 2016.

“Remarkable Declines in Global Poverty, But Major Challenges Remain”, 17 March 2016, World Bank.

Report by IKB Deutsche Industriebank AG in cooperation with the VDMA.

Sauermost, GTAI, "Zu Jahresbeginn 2017 steht Japan auf einmal relativ gut da," 18 January 2017.

Schuh, G., Kampker, A., Potente, T, Jasinski, T. Zukunftsperspektive des deutschen Maschinenbaus. Expertise Hans-Böckler-Stiftung. Aachen, 2012.

Statistisches Bundesamt, "Klassifikation der Wirtschaftszweige Mit Erläuterungen," 2008

VDMA (2016). "Weltmärkte verunsichert – Neue Wettbewerbschancen schaffen". Lagebericht 2015/2016.

Willershausen et al. "Zu klein für ganz groß". Wirtschaftswoche, 47, 64-69, 2014. World Trade Organization, Statistics Database, 6 March 2017.

[www.asean.org/storage/2015/11/ASEAN\\_Statistic\\_Leaflet\\_2015.pdf](http://www.asean.org/storage/2015/11/ASEAN_Statistic_Leaflet_2015.pdf), 1 March 2017.

[www.autodeskresearch.com/blog/dreamcatcher-bridge](http://www.autodeskresearch.com/blog/dreamcatcher-bridge), 14 March 2015.

The 2016 edition of Research and Development Statistics (RDS), OECD, <http://www.oecd.org/innovation/inno/researchanddevelopmentstatisticsrds.htm>, April 2016

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