Role of consulting engineers in sustainable civil and industrial infrastructure projects

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How the top firms supplying environmental consulting services address sustainability – a survey

No single firm or group currently dominates a significant portion of the consulting engineering sector. To understand the sector's role and how it can address sustainability it is therefore necessary to review the engineering and construction industry's firms active in the environmental consulting sector. These firms would be expected to respond vigorously to the challenges of sustainability owing to their relatively deep and long-standing involvement with environmental issues.

Part 1: Acquisition and merger activity

The top environmental consulting (EC) firms among the engineering and construction industry's top firms are growing much more aggressively, within both the engineering and construction (E&C) industry itself and the industry's environmental sector, than the E&C industry's remaining top firms. Further analysis therefore focused on these top environmental consulting firms (four from the consulting engineering sector and four from the engineering and construction sector).

> In 2014, 98% of the M&A turnover in the EC sector acquired by the 22 top firms in the E&C industry was acquired by the top 9 EC firms among these 22 top firms.

Part 2: Sustainability drivers

Sustainability drivers upon which the top environmental consulting firms based their sustainability strategies and implementation plans are weighted appropriately.

> The environmental dimension of sustainability remains the main driver, but is now closely followed by the social dimension.

Part 3: Implementing sustainability

Sustainability implementation for the top environmental consulting firms focussed on strategies and project-level issues, notably innovative delivery, new tools and ensuring desired outcomes are achieved. However, reference to today's targeted *Millennium Development Goals* and forthcoming global *Sustainable Development Goals* was absent.

> Sustainability strategies must ensure that precautionary measures are implemented at the project level and that understanding gained from projects is shared as widely as possible.

> Sustainability project tools were the main focus and included project sustainability standards, sustainability impact management, value-add sustainability frameworks, certification-based life-cycle project cost benefit analysis, and sustainable target assessment rating.

Part 1: Acquisition and merger activity in the engineering and construction industry

1. The construction and consulting industry

The relationship between the various sectors in the engineering and construction (E&C) industry is illustrated in Fig. 1.

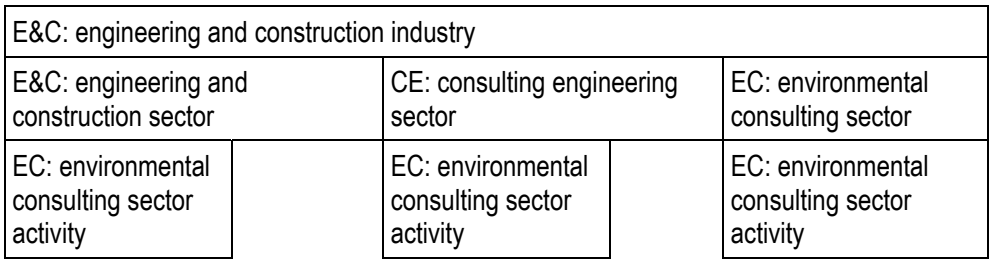

Fig. 1 – The engineering and construction industry showing the relationships between the various engineering, consulting and construction sectors. Some firms and groups in the engineering and construction (E&C) and consulting engineering (CE) sectors have capability and activity in the environmental consulting (EC) sector.

Within the E&C industry there are firms (including groups) in the:

- engineering and construction (E&C) sector which undertake construction, design‑build and turnkey projects and in some cases facility ownership, as well as supplying professional services of all types (management, compliance audits, auditing, assessment and policy development, information, design, engineering, remediation, operations and maintenance);
- consulting engineering (CE) sector which supply professional services such as engineering, consulting and support services (so-called "pure play" firms);
- environmental consulting (EC) sector which are specialised and historically only supplied consulting engineering services related to the environment. These firms identify environmental problems, measure and evaluate risks and recommend designs and implement solutions and employ a multidisciplinary staff of scientists, engineers and technicians.

The present review, in three parts, aims to examine how consulting engineering firms can respond to the challenges and opportunities arising from sustainable development, notably the role of consulting engineers in sustainable civil and industrial infrastructure projects.

It does this by analysing how engineering and construction (E&C) and consulting engineering (CE) firms among the environmental consulting (EC) sector's top firms have responded. Owing to their relatively deep and longstanding involvement with the environmental consulting, firms in the EC sector are well placed to identify market drivers and to develop appropriate sustainability policies, business strategies and implementation plans.

The first part of the review draws conclusions from a detailed analysis of mergers and acquisitions in the C&E industry.

2. The environmental consulting sector

The revenue worldwide in 2014 for the top 200 E&C industry (engineering and construction,

consulting engineering and environmental consulting firms) in the environmental consulting (EC) sector was USD 51.4 billion (*ENR*).

The top 200 firms' EC market sectors in 2013 were:

- hazardous waste, water supply, waste water, nuclear waste 73.8%
- environmental science 8.9%
- environmental management 6.6%
- air 6.5%
- other 4.2%

The top 200 firms' EC clients in 2013 were:

- government 51%
- private 49%

The revenue worldwide in 2013 for the top 25 firms in the EC sector was USD 28.7 billion (*Environment Analyst*). These 25 E&C, CE and EC firms accounted for a combined share of 46% of the EC sector revenue.

The top 22 EC firms' EC market sectors in 2013 were:

- water, waste management, site remediation and contaminated land services 59%
- environmental auditing, management, compliance, and due diligence 14%
- environmental impact assessment and sustainable development 14%
- climate change and energy 8%
- other 5%

The top 22 EC firms' clients in 2013 were:

- government and regulators 32%
- private 68%
  (utilities and energy: 24%; mining, manufacturing, and process industries: 24%; construction, property, and transportation: 14%; financial, professional, service sector; 4%; other: 2%)

Differences in the EC sector revenue, market sectors and clients between the top 200 firms in the E&C industry and the top 22 firms in the EC sector are largely due to the fact that the E&C top 200 firms undertake a considerable amount of construction activity in hazardous waste, water supply, waste water, and nuclear for government clients. Aside from this, firms in the two industry sectors supply broadly similar services.

The demand from the public and private sectors will bolster the environmental consulting sector's revenue over the next five years since clients, both public and private, need to:

- reduce their ecological footprint;
- conform to new laws and regulations;
- improve their image and reputation (the threat of climate change has influenced popular opinion, with both firms and public bodies being held more accountable for their environmental impact).

Numerous mergers and acquisitions have resulted in a collection of large E&C firms that offer the

full complement of single-source environmental products and services. These large firms provide a wide range of environmental expertise and offer full life-cycle "one-stop shopping" solutions for clients.

In spite of the important market drivers and the trend towards consolidation, the environmental consulting sector remains very fragmented. For example, in 2013 in the US which accounted for USD 30.7 billion (50%) of EC sector revenue, the 50 largest firms in the US accounted for only about 30%, with the top 3 EC firms claiming market shares of only about 4.5%.

The sector remains fragmented because CE firms supplying EC services as well as EC firms are very dynamic, growing fast and able to compete with the large E&C firms by specialising in regional markets or particular areas of expertise.

This is illustrated by the growth rates for the EC sector revenue in North America (US and Canada) as summarised in Table 1. The rates for specialised firms in the US and for the entire sector in Canada were above 20% as compared to only 1.0 - 1.3% each year for the entire E&C industry in the US.

Country	Period	EC revenue, 2013 bUSD	Revenue growth	
			EC sector	E&C industry average
US	2011-4	30.4	>25%	1.0-1.3%
Canada	2010-2	1.86	24%	

Table 1 – Revenue growth for the environmental consulting industry in the US and Canada. Canada's E&C industry is dominated by the CE sector which accounts for the very high E&C industry growth rate.

To capitalise on the trends:

- small specialised consulting firms will enter the environmental consulting sector;
- the larger E&C and CE firms will become much more sector-specific, i.e., like EC firms, they will specialise, mainly through mergers and acquisitions, in specific environmental engineering and construction market sectors such as water, energy, transport, etc.

3. The consulting engineering sector

The focus of this review is the global consulting engineering sector, where there is some debate concerning the size of the sector. In addition to traditional markets for consulting engineering services in the architectural, engineering, building and infrastructure markets, a relatively broad market scope based on current standards for national accounts would include consulting services for industry, defence systems, research and development, and mineral exploration. On this basis the revenue of the global consulting engineering sector without environmental consulting in 2014 was some USD 700 billion (some 4% of engineering and construction industry revenue).

The consulting engineering sector as a whole is currently well placed to respond to opportunities in the environmental consulting sector. For consulting engineering firms in the US for example, this is because:

- project management, notably for design, has improved dramatically thus reducing risks;
- staff productivity is at an all-time high;
- the revenue needed to support staff has decreased;

- firms are benefiting from high multipliers in mechanical, electrical, plumbing, and fire protection engineering for transportation infrastructure, in niche areas of security and "smart systems" and in new types of power networks such as smart grids and sources of low carbon electricity.

4. The top environmental consulting firms

Table 1 in Appendix A profiles the largest (by end-2014 staff number) engineering and construction, "pure play" consulting engineering firms and environmental consulting firms (including groups) which are among the top 25 environmental consulting (EC) firms.

E&C firms are by definition major players in the construction, contracting and/or remediation (the so-called "CON" market as categorised by *ENR*). As shown in the table, of the E&C firms in the top 25 EC firms, engineering and/or design and consulting and/or studies ("EDCS") is the most important or equally important EC activity for all of these firms.

E&C firms offering environmental consulting therefore compete directly the CE firms in spite of their having a significant amount of construction-related activity.

To understand the role of consulting engineers in sustainable civil and industrial infrastructure projects, sustainability strategies and the way they are implemented by both E&C and CE firms among the E&C industry's top 22 firms given in the table will be reviewed, except for TetraTech, the largest EC firm.

Reviewed to date are the EC sector's top 4 CE firms (WSP Global, Arcadis, Atkins, and Ramboll) and top E&C firms (AECOM, Jacobs, Amec Foster Wheeler, and CH2M Hill).

It is envisaged that the survey will be extended to include all of the top 25 EC firms (the next nine in decreasing 2014 revenue are Antea Group, Golder Associates, GHD, Cardno, Grontmij, MHW Global, RPS Group, Royal Haskoning DHV, and Coffey International, at which point it becomes difficult to identify accurately the remaining six firms among the top 25 EC firms).

5. M&A activity in the E&C industry

5.1. E&C industry

5.1.2. All firms

For engineering and construction firms in the E&C industry in 2013-5, M&A activity measured by the number of transactions exceeding USD 50 million in value are summarised in Table 2 (source *PWC*).

Year	Quarter	Number		Average number per quarter	Transaction value million USD
2013	Q1-4	176		44	313
2014	Q1	220		55	801
	Q2				
	Q3				
	Q4		48		
2015	Q1		37	51	
	Q2		64		459

Table 2 – The number of M&A transactions (transaction value greater than USD 50 million) for all firms in the E&C industry (source *PWC*).

The table shows that the average transaction value peaked at USD 801 million in 2014, when the average number of transactions each quarter was 55.

So far in 2015, the average number of transactions per quarter is only about 51 (a 7% decrease relative to 2014) with the average value per transaction in Q2 (second quarter) now at USD 459 million (a massive 60% decrease relative to 2014).

5.1.2. Top 22 E&C industry firms

Mergers and acquisitions in 2014 for which the E&C industry's top 22 firms were responsible are detailed in Table A2 in Appendix A. The table gives the revenue at the end of 2014 after all transactions had been completed as well as the total and the EC revenue of the acquisition target or merged firm before the transaction.

Firms	Number	E&C industry		
		Total		Average
		bUSD	% firm revenue	USD million
E&C Top 22	64	26.21	18.0	467
Top 9 EC	42	25.73	49.4	612

Table 3 – E&C industry M&A activity in 2014 of the E&C industry's top 22 firms and of the top 9 EC firms among the E&C industry's top 22 firms. The total M&A transaction revenue is given as a percentage of the total firm revenue at the end of 2014 of the E&C top 22 and top 9 EC firms once all mergers and acquisitions for 2014 had been completed.

Table 3 taken from Appendix A shows that in 2014, when M&A activity in the E&C industry reached a peak, the industry's top 22 firms made 64 M&A transactions. Eliminating transactions with values under USD 50 million leaves an estimated 40 transactions with values over USD 50 million which were made by the E&C industry's top 22 firms.

The E&C industry's top 22 firms acquired and merged with firms that had a total revenue of USD 26.21 billion (18.0% of their firm revenue).

5.2. CE sector

For the global "engineering consultancy" sector surveyed by *Equitec*, which broadly corresponds to the consulting engineering (CE) sector, the number of M&A transactions was very similar in 2013 (380) and 2014 (373) corresponding to a 2% decrease in 2014.

For the CE sector, the number of transactions involving firms with an environment capability (i.e., consulting engineering firms which were also in the environmental consulting sector) peaked in 2013 and then decreased by 16.2% in 2014 (*Equiteq*). With about 20% of all CE firms active in the EC sector, the numbers of acquisitions involving CE firms in and outside the EC sector was 76 in 2013 and 77 in 2014.

5.3. EC sector

5.3. 1. All firms

For the global environmental consulting sector in 2013, the number of transactions in 2013 was 206 as compared to 225 in 2014 indicating that M&A activity had increased by 9% in 2014 (*Lincoln International).*

5.3.2. Top 9 EC sector firms

Table 3 taken from Appendix A shows that in 2014 the EC sector's top 9 firms made 42 M&A transactions that had a total revenue of USD 25.73 billion, equivalent to 49.4% of the firms' total revenue after the transaction. Eliminating transactions with values under USD 50 million leaves an estimated 30 transactions with values over USD 50 million which were made by the EC sector's top 9 firms.

5.4. Conclusions

5.4.1. Number of transactions

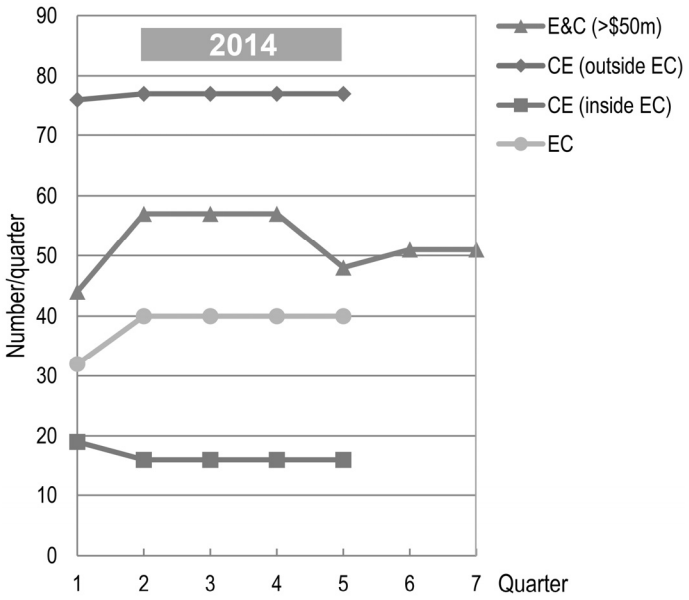

Fig. 2 – The number of M&A transactions per quarter starting in the 4th quarter of 2013 where this quarter's value is the average for 2013. The categories are as follows: E&C industry

("E&C"; transactions exceeding USD 50 million; source: *PWC*); consulting engineering firms for active in the CE sector ("CE outside EC"; source *Equiteq*); consulting firms active in the EC sector ("CE inside EC"; source *Equiteq*); EC sector ("EC"; source *Lincoln International*). Where the same value is given over successive quarters, the quarter value is an average value.

Industry/Sector	Firms	2014 transactions	
		Average number of transactions per quarter	Average change from 2013
E&C industry (transaction value above $50m)	All	57	+25%
	Top 22	10	-
CE sector	Outside EC sector	77	+1%
	Inside EC sector	19	-1%
EC sector	All	44	+25%
	Top 9	8	-
Total: E&C industry (all transactions)		>197	

Table 4 – The number of M&A transactions per quarter in 2014. The changes relative to 2013 are relative to the average number per quarter for 2013.

Fig. 2 and Table 4 summarise the number of M&A transactions in 2014 for the various sectors of the E&C industry.

There were at least an average of 197 transactions per quarter in the E&C industry of which the various sectors accounted for: CE – 96; EC – 44. The sector revenues were: CE without environmental activity – USD 700 billion; EC – USD 62.4 billion.

Therefore, compared to its sector size, the EC sector was much more active that the CE sector. Unfortunately, it is difficult to compare CE and EC sector activities with the E&C sector activity since there is little information concerning both the E&C sector revenue and the sector's M&A transactions that do not involve CE and EC sector activity.

5.2. Revenue

Mergers and acquisitions in 2014 for the 9 largest (in terms of staff size) engineering and construction (E&C), consulting engineering (CE) and environmental consulting (EC) firms active in the EC sector and among the E&C industry's top 22 firms are detailed in Table A2 in Appendix A. The table gives the revenue at the end of 2014 after all transactions had been completed and the EC revenue of the acquisition target or merged firm before the transaction.

Regarding the revenue across all E&C sectors of the E&C industry's top 22 firms that were acquired as a result of M&A transactions, Table 3 shows that the top 22 EC firms (with USD 25.73 billion of acquired revenue) were responsible for virtual all (98%) of the acquired revenue (USD 26.21 billion).

Firms	Number	EC sector		
		Total		Average
		bUSD	% firm revenue	USD million
E&C Top 22	64	5.49	3.8	98
Top 9 EC	42	5.24	4.9	125

Table 5 – EC sector M&A activity in 2014 of the E&C industry's top 22 firms and of the top 9 EC firms among the E&C industry's top 22 firms. The total M&A transaction revenue in the EC sector is given as a percentage of the total firm revenue at the end of 2014 of the E&C top 22 and top 9 EC firms once all mergers and acquisitions for 2014 had been completed.

Table 5 taken from Appendix A shows that in 2014 the E&C industry's top 22 firms acquired and merged with firms that had a total revenue in the EC sector of 5.49 billion, equivalent to 3.8% of their firms' total revenue and 29% of the revenue acquired from the E&C industry as a whole.

The top 9 firms in the EC sector acquired and merged with firms that had nearly the same total revenue in the EC sector of 5.24 billion equivalent to 4.9% of their firms' total revenue, a significantly higher percentage than for the E&C industry's top 22 firms.

5.3. Conclusions

The conclusions are that:

- the EC sector was the more active than the CE sector in terms of the number of transactions relative to the size of the sector;
- the EC sector's top 9 firms among the E&C industry's top 22 firms were responsible for:
  - some 80% of the estimated 18% of the total number of E&C industry transactions with a value above $50 million;
  - nearly twice as many EC transactions (42) than for the 13 remaining E&C industry top 22 firms which made 22 transactions;
  - the target firms' combined revenue for environmental consulting at the time of the transactions was USD 5.24 billion (96% of the total) for the EC sector's top 9 firms, and only USD 0.25 billion for the 13 remaining E&C industry top 22 firms (i.e., 98% of the revenue acquired was acquired by the EC firms in the E&C industry's top 22 firms).

The dramatic increase in M&A activity for the EC sector and the virtual exclusion of the E&C sector's top firms which are not among the EC sector's top firms suggests that the primary drivers for M&A activity in the E&C industry are as follows:

- E&C sector:
  - firms seek to simplify their businesses, focus on core operations, and shed non-strategic units;
  - strategic alignment where large E&C firms need to become more specialised.
- CE sector:
  - CE firms active in the EC sector are attracting more M&A activity compared to the more generalist CE firms since firms in the EC sector need to scale up to compete on larger, more complex projects (as projects grow in size and complexity, firms with a limited scale have the most to lose from inactivity).

- EC sector:
  - the current economic climate is encouraging M&A activity because strategic buyers see opportunities to gain specialisation and scale by acquiring firms which are mainly active in local markets that are recovering;
  - firms need to scale up to compete on larger, more complex projects.

Since the top 9 EC firms dominate the way environmental capabilities are being taken up by the C&E industry, a survey of how consulting engineering firms implement sustainability will focus on the 8 E&C and CE firms among these top 9 EC firms.

Part 2: Sustainability drivers in the engineering and construction industry

Following on from Part 1, this and the following sections review how sustainability is implemented by 8 of the top firms in the environmental consulting sector that are also among the 22 largest firms (by staff number) in the engineering and consulting industry. Four of these 8 firms are engineering and consulting firms (AECOM, Jacobs, Amec Foster Wheeler, CH2M Hill); the remainder are consulting engineering firms (WSP Global, Arcadis, Atkins, Ramboll).

Sustainability drivers are analysed as a first step to see if they are appropriate for guiding implementation plans that are surveyed in the second step.

1. Growth drivers

Table B1 in Appendix B lists the drivers for sustainability in consulting services that were highlighted by several of the engineering and construction (E&C) industry's 22 largest firms which are also among the top 25 suppliers of environmental consulting services (see Table A1 in Appendix A).

The firms are:

A: Aecom
B: Amec Foster Wheeler
C: WSP
D: Arcadis
E: CH2M Hill
F: Atkins

It is planned to complete the table for all 8 of the top suppliers of environmental consulting services which are either engineering and construction firms or consulting engineers.

All of the listed drivers come from official company sources such as sustainability reports, annual reports, marketing brochures, company presentations, and reported interviews of company officers.

The drivers cover the well-established financial/economic (F), social (S), environmental (E), and governance (G) dimensions of sustainability to a greater or lesser extent. The sustainability dimension for each issue in the table is indicated in the "Dim" column along with various themes, issues and criteria.

The classification in terms of dimensions, themes, issues, and criteria is based on a similar and relatively standard approach used for example by the *FIDIC Project and Programme Sustainability Logbook* and the draft of the *Global Infrastructure Basel SuRe Standard* for financing sustainable infrastructure.

From the table this it is found that the number of times a given dimension is implied is as follows:

- Environmental 38%
- Financial/economic 30%
- Social 18%
- Governance 14%

2. Comparison

The weighting of the sustainability dimensions has been examined in depth over many years for sustainability rating systems and composite indexes of sustainability. Problems that have been addressed cover many aspects, from the philosophical and theoretical rationale of sustainable development to very technical and mathematical issues.

Many rating systems use equal ratings. More recently, the weightings are adjusted to the type of object or body that is being rated or assigned an index (a "score"). In this approach the weightings are often assigned following an extensive survey of perceptions. For example, Capelle-Blancard and Petit established weightings of Environmental 30% - Social 30% - Governance for banks with Environment 50% - Social 20% - Governance 30% for a mining company (see Table 1).

The *Standard and Poor Dow Jones SAM RobecoSA Corporate Sustainability Assessment* ("SAM") is the best known and best established sustainability rating for financial products. The most recent update released in April 2015 gives as representative examples of industry specific weightings the weightings listed in Table 1. They are derived by combining the weightings of general and industry specific criteria established by analysing experts' opinions.

There are relatively few rating and index systems that use four dimensions of sustainability. To compare them with three-dimension systems one normally combines Social and Governance. This is done in Table 1 to show that the weights from the survey of sustainability drivers are very similar to those SAM uses for infrastructure service facilities. This result is perhaps not unexpected because C&E firms focus most of their activity on supplying infrastructure.

Scheme	**Year**	**Approach**	**Industry**	**Dimension**				
				E	**F**	**S**	**G**	**S+G**
Table B1	2015	Drivers survey	EC firms	38	30	18	14	32
SP RobecoSA Corporate Sustainability Assessment	2015	Experts' assessment	Banks	24	38	38	-	38
			Service utilities	35	35	30	-	30
			Pharma	10	40	50	-	50
Capelle-Blancard & Petit	2012	Survey database	Banks	20		30	50	
			Mining	50		20	30	
			Consumer products	30		40	30	

Table 1 – Industry-specific weightings used for sustainability ratings and indexes.

In conclusion, the sustainability drivers upon which the environmental consulting sector's top firms base their sustainability strategies and implementation plans (reviewed below) are weighted appropriately. The environmental dimension remains the main driver, but is now closely followed by the social dimension.

Part 3: Implementing sustainability in the engineering and construction industry

Following on from Parts 1 and 2, this section reviews how sustainability is implemented by 8 of the largest of the top 25 firms in the environmental consulting sector that are also among the 22 largest firms (by staff number) in the engineering and construction industry. Four of these 8 firms are engineering and consulting firms (AECOM, Jacobs, Amec Foster Wheeler, CH2M Hill). The remainder are consulting engineering firms (WSP Global, Arcadis, Atkins, Ramboll).

The review starts by analysing the following firms:

A: Aecom
B: Amec Foster Wheeler
D: Arcadis
E: Ramboll

1. Overview

Table C1 in Appendix C lists the various implementation measures taken by several of the engineering and construction (E&C) industry's 22 largest firms which are also among the top 25 suppliers of environmental consulting services (see Table A1 in Appendix A).

As for the review of drivers in Part 2, the various declarations relating to the implementation of sustainability given in Table C1 are drawn from official company sources such as sustainability reports, annual reports, marketing brochures, company presentations and reported interviews of company officers.

Some of the initiatives dealing with aspects of the firms' operations that do not deal directly with sustainability are included in Table C1 but they will not be discussed. Clearly, many of these initiatives will impact to a greater or less extent on the way firms address sustainability.

For the sustainability initiatives, generic issues dealing with the integration of sustainability in business operations (e.g., alignment with stakeholders) were covered. However, for most firms the aim was to develop specific actions items in the following areas:

- Strategies
- Project delivery
- Project tools
- Project performance
- Asset life-cycle
- Value creation
- Supply chains
- Climate change

The main focus was clearly project delivery, project tools for sustainability and project performance. Supporting initiatives in these areas mainly considered the client's asset life-cycle, value creation, supply chains, and specific aspects of climate change.

Strategies and project-level initiatives will be discussed, with initiatives in the areas of asset life-cycle, value creation, supply chains and climate change summarised in Table C1.

2. Sustainability strategies

Theme	Issue	Action
Complex challenges	Clients face complex challenges	Help clients by managing risk with a specific reference to all main forms of capital (financial, natural, social and human capital). The construction and engineering industry has perhaps been reticent to have this very broad perspective.
Locally based	Each client's sustainability needs are different.	Needs depend on a wide range of factors (market, materiality, regulation, short versus long-term focus, stakeholder and commercial objectives).
Balanced solutions	How to deal with the many considerations.	Deal with many needs and considerations, weighing the social, environmental and economic dimensions of an issue to find balanced solutions.
Indirect impact	The industry's main impact is from the manner in which clients can be supported.	Greatest impact arises in areas such as energy and water where clients can be supported directly.
Coherent overall strategy	Need a coherent overall strategy for all market sectors: *Global Commitment Programme* (Ramboll)	Develop a coherent overall strategy for all market sectors such as a *Global Commitment Programme* (see comments in Table C1).
	May need a coherent overall strategy for specific market sector: *Resilient World* (Amec Foster Wheeler)	Develop a coherent overall strategy such as *Resilient World* for a specific market sector, in this case resource extraction. (see comments in Table C1).
Spread benefits	Proactive in diffusing knowledge as widely as possible.	Consider how knowledge generated by the firm can benefit as many people as possible without compromising legitimate business interests.
Preventive measures	Proactive in seeing if there is conflict with the firm's values.	Implement preventive (some would say precautionary) measures such as screening of business partners and proactive communication of commitments in proposals to say "no" because when a project or client is in clear conflict with the firm's values.

Table 1 – A summary of the implementation of initiatives in the area of sustainability strategies.

As summarised in Table 1, a firm's sustainability strategies must recognise that:

- challenges are complex;
- solutions must be locally based and based on balancing sustainability aspects;
- implementation works indirectly;
- coherent overall strategies are needed;
- new understanding gained from projects should be shared as widely as possible;
- preventive (or precautionary) measures are required.

3. Project tools

Theme	Issue	Action
Project delivery	Have thought leaders for every market sector	Ensure that the principles of sustainability underpin everything the firm does by having thought leaders in each business sector to devise new and innovative methods for project delivery.
	Ensure sustainability by seamless integration in project delivery from several sources.	Seamless project delivery generally refers to project delivery by a single source for complete facility from design to commissioning. The challenge is to integrate sustainability and to some extent health and safety at all phases. The initiative referred to here is seamless integration in service delivery with the ability to integrate health and safety and sustainability into the design and delivery of solutions. The challenge of integration arises when delivery is not single source.
	Ensure sustainability at every phase.	Increase the environmental, economic and social sustainability of every project at all phases from concept to completion.
	Consider long-term social requirements	Consider long-term social requirements on projects such as using the local workforce and suppliers, supporting local communities, etc.
Project tools	Project sustainability standard	Embed a consistent sustainability standard across projects (common systems; system of globally applied policies and procedures; comprehensive management oversight; a standard, best-practice, consistent approach to inherently embedding sustainability into projects; in standard operating procedures a procedure showing that all projects can demonstrate sustainability has been embedded into the delivery).
	New standards (of best practice)	For example, set new high standards in the energy industry by focusing on producing the cleanest and most efficient solutions.
	Sustainability impact management	Sustainability impacts are inextricably linked to the regions in which the firm operates.Sustainability impact management must be based on the local context and integrated throughout the entire management system.
	Value-add sustainability framework	Develop a value-add sustainability framework for advanced objectives by integrating into standard operating procedures a value-add sustainability framework that goes above and beyond the standard approach to be used for clients with advanced sustainability objectives.
	Certification-based life-cycle project cost benefit analysis	Develop a life-cycle project cost benefit analysis based on a client's desired level of certification.
	Sustainable Target Assessment Rating	Use the Sustainable Target Assessment Rating.
Project performance	Drive project performance by challenging project teams	Challenge infrastructure design teams to drive improved performance into construction projects. Design teams to drive improved social and environmental performance into construction projects by, for example, including carbon footprint calculations, transport and traffic mapping,

		environmental and socioeconomic baseline studies, and stakeholder management initiatives.
	Performance driven design	Use the performance driven design concepts.
	Verify commissioning	Ensure that commissioning services verify that a project's systems are designed, installed and calibrated to operate efficiently and effectively.
	Include sustainability in close-out reports.	Sustainability as a key component of project close-out reports.

Table 2 – A summary of the implementation of initiatives in the area of project delivery tools and performance.

As summarised in Table C1 most of the firms' sustainability implementation focussed on the project level, notably project delivery, project tools and project performance.

The summary for sustainability at the project level (Table 2) indicates that approaches for integrating sustainability in project delivery requires:

- thought leaders for every market sector;
- seamless integration in project delivery from several sources;
- sustainability taken up at every phase;
- long-term social requirements to be included.

Essential sustainability project tools are seen to be:

- project sustainability standard
- new standards (of best practice)
- sustainability impact management
- value-add sustainability framework
- certification-based life-cycle project cost benefit analysis
- sustainable target assessment rating

To ensure that projects deliver sustainability performance by, the various firms envisage:

- proactively driving project performance by challenging project teams;
- using performance driven design;
- verifying commissioning is thorough;
- including sustainability in close-out reports.

4. MDGs and SDGs

Perhaps surprising is that none of the strategies and implementations of sustainability refer specifically to global goals for poverty reduction (*Millennium Development Goals*) and the conditions for development sustainability (*Sustainable Development Goals*). The MDGs are due to end in 2015 if there is no extension and the SDGs will be agreed in late-2015 for implementation in 2016.

The MDGs mainly target poor countries with rich countries bringing assistance through finance and technology. There are indicators for wellbeing covering, for instance, education, health and access to water that are measured at the micro-level and relate directly to projects. The SDGs will probably involve micro-indicators but there will also be macro-indicators referring to global

public goods (limiting climate change; financial stability) that relate to the national level.

The absence of any reference to MDG (and indeed SDG) goals and targets in E&C industry sustainability strategies and project tools may have arisen because the E&C firms surveyed were not directly affected by the needs of poor countries. This will need to change if SDGs are adopted as they will affect all countries. The top EC firms surveyed may then need to adapt their sustainability strategies and implementation in ways which have certainly not yet been articulated.

Appendix A

Merger and acquisition activity for the engineering and consulting sector's largest firms

Firm	Country	Type	Staff	Revenue, bUSD	Country offices	% international revenue	% public revenue	*EC type	**EC activity
AECOM	US	E&C	97000	19.5	80	37	54	EDCS	Top 10
Bechtel	US	E&C	58000	37.2	23				
CB&I	NL	E&C	54000	13	28				
Jacobs	US	E&C	53500	12.7	34			?	Top 25
Amec Foster Wheeler	UK	E&C	40000	8.5	50			EDCS CON	Top 10
Fluor	US	E&C	40000	21.5	32				
Technip	FR	E&C	37500	14.8	52				
WorleyParsons	AU	E&C	35600	6.8	46				
WSP Global	CA	CE	31000	4.1	39			EDCS CON	Top 10
SNC-Lavalin	CA	E&C	29700	7.6	50				
Arcadis	NL	CE	28000	3.0	39	89		EDCS	Top 10
CH2M Hill	US	E&C	26000	5.4	34	30		EDCS	Top 10
KBR	US	E&C	25000	6.4	7	63			
Altran Group	FR	CE	23000	2.4	23				
Royal Imtech	NL	E&C	22200	5.4	6	79			
Alten Group	FR	CE	18400	1.9	14				
Atkins	UK	CE	17500	2.7	23	43	60	EDCS	Top 25
MottMacDonald	UK	CE	16000	2.0	47	73			
Stantech	CA	CE	15000	2.0	8	47			
TetraTech	US	EC	14000	2.5	20			EDCS	Top 10
Fugro	NL	CE	13500	2.9	70				
Ramboll	DK	CE	12300	1.5	35	67		EDCS	Top 25

Table A1 – The largest (by end-2014 staff number) engineering and construction and "pure play" consulting engineering firms and groups ranked by staff number. Their environmental consulting (EC) sector activity is also ranked if it is in the sector's top 10 or top 25 firms.
*: the type of EC activity is the activity with largest percentage of environmental revenue (based on *ENR* categories). Categories are engineering and/or design and consulting and/or studies (EDCS) and construction, contracting and/or remediation (CON).
**: total EC activity is ranked by 2014 turnover as a top 10 or top 25 firm (*Environmental Analyst*).

Firm	Type	Revenue bUSD	Acquisition	Activities	Reason	Total revenue bUSD	EC revenue bUSD
AECOM”	E&C	19.5	URS, US; 50000 staff; 50 countries	E&C	Additional capabilities in the energy, oil and gas, government services and construction sectors. Enhance ability to provide integrated services.	11.0	3.15
			Hunt Construction, US; 700 staff	Stadium construction management.	To enter specialised construction markets. Expand presence in the US construction services market.	1.30	0
			ACE International Consultants, SP; 80 staff	Economic and social development consultant.	Add to international development business. Add to relationships with key Europe-based aid organizations.	0.14	0
Bechtel	E&C	37.2	None				
CB&I	E&C	13.0	None				
Jacobs”	E&C	12.7	SKM, AU; 6900 staff	CE	Add to geographic offering and the end-markets.	1.20	0.25
			Stobbarts, UK; 300 staff	Nuclear decommissioning	Add to construction services to the nuclear sector.	0.43	0.43
			Eagleton Engineering, US	Pipeline engineering	Add to midstream and upstream pipeline capacity.	0.02	0
			Marmac assets	Field services		-	0
			Guimar Engenharia interest, BR; 1100 staff	CE	Add Brazil to geographic spread.	0.094	0
			FMHC, US; 200 staff	CE	Add to telecom capacity.	0.50	0
			Federal Network Systems, US; 750 staff	CE	Add to security and intelligence capacity.	0.20	0
Amec Foster Wheeler*	E&C	8.5	Foster Wheeler, CH; 13300 staff, 37 countries	Market leader in mid-stream and down-stream oil and gas industry.	Add to oil and gas value chain, adding mid- and down-stream capabilities. Add to revenues in growth regions (e.g., Latin America). Add to North American and	3.40	0.20

					European markets.		
			Scopus Group, UK; 200 staff	Piping and structural engineering; surveying data specialist.	Add to project delivery capability across the upstream, midstream and downstream oil and gas sectors.	0.003	0
Fluor	E&C	21.5	None				
Technip	E&C	14.8	Air Liquide Zimmer polymer assets, DE; 40 staff	Polymer processing		0.001	0
			49% of Kanfa AS, NO; 100 staff	Oil and gas process engineering		0.001	0
			51% of Inocean AS, NO; 100 staff	Naval architect and engineering		0.002	0
WorleyParsons	E&C	6.8	MTG, US; 200 staff	Oil and gas consulting.	Add to global oil and gas advisory business.	0.003	0
WSP Global*	CE	4.1	Parsons Brinckerhoff, US; 14,000 staff; 25 countries	CE	Strengthen transportation in the USA, buildings and infrastructure, energy, and project and programme management.	2.60	
			Focus Group, CA; 1700 staff	Engineering and geomatics serving oil and gas.	Expand and diversify oil and gas engineering portfolio.	0.28	0
			Technip TPS, FR; 100 staff	Building and infrastructure engineering	Strengthen building and structures activities.	0.27	0
			Texas Energy Engineers, US; 180 staff	Building systems provider in healthcare, science and technology.		0.30	0
			Winward Group, AU; 50 staff	CE		0.001	0
			Dessau CEI, CO; 415 staff	CE	Add to oil and gas	0.80	0
			CCRD, US; 250 staff	CE	Facilities engineering	0.025	0
			ESC, SU	-	-	0.001	0
			ComTest, SU; 20 staff	CE	Auto testing	0.001	0
			Byggteknik Kurt Fransson, SU; 15 staff	CE	Buildings	0.001	0

			Teknikfunktion, SU; 12 staff	Project management	Project management	0.001	0
SNC-Lavalin	E&C	7.6	Kentz,UK; 15500 staff	E&C	Add to high-end oil and gas engineering and construction expertise.	1.66	0.20
Arcadis	CE	3.0	Hyder Consulting, UK; 4000 staff; 11 countries	CE	Strengthen transport, property, utilities and environmental sectors. Global design excellence centres in India, Philippines and Jordan	0.47	0.05
			Callison, USA; 1000 staff	Retail and mixed use architecture and design.	To be a global leader in high level design and architecture.	0.32	0
			inProjects, HK; 200 staff	Project management	Strengthen single provider management capability.	0.02	0
			Franz Environmental, Canada; 100 staff	EC	Complement environmental remediation, site assessments, brownfields and hydrogeology.	0.02	0.02
CH2M Hill**	E&C	5.4	TERA Environmental Consultants, CA; 450 staff	EC	Strengthen environmental consulting for power line, and oil and gas	0.11	0.11
KBR	E&C	6.4	None				
Altran Group	CE	2.4	Foliage, US; 500 staff	Product development	Add to healthcare and life sciences product development.	0.05	0
			TASS, NL; 230 staff	Intelligent systems (embedded software)	Add to intelligent systems.	0.03	0
			Concept Tech, AU; 100 staff	Development, simulation and testing services for auto safety.	Add to automotive capabilities.	0.002	0
			Scalae, SU; 40 staff	Product development	Add to product development.	0.001	0
			Beyondsoft telecomm assets, CN; 800 staff	Telecom and auto R&D services	Add to telecom and auto R&D services.	0.01	0
Royal Imtech	E&C	5.4	None				
Alten Group	CE	1.9	cPrime, US; 70 staff	Agile-based consulting and training	Integrated consulting, technology consulting, and implementation.	0.02	0

			5 specialised technology consulting firms (FR, US, DE); 720 staff	IT, project management; embedded software; manufacturing engineering	Add to product engineering services.	0.11	0
Atkins*	CE	2.7	Houston Offshore Engineering, US; 150 staff	Oil and gas engineering	Add to deepwater platform design.	0.04	0
			NSA, US; 130 staff	CE	To provide nuclear safety and licensing services.	0.03	0.03
			Confluence , SN; 200 staff	CE	Add to project and cost management capability.	0.02	0
MottMacDonald	CE	2.0	JN Bentley, UK; 700 staff	C&E	Add to water capability.	0.20	0.20
			AWT, NZ; 80 staff	CE	Add to water services in Australia and New Zealand.	0.006	0.006
			CHE, US; 35 staff	CE	Add to protection and restoration of coastlines.	0.01	0.01
Stantech	CE	2.0	8 acquisitions, US; 255 EC staff; 1194 CE staff	EC and CE	Add to geographic spread.	0.07	0.02
TetraTech	CE**	2.5	None				
Fugro	CE	2.9	Roames, AU; 19 staff	CE	Add to power services	0.011	0
			RailData, NL; 15 staff	CE	Add to rail services.	0.002	0
			Earth Resources, SA; 120 staff	Drilling contractor.	Add to specialised exploration.	0.002	0
			GeoFor, Cameroon; 600 staff	CE	Add to capabilities in Africa.	0.036	0.01
Ramboll	CE*	1.5	Environ, US; 1500 staff	EC	Add to chemical manufacturing.	0.30	0.30
			Apply Altra, UK; 30 staff	CE	Add to energy and gas in the UK.	0.001	0
			Poyry assets, FI; 435 staff	CE	Add to buildings and project management.	0.060	0
			Putz, DE; 100 staff	Management consultant	Add to German business.	0.002	0
			GBL, DK; 11 staff	Landscape architects	Add to urban planning.	0.001	0.001

Note: firms designated by *ENR* as supplying engineering and/or design and consulting and/or

studies to the environmental consulting sector are indicated by * and ** depending upon whether they are ranked as in the top 10 or top 25 firms, respectively, in the environmental consulting sector by *Environmental Analyst*. The only exception is possibly Jacobs, which is ranked by *Environmental Analyst* but not by *ENR* in spite of its important activity in the environmental sector.

Table A2 – Merger and acquisition activity for fiscal 2014 for the largest (by end-2014 staff number) engineering and construction (E&C), "pure play" consulting engineering (CE) firms and environmental consulting (EC) firms ranked by staff number (see Table A1).

Appendix B

Sustainability drivers reported by the engineering and consulting sector's largest firms

Theme	Issue	Criterion	Dim	A	B	C	D	E	F
Resources	Urban	Sustain economically viable cities	F	x					
	Availability	Drought and water scarcity	F			x		x	
	Recoverability	Increase	F			x			
	Extraction	Becoming more complex	E				x		
	Services	Need	G						x
Water	Clean	Need lean, safe, potable water	E	x			x		
	Resource detection	Need	F				x		
	Use	Improve water management	E				x		x
Energy	Cleanliness	Need	E	x				x	
	Reliability	Need	F	x					
	Changing mix	Unsustainable subsidies	F		x				
		Both carbon based and renewable energy.	E				x		
		Consumer preferences	G		x				
	Efficiency	Need greater efficiency	E		x				
	Regulation	Requiring renewable	G		x				
	Finite	Renewable energy, waste to energy	E						x
	Services	Growth	F		x				
Oil and gas	Price fall	Efficient ways to produce and deliver to markets	F						
		Smaller projects and operating expenditure.	F		x				
		Negative impact on energy market.	F						x
	Production	More efficient	E	x					
Transportation	Urban centres	More efficient	S	x			x		
		More capacity	S						x
Social trends	Aging populations	Facilities: older persons need care facilities	S	x					
	Demography	Changing	S						x
Urbanisation	Balance	Urbanisation, resource use and climate change	S	x					
	Emerging markets	1.5bn people to be urbanised by 2035.	S		x		x		
	Large cities	Many more	S			x			
	Investment	Cities compete for inward investments.	F				x		
		Drive economic development	F						x
	Regeneration	Developed world urban regeneration	E				x		
	Emissions	Need handling	E						x
Economic growth	Effects	Disaster preparedness	E	x					
	Consulting	Market to grow in line with GDP	F		x				
	Infrastructure	Need investment	S					x	
	Globalisation	Changes practices	S						x
Climate change	Sea level changes	Disaster preparedness: adaptation and mitigation	E	x		x			
	Flooding	Improve flood protection.	E				x		
	Legislation	Operation: increasing for sustainable operation	G		x				
	Services	Need	F		x				x
	GHG and carbon	Reduce footprints	E				x		

	Infrastructure	Need resiliency	E					x	
Ecosystems / environment	Urban sprawl	Into environmentally sensitive areas	E	x					
	Natural buffers	Loss	E						
	Land	Remediation of contaminated land	E		x				
	Capacities	Reduced	E			x			
	Human health	Environmental challenges	S						x
	Data monitoring	Increase environmental responsibility	G						x
Assets	Productivity	Improve	F						
	Ageing	Infrastructure ageing	F					x	
	Buildings	Performance improvement	E						x
Technology	Advances	Exploit	G			x			
Projects	Complexity	Increasing: more time critical; more management	F						
	Programmes	Becoming larger and longer term	G					x	
	Services	Need full-suite.	F					x	
Regulation	Stricter	In all aspects	G		x			x	

Table B1 – Sustainability drivers reported by 5 engineering and consulting and consulting engineering firms which are among both the engineering and consulting industry's top 22 firms and the environmental consulting sector's top 25 firms.

Appendix C

Implementation initiatives responding to growth drivers as reported by the engineering and consulting sector's largest firms

Theme	Issue	Area for action	Comments	A	B	C	D
Sustainability	Business considerations	Align sustainability	Align business values, purpose and strategy with the social, environmental and economic needs of the firm's stakeholders.	x			
		Integrate sustainability	Sustainable business is about integrating social, environmental and economic concerns into core values, decision making processes, and operations in a transparent and accountable manner.		x		
	Strategies	Complex challenges	Help clients, society and firms address complex challenges by managing financial, natural, social and human capital, with minimum risk. Specifically refers to capital. But will capital based methodologies be used in planning, design, etc?	x			
		Locally based	Recognise that each client's sustainability needs vary. Each client's sustainability needs vary depending on the market, materiality, regulation, short versus long-term focus, and stakeholder and commercial objectives.			x	x
		Indirect impact	Biggest impact is from the manner in which clients can be supported. Support clients to address their energy and water use.		x		
		Coherent overall strategy	Have a broadly based *Global Commitment Programme*: - to ensure compliance with regulations and internationally recognised principles; - to meet future expectations from customers and society globally; - to foster a better coherence and a clearer hierarchy of a firm's underlying policies, making it easier to operationalise the firm's commitments; - to create a stronger global language and understanding of the firm's responsibilities based on internationally recognised definitions; - to ensure that the firm speaks the same language as clients, society and business partners; - to embed the commitment in operational policies, all group policies are aligned with the Global Commitment.				x
			Develop a sector strategy to solve tomorrow's natural resource challenges using the *Resilient World* sustainability strategy. Resilient World sustainability strategy.: - natural resources extraction to be cleaner		x		

			and more efficient through new solutions that are cleaner, more efficient, and built to last; - demand growth is satisfied through access to a stable and secure supply of natural resources.				
		Spread benefits	Consider how knowledge generated by the firm can benefit as many people as possible without compromising legitimate business interests.				x
		Balanced solutions	Deal with many needs and considerations, weighing the social, environmental and economic dimensions of an issue to find balanced solutions.				x
		Preventive measures	Implement preventive measures such as screening of business partners and proactive communication of our commitment in proposals to say ”no” because when a project or client is in clear conflict with the firm's values.				x
	Climate change	Manage issues	Manage climate change issues, while ensuring compliance with local, national and international legal requirements.		x		
	Project delivery	Thought leaders	Ensure that the principles of sustainability underpin everything the firm does by having thought leaders in each business sector to devise new and innovative methods for project delivery.	x			
		Seamless integration	Seamless integration in service delivery with the ability to integrate health and safety and sustainability into the design and delivery of solutions seamlessly.			x	
		Sustainability at every phase	Increase the environmental, economic and social sustainability of every project at all phases from concept to completion.	x			
		Long-term social requirements	Consider long-term social requirements on projects. Long-term social requirements on projects include using a local workforce and suppliers, supporting local communities, etc.).		x		
	Project tools	Sustainability standard for projects	Embed a consistent sustainability standard across projects. No details given of this sustainability standard. But: - Use common systems to deliver work consistently and share work across offices and time zones. - Have a system of globally applied policies and procedures combined with comprehensive management oversight. - Integrate into standard operating procedures a standard, best-practice, consistent approach to inherently embedding sustainability into the core of projects - Integrate into standard operating procedures a procedure showing that all projects can demonstrate sustainability has been		x		

			embedded into the delivery.				
		New standards	Set new high standards in the energy industry by focusing on producing the cleanest and most efficient solutions.	x			
		Sustainability impact management	Use local sustainability impact management. Sustainability impacts are inextricably linked to the regions in which the firm operates. Sustainability impact management must be: - based on the local context; - integral to the way the firm is managed; - integrated throughout the entire management system.		x		
		Value-add sustainability framework	Develop a value-add sustainability framework for advanced objectives by integrating into standard operating procedures a value-add sustainability framework that goes above and beyond the standard approach to be used for those clients with advanced sustainability objectives.		x		
		Certification-based life-cycle project cost benefit analysis	Develop a life-cycle project cost benefit analysis based on a client's desired level of certification.	x			
		Close-out reports	Sustainability as a key component of project close-out reports.		x		
	Project performance	Challenge project teams	Challenge infrastructure design teams to drive improved performance into construction projects. Design teams to drive improved social and environmental performance into construction projects by, for example, including carbon footprint calculations, transport and traffic mapping, environmental and socioeconomic baseline studies, and stakeholder management initiatives.				x
		Performance driven design	Use the performance driven design concepts.			x	
		Target rating	Use the Sustainable Target Assessment Rating.			x	
		Commissioning	Ensure that commissioning services verify that a project's systems are designed, installed and calibrated to operate efficiently and effectively.	x			
	Asset life-cycle	Services	Provide high value services across the life-cycle of clients' assets. Specifically refers to life-cycle.		x		
		Solutions	Offer full life-cycle solutions. Major markets for life-cycle solutions include business advisory and consulting, design and engineering and programme, project and cost management.			x	
		Capabilities	Have capabilities that cover the whole asset life cycle.			x	
		Productivity	Asset productivity: provide programme, project and cost management; reduce operational expenditure while enhancing existing asset			x	

			performance, including reuse.				
	Sustainable value creation	Innovation	Sustainable value creation is enabled by continuously developing and applying innovative solutions that address the world's global challenges.				x
	Supply chain	Reduce resources	Support clients by working with partners and the supply chain to provide innovative solutions to minimise resource use.		x		
Services	Global, integrated, diversified	Global, diversified and fully integrated provider.	Be a global, diversified and fully integrated provider of infrastructure and support services	x			
	Global business	Leverage expertise and deepen market sector capabilities;	Global business lines to leverage expertise and deepen market sector capabilities.			x	
	Global business	Work across disciplines and geographies	Global business lines to work across disciplines and geographies to deliver integrated solutions to complex challenges.			x	
	Integrate	Integrate services over a broad range.	Integrate services over a broad range of services to deliver maximum value to clients at competitive cost. But is it clear that integration increases productivity, thereby lowering costs while at the same time increasing value?	x			
	Seamless delivery	Combine diversified services and global execution with seamless delivery.	Combine diversified services with global execution capabilities and seamless delivery. The concept of seamless delivery needs explanation.	x			
	Seamless delivery	Needed by private and public clients	Seamless delivery is needed by: - companies with global operations which look for solution providers that can work with them seamlessly around the world; - cities that compete on the global stage for inward investments.			x	
	Full service	Expand from the US	Expand from the US full service engineering, procurement and construction solutions.		x		
		Provide full service	Provide full service engineering, procurement and construction solutions.		x		
	Programme management	Programme management more complex projects	As projects also become more complex, time critical and require expert programme management services.			x	
	Industrial environmental management	Expand activity	Through acquisitions, expand into industrial environmental management. Industrial environmental management: local knowledge, presence and technical expertise combined with an understanding of environmental environmental, land use and redevelopment regulations and procedures can assess and plan for future land use alternatives and opportunities for potential development of a for a chemical manufacturing site into residential, industrial, and recreational areas.				x

	Long-term contracts	Long-term partnership contracts	Provide services through long-term contracts to have the opportunity to provide critical services in partnership with clients.		x		
	Front-end services	For full project life-cycle	Position as a trusted partner at the beginning of a project leading to the delivery of comprehensive solutions across the life-cycle of a client's assets.		x		
	Front-end solutions	Increasingly demanding	Front-end solutions are increasingly demanded by clients (strategic consultancy, asset management strategies, outlining and structuring investment programs, and managing projects, programmes and processes)			x	
	Local and global	Global in thinking / local in delivery	Global in thinking and in reach, yet local when it comes to the delivery and execution of our solutions		x		
		Combine global competences	Combine world class global competences with local insights and knowledge.				x
		Global knowledge base	Combine a global knowledge base with a local presence.				x
		More synergy and strong local position	National and local clients look for world-class solutions to be delivered to their doorstep regardless of where they are sourced in the world. In this sense the industry is following the path that was taken by accountancy firms, IT consultancies, and many other professional service businesses. Therefore, have more synergies from what one already has through improved global collaboration, performance excellence and sharing of best practices and where possible sharing of work.			x	
		Be global with strong local positions	Be global with strong local positions to successfully meet the demands in our increasingly consolidating environment.			x	
		Tailored to local conditions	Deliver building and infrastructure solutions for all scales and levels of complexity that are tailored to local solutions combining global reach, global expertise, local knowledge, innovation and technical excellence.	x			
Outsourcing	Collaboration	Improved global collaboration through the global Design Excellence Centres.				x	
Innovation	Complex challenges	Address complex challenges in innovative and better ways.		x			
	Interdisciplinary	Exploit interdisciplinary insight and diverse experience.	Applying creative vision, technical expertise, interdisciplinary insight, and diverse experience. Go well beyond simply technical expertise.	x			

	Integrated	Use an integrated approach to analysis and problem-solving.	Use an integrated approach to analysis and problem-solving. What is meant by an " integrated approach" is unclear.	x			
	Team focussed	Draw together teams of specialists (engineers, planners, etc.)		x			
	Holistic innovation	Adopt holistic approaches to innovative solutions;					x
Science	Apply	Apply scientific progress, knowledge.	Apply scientific progress, knowledge and understanding to optimise long-term value and more qualified decision-making				x
	Combine disciplines	Innovatively combine technical and scientific disciplines	Innovatively combine technical and scientific disciplines to help clients manage their impacts and reach their business and sustainability goals.				x
Project delivery	Collaboration	Dedicated process of collaboration with clients.	Deliver dynamic and innovative buildings and infrastructure around the world through experience and a dedicated process of collaboration with clients. "Dynamic buildings and infrastructure" is unclear.	x			
	Knowledge access	Access to an unique knowledge.	Deliver infrastructure through access to an unique breadth of knowledge.	x			
		Structured knowledge base, accessible firm-wide.	Be able to export leading edge technical skills to any region in the world by coordinating and consolidating the firm's knowledge base.	x			
	Integrated	Integrated approach to delivery	Use an integrated approach to delivery embracing the skills of architects, etc.	x			
	Supply chain	Management capability.	Deliver to clients a globally consistent and collaborative supply chain management capability that is a core part of the overall project delivery function.		x		
		Integration for local solutions	Advise the end customer by supplying overall programme management, design or delivering specialised services that help create competitive solutions based on a thorough understanding of local conditions.			x	
		Alternative delivery methods	Support alternative delivery methods to enhance supply chain integration such as, e.g., Design/Build (D/B) and Design, Build, Finance and Operate (DBFO)			x	
	Global platform	Global infrastructure delivery platform	Use an integrated global infrastructure delivery platform for all components of the in-project cycle (design, build, finance and operate). Few details of the platform are available.	x			
	Transferable	Skills easily transferable	Ensure that skills are easily transferable across clients.		x		
		Services transferable across markets	Ensure that services are transferable across markets.		x		

	Safety	Inherently safe projects at all phases	Ensure the delivery of safe projects (inherent within the design, on-site during delivery and onwards during the operation).		x		
		Implement Inherently Safer Design	Implement Inherently Safer Design principles as an integral part of the project engineering design workflow: - address life-cycle health, safety and environmental risks and environmental aspects including management of the use of natural resources in development projects; - systematically and comprehensively identify and assess hazards and environmental challenges, and their associated risk to people, environment, asset and production loss, and the firm's reputation; - examine whether actual and potential negative impacts can be entirely avoided, or their magnitude reduced by design. If this is not possible then appropriate and preferably engineered controls (i.e., by isolating people from the hazard by use of enclosures) shall be put in place to manage the residual risks and environmental impacts.		x		
	Services management	Strengthen programme, project and cost management	Strengthen programme, project and cost management since outcomes increasingly uncertain: - projects becoming larger and increasingly complex; - individual projects are being rolled up into programmes; - timescales to start up are requiring a strong focus on delivery certainty.			x	
Client relationships	Long term	Structured and impartial analysis	Create long-term partnerships of trust with clients using creative thinking, structured and impartial analysis, and clear communications.	x			
		Develop long-term, worldwide relationships with key clients.			x		
	Management	Strategic approach	Must now have a strategic approach to managing global, regional and local client relationships. “Strategic approach” needs clarification.		x		
		Strategic global account management	Using strategic account management and global accounts managed centrally by an expanded business development teams; regional and local account management will remain important.				
	Follow	Follow major clients, both private and public	Need to follow clients: - help cities become more “liveable” and improve their competitive edge through a full suite of competencies necessary to provide integrated and sustainable city conditions;				

			- service oil and gas industry clients wherever they decide to operate.				
	Outsourcing	Assistance	Enhance capabilities to assist clients in formulating outsourcing and privatisation projects since: - companies: focus on their core businesses; more non-core functions, such as environmental management, are being outsourced. - public sector: budget pressures have increased the focus on policy making, while execution, including design and engineering work, is being outsourced.				
Staff motivation and development	Focus	Most innovative and appropriate	Dedicated to finding the most innovative and appropriate solutions, and improving quality of life; collaborate with universities	x			
		Execution competencies	Create a focused and prominent project delivery function including a Group Project Delivery Director reporting directly to the Chief Executive to support the development, training and mobilisation of staff to enhance execution competencies.		x		
Private infrastructure investment	Promote	Investment fund	Create an investment fund to invest in public-private partnerships (PPP) and private-sector real estate projects for which the firm provides integrated solutions that include equity capital, design, engineering and construction services.	x			
	Assist clients	Lever knowledge	Enable clients to fund their projects without direct investment by the firm. Leverage the firm's practical knowledge of PPP and other forms of alternative delivery.	x			
	Advice	Structuring and Managing	Using private-public-private partnerships, governments are seeking to attract private capital to (co)finance infrastructure investments. Advise on structuring and managing these schemes.			x	
	Speed up	Focus on lenders and investors	Speed up projects come to market by focusing on lenders and investors and using, for example, a deep knowledge of urban design and master planning and environmental impact assessments.			x	
	Guaranteed outcome	Guaranteed outcomes and fixed price solutions	Select projects to offer guaranteed outcomes and fixed price solutions in key areas as part of risk participation: - clients increasingly require suppliers to take on a portion of project risks; - control risks through the firm's internal procedures; - do not invest, in principle, in project equity.			x	
Business portfolio	Balanced	Geographies, markets, clients, services	Balanced business portfolio of geographies, markets, clients and diversified services.		x		

	Transversal	Position to handle change in product mix.	Positioned across (energy) sectors so as to benefit whatever the relative weighting in the (energy) mix.		x		
Business expansion	Approach	Opportunistic	Opportunistically enter new and emerging markets and geographies.	x			
	Presence	Balanced geographic presence.	Balanced geographic presence through acquisitions and organic growth.		x		
	Focussed	Focus on three end markets	Have focused growth in three end markets (emerging markets, big urban clients, US mining, and international oil and gas).			x	
		Focus on four value propositions	Have focused growth stemming from four value propositions.			x	

Fig. C1 – The various approaches taken by four engineering and consulting and consulting engineering firms to respond to today's growth drivers. The firms are among the engineering and consulting industry's 22 largest firms and among the environmental consulting sectors largest 25 firms.

Further information:

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