

Critical success factors in multi-organizational design and construction projects

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Abstract

The IDBE masters programme at Cambridge attracts early mid-career built environment professionals from across architecture, engineering, surveying, project management, and construction law. Their first assignment is to write a critical and reflective 5000-word account of a construction project in which they have been engaged. They are asked to report on their own actions and those of others, and on the outcome as they see it. Since the course started in 1994, some 292 case studies have been submitted. From this rich data source, 15 cases have been selected for detailed investigation. They are from different authors and organisations, and have been selected primarily for the authors' reflections on people-based issues like teamwork, leadership, communication, design integration, and collaboration among different disciplines.

The writers are not briefed to focus on *critical success factors* but the case studies have been analysed against a set of 31 critical success factors drawn from the literature. The expectation was that projects judged by the authors as having weaknesses in terms of delivery or quality would lack vital attributes found in more successful ones. However, the pattern across the case studies is less clear with examples where despite good leadership, commitment, honesty, credibility, well-defined responsibilities, and high degrees of technical skill, the outcome is nevertheless judged by the writer as low-performing. At the same time, a set of ten factors that all the better-performing cases shared have been identified: the setting of a challenging task; commercial awareness; technical skills; social skills; attention to team building process; interdisciplinary working; client focus; change management and flexibility; passion and enthusiasm; and motivation. The results have implications for the IDBE course syllabus.

Keywords: case studies, success factors, interdisciplinary collaboration, motivation, social skills.

1 Introduction and objectives

This study draws upon an original database of 292 case studies submitted over an 18-year period by students of the *Interdisciplinary Design for the Built Environment* (IDBE) course at the

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University of Cambridge. As part of their course-work, every student is expected to prepare a case study where they review and assess a recent project in which they have been involved. The main purpose of the assignment is an educational one of encouraging the writers to reflect critically on a project with which they are fully familiar and have most of the facts at their fingertips. Critical reflection and effective communication are among the key aims of the course itself. The case study briefing to the students in the Course Handbook includes requiring them to describe and reflect upon the decisions and actions of the participants, to gauge the strengths and weaknesses of the process followed, and to evaluate the outcome. The aim of this analysis is to undertake a cross-case comparison, to report on the factors that the authors identify as critical to project performance, to offer some generalisable lessons about project success, and to assess the course syllabus against them. Because of the scale of the task in comparing cases, just 15 cases from the 292 have been chosen. The selection of projects was made before any detailed analysis was undertaken. Author and project details are given in Table 1. The projects ranged from a \$1bn project down to just £4.5m. The median value is £30m. Projects were selected according to the following criteria:

- *Detailed coverage of teamwork and process issues including collaboration across professional disciplines:* as opposed to a more technical focus.
- *Completion:* the project (or part of it reported upon) had been constructed; none of the projects was a design-stage only case study.
- *Size and type:* domestic-scale projects were omitted, the smallest in value is US\$4.5m.
- *Location:* while IDBE students come from all over the world, selected projects were limited to those in UK and US.

Table 1 Summary of the 15 projects chosen for analysis

CS	Discipline of author (and project role if different)	Project location	Project type	Cost US\$ 000s*
9	Civil engineer	US	University science complex	1000
7	Architect	UK	Multi-storey office	160
5	Structural engineer	UK	Multi-storey office	150
11	Structural engineer	UK	Multi-storey office	100
14	Project Manager	US	Media centre	72
15	Mechanical engineer	US	Art museum	50
13	Mechanical engineer	UK	School	36
4	Mechanical engineer	UK	School, library and housing	30
3	Structural engineer	UK	Sports stadium	30
10	Architect (project manager)	US	Industrial scale bakery	20
8	Building Regulator (client and end user)	UK	Council Offices	10
1	Structural engineer	UKI	University research building	10
12	Building Regulator	US	Food production facility	5
6	Architect	UK	Agricultural college	5
2	Mechanical engineer	UK	Low carbon housing	4.5

*Some of these cost figures are estimates based on floor areas

2 Literature Survey

There are many definitions and explanations of when a project is a success, and success for one stakeholder or group of stakeholders does not necessarily represent success for others. For example, a prizewinning architectural project may have been highly challenging technically leading to expense and delays. As Jugdev and Müller (2005) state 'project success is ambiguous and highly context dependent'. Nevertheless, several authors offer descriptions of success. Ashley (1987) describes it as 'results much better than expected or normally observed in terms of cost, schedule, quality, safety, and participant satisfaction'. Tuman (1986) sums it up as 'having everything turn out as hoped . . . anticipating all project requirements and having sufficient resources to meet needs in a timely manner'. A more comprehensive definition is given by De Wit (1986) who argues: 'The project is considered an overall success if it meets the technical performance specifications and/or mission to be performed, and if there is a high level of satisfaction concerning the project outcome among: key people in the parent organization, key people in the project team, and key users or clientele of the project effort'.

Accepting that success is relative, is it nevertheless possible to determine common factors that contribute to its achievement so that organisations and individuals can become more aware of them, and universities can address them in their teaching? The topic of CSFs has attracted considerable interest from both academic and professional communities, and numerous studies have been conducted that seek to define 'critical success factors' (CSFs), especially within information systems, R&D, and various engineering environments. Table 1 shows some descriptions from the literature.

Table 2 Some descriptions of critical success factors from the literature

Rockhart (1979)	CSFs are a means of identifying the essential elements that need to be addressed for organisations to implement change more effectively. Within a project context, CSFs can be described as the factors that the manager needs to keep a firm eye on to achieve a successful delivery.
Anderson et al., (2006)	The implication is that if critical success factors are not present or taken into consideration, problems will be experienced which may act as barriers to success.
Jugdev and Muller (2005)	Project success is ambiguous and highly context dependent. Consequently, what is considered to lead to success is coloured by personal perception and by the circumstances under which the judgement is made.
Cooke-Davies (2002)	The question of which factors are critical depends on answering three separate questions: What factors lead to project management success? What factors lead to a successful project? And what factors lead to consistently successful projects? Cooke-Davies distinguishes between project success (measured against the overall objectives of the project), and project management success (measured against traditional measures of performance such as cost, time and quality). A further distinction is between success criteria (the measures by which success or failure of a project will be judged) and success factors (those inputs to the management system that lead directly to the success of the project).
Fortune and White (2006)	These authors demonstrate there is lack of consensus about what factors affect project success. They found the three most cited factors to be support from senior management; clear and realistic objectives; and the production of an efficient implementation plan.

Researchers concerned with the production of the built environment have identified several critical frameworks for success. The most basic comprises the widely accepted trio of time, cost and quality which, at its most elementary, is an assessment of whether a project meets the budget, the timetable and the technical specifications (Phua, 2003). Certain success criteria are concerned with the delivery team and its procurement and management procedures such as project partnering, construction contracting methods, planning and project management (Chua et al,1994). Equally from the perspective of clients and other building users, lie issues of whether qualitative and quantitative client expectations, plus those of the wider stakeholder community, have been met. Without the inclusion of these issues, the measurement of success is incomplete, and normative frameworks will be inadequate to guide management (Zwikael and Globerson, 2006).

In construction management, Chan et al (2004) propose that CSFs can be sorted into five independent groups which they term: *human related factors* (experience, client characteristics, project team), *project factors* (type, complexity, size), *project procedures* (procurement, tendering), *project management actions* (communication system, planning and control mechanisms) and *external environment* (social, economical, political).

In their study of a multi-disciplinary engineering consultancy in the UK, Koutsikouri et al (2008) state that there are few studies of the design phase of construction projects that use the framework of critical success factors. She and her colleagues summarise the organisational setting as often multidisciplinary and characterised by creativity, iteration and the uniqueness and temporality of project arrangements. They note that the challenges faced by project participants are many and varied, there is high dependence on diverse skills, often difficulty in developing a shared vision, and limited time to locate relevant knowledge. They identified that it is vital in design projects involving different professional disciplines to include soft skills, that is, the subjective dynamics of people and social processes, such as passion and enthusiasm, creativity and innovation, and culture and values. These, they show, are all of particular importance within multi-disciplinary design projects. Drawing on research into project management success factors by Fortune (2006) as well as other sources, they developed a framework of CSFs and applied it to projects in the consultancy they studied.

IDBE case studies are not limited to a single engineering design consultancy but are spread more broadly across wider disciplines. Nor are they limited to the UK but are international. The student authors do not necessarily share even among themselves a single definition of design, which is an ambiguous term even within the built environment let alone more broadly across manufacturing and the creative arts. Nevertheless the framework of critical success factors used by Koutsikouri and her colleagues has been adopted for this study. The list of factors is shown in column 2 of Table 3 (below).

3 Data Analysis

In an iterative process, each of the 15 projects was subjected to an independent review and evaluation by the first author of this paper. The text of each case study was scrutinised to identify references to the 31 CSFs, and the relevant content from the original case study referring to each CSF was pasted into a table. This resulted in a table for each of the case studies comprising 31 rows. Next, the first author of this paper assessed the case study writer's comments about each CSF and allocated a score against each one on a scale of 1-5 (5=high) interpreting as faithfully as possible the original case study author's perception of how strong or weak the project was with respect to that factor. Tables 4, 5 and 6 contain selections of the case study text *in italics* and the scores allocated. In all 15 cases also, the original student author's overall perception of the project outcome from their own perspective was rated by the first author of this paper on a scale of 1-5; again this is a subjective interpretation but at least by a single researcher to achieve a level of consistency. Just as projects are likely to be evaluated differently by different stakeholders, it has to be admitted that the research method adopted here is not an objective process but a subjective one, whose aim is to identify whether there are common patterns across this set of case studies.

Although the case studies were not written around the 31 factors, in practice detailed examination yielded a mention of almost all of them. The scores allocated were tabulated and the cases were then ranked by total score. Trends and patterns in the data could then be identified and investigated. The overall ratings made by the first author of this paper were also tabulated. The results are given in Table 3 which divides the projects into three broad categories of low (four projects), medium (6 projects) and high (five projects) ratings. Where there is no mention of a factor in the original student case study, table 4 shows n/a (not applicable).

Table 3 Rating ascribed to each CSF in each case study

	CASE STUDY NUMBER:	8	3	14	12	6	1	5	9	2	13	4	11	15	10	7
	OVERALL SCORE	1	1	2	2	3	3	3	3	3.5	3.5	3.5	4	4	4	4.5
A	Goals and Objectives															
1	Defined project goals	2	2	1	2	4	2	2	4	4	4	5	3	2	4	5
2	Shared project vision	2	2	2	3	2	2	2	4	4	4	5	4	3	4	4
3	Defined roles & responsibilities	1	1	4	1	2	2	4	4	2	4	3	2	3	4	5
B	Performance Monitoring															
4	Project management practices	1	1	2	2	2	2	3	4	2	3	3	3	4	4	4
C	Decision Makers															
5	Quality of leadership	1	1	1	4	2	2	3	2	2	4	3	2	3	4	4
6	Team selection & composition	1	1	1	1	2	2	4	4	2	4	3	na	2	4	4
7	Commercial awareness	3	1	1	5	2	3	3	2	2	na	4	5	3	5	5
D	Transformations															
8	Technical skill	1	2	4	2	2	2	4	2	2	3	3	4	4	5	5
9	Social skills	1	2	1	2	1	3	2	n/a	2	4	na	4	4	5	4
10	Team Building process	1	1	1	2	1	2	1	n/a	3	4	4	4	4	5	4
11	Creativity and innovation	1	2	2	1	5	3	3	4	5	4	3	4	4	2	4
12	Effective teamwork	1	1	2	4	1	2	2	3	3	4	2	4	4	3	4
13	Time management	3	2	2	2	3	2	3	4	3	2	5	4	2.5	5	3
E	Communication															
14	Rich Communication	1	1	2	1	2	2	2	2	3	3	3	4	3	4	4
15	Knowledge sharing	1	1	1	3	2	2	2	4	4	2	3	4	2	4	4

16	Management of expectations	1	1	1	4	2	3	3	2	2	2	3	3	4	4	4
17	Feedback on progress	1	2	1	1	2	2	2	na	3	3	2	2	5	4	4
F	Environment															
18	Organizational structure	1	2	3	3	2	2	2	4	2	3	2	2	3	2	4
19	Culture	n/a	2	3	1	1	n/a	3	2	4	n/a	4	2	3	n/a	n/a
20	Physical environment	n/a	1	n/a	n/a	2	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	4
I	Boundaries															
21	Relationships	3	1	3	2	2	3	2.5	2	2	2	2	4	4	4	3
J	Resources															
22	Sufficient resources	2	1	2	2	3	3	4	5	4	3	3	4	3	2	3
23	Appropriate technologies	1	3	1	na	2	2	3	4	4	4	4	4	4	3	5
K	Continuity															
24	Client focus	1	1	2	5	3	5	4	4	2	5	4	4	5	4	5
25	Mutual trust & understanding	2	1	1	2	2	2	2	2	2	2	2	2	4	3	3
26	Change management & flexibility	1	1	1	2	3	4	3	2	3	2	4	4	4	5	4
27	Motivation	1	2	1	1	4	4	2	3	4	4	4	4	3	4	4
28	Challenging task	1	2	4	2	4	4	4	4	3	3	4	4	4	4	4
29	Passion and enthusiasm	1	1	2	2	4	2	2	2	4	4	3	4	4	3	4
30	Shared values	1	2	1	2	1	2	2	2	4	2	2	2	4	1	4
31	Recognition and appreciation	1	0	4	1	4	4	3	4	5	4	4	4	4	2.5	4
	TOTAL	39	44	57	65	74	75	81.5	85	91	92	96	100	106	108	122

4 Findings

As table 3 shows, the 15 projects occupy a spread of performance achievements. At the extremes, the least successful projects show a relatively uniform pattern of low performance across all, or almost all, of the critical success factors. At the other extreme, the most successful projects showed fairly consistent good performance across the board. The factor ‘physical office environment’ was rarely referred to in the original case studies and does not seem to have been a significant issue in this set of case studies. ‘Culture’ was also rarely mentioned.

In tables 4, 5 and 6, a selection of direct quotes from the original case studies are presented *in italics* under the various CSFs to demonstrate some of the process that has been followed in the analysis; other summary observations about each CSF made by the first author of this paper are given in normal text.

4.1 Low and medium performing projects

The main trend shown by the low performing projects was uniform low ratings across all or almost all factors, although the data do contain examples of projects that are not uniform. These have been highlighted in table 4. So for example, case studies 12 and 14 exhibited a high quality of leadership from the client side, good commercial awareness and rigorous client focus.

Table 4 Case studies 12 and 14 – low performing overall but good in parts

CS no.	CSF	Analysis including original quotes from the case study <i>in italics</i>
CS12	a. Quality of leadership (4)	This project ranked in bottom four according to overall performance. However, it had high scores in some factors: a. <i>“Client’s agent was dedicated and honest, high credibility, very experienced with excellent negotiation skills and ability to solve problems quickly and effectively.”</i> b. <i>“Quick cost effective construction was first priority, knowledge of building inspector used in lieu of architect to save money.”</i> Although there was much focus on commercial awareness, this was the
	b. Commercial awareness (5)	

	c. Client focus (5)	only thing the team was focusing on. Very little attention to creativity and innovation, an architect was not used in order to save money. c. "Client brief of cost control was followed religiously by the team, clients expectations met perfectly (ON TIME), the agent dealt with the problems competently." The strong client demanded extreme cost cutting and time management; this resulted in other factors being completely sidelined and effecting the morale of the team.
CS14	a. Defined roles and responsibilities (4) b. Technical skills (4) c. Challenging task (4)	Overall the project did not perform well. However, it had high scores in some factors, a. these were clearly defined among consultants and [the consultant's] team. b. "All consultants sufficiently experienced but were not integrated into the project well, [The consultant] decided on use of evidence based design in lieu of industry standards which was ill-matched for such a technical project." c. "Very technical building, broadcast and data infrastructure needed to run through entire building, needed more coordination, time and effort between design team and owner to achieve architecture support for the facility and design of such unique elements."

Projects with medium performance similarly showed considerable variety across the individual factors. Table 5 shows examples including quotations where the medium projects still score highly. One interpretation is that despite generally low scores, the seven CSFs highlighted in Table 3 (*defined project goals, creativity and innovation, sufficient resources, client focus, motivation, challenging task and recognition and appreciation*) can raise an otherwise weakly performing project to make it moderately successful.

Table 5 Projects with moderate performance but showing some high scores in CSFs

CS no.	CSF	Analysis
CS1	Client focus (5)	There was constant focus on client needs. "The client expressed gratitude to design team for sensitive way cost savings had been made, with little detrimental effect on space"
CS2	a. Creativity and Innovation (5) b. Recognition and appreciation (5)	a. According to the author, it was an "innovative, award winning design by high profile star architect Renzo Piano." b. The team was motivated to give its best as the building was in the national register of historic buildings and afforded them much recognition and appreciation.
CS5	a. Defined roles and responsibilities (4) b. Team selection and composition (4) c. Team building process (1)	a. The team was composed of experienced experts and each had a clearly defined role d. One factor that stood out is 'Team building process': "There was no effort towards team building exercises, everyone worked in isolation and people were not proactive in building relationships with each other."
CS9	a. Defined project goals (4) b. Shared project vision (4) c. Defined roles and responsibilities (4)	a. The main goals were to achieve high quality and complete the project on schedule. b. The project benefited from a strong vision statement: "The [University] Campus initiative report and a series of other documents present the aspirations, benchmarks and clear vision that the redevelopment of a former industrial zone into a university extension will have direct benefit for the entire community." "Also aim to lead by example in terms of sustainable development and construction." c. "Clearly defined by organograms in [the consultant] and [the client's representative] to direct progress of the masterplan. They in turn appointed [the project manager]."
CS13	a. Goals and objectives (4) b. Defined roles and	a. "High aspirations for the school to achieve specialist status in music and IT." b. Initially the roles and responsibilities were clearly defined but later on there were communication problems: "The specialist needs required

	responsibilities (4) c. Team building (4) d. Creativity and innovation (4) e. Effective interdisciplinary team work (4)	<p><i>specialised consultant appointments-causing large number of consultants on the project. However, development of specializations led to breakdown of understanding between the different participants--neither the design team nor the specialists were aware of the task the other needs to undertake. With no one spanning the gap-continual breakdown in communication occurred."</i></p> <p>c. <i>"Kick-off meeting (internal to the consultant) to introduce all design team members to the scheme and to each other, this brought the members together at an early stage and develop a sense of belonging before turning up together at external meetings."</i></p> <p>d. <i>"Architect, known to be perfectionist, brought in innovative measures based on extensive research and forced consultants to think out of the box."</i></p> <p>e. <i>"...seen in design of structural systems where architect and structural engineer brought opposite ideas but adapted well to solving new problems ... the whole team bonded over the differences in opinions and the fact that a satisfactory situation was reached in the end."</i></p>
CS6	a. 'Creativity and Innovation' (5) b. 'Recognition and appreciation' (4)	<p>The project was moderate success, but scored high in these two factors:</p> <p>a. A very creative and dominant architect: <i>"... brilliant renowned architect who was tenacious about his design. [He defined the goal] to build a beautiful building which matched his vision."</i></p> <p>b. It was a very prestigious project with much scope for recognition for the team. Both these factors kept the design team motivated and passionate to deliver their creative vision.</p>

4.2 High performing projects

Table 6 summarises five high performing projects in terms of the original authors' observations tabulated against CSFs that were met to a high level. The most successful projects showed high ratings in almost all factors but most significantly in the two areas:

- *Transformations* - technical skills, social skills, team building process and effective interdisciplinary teamwork
- *Continuity* – client focus, change management and flexibility, challenging task and passion and enthusiasm.

This suggests that the most successful projects focused on the core issues of creating a strong team by team-building exercises and creating open channels of communication. Secondly they maintained constant client focus and kept the team motivated by offering challenges tasks. This ensured that the team was open and flexible, and managed changes well.

Another factor in which successful projects rate highly is *commercial awareness* which means that the commercial value of the building was paramount. Often this led to tight control on spending and ensured the projects did not go over budget. As a result clients were satisfied and deemed the projects a success. Another prominent factor is *management of expectations*, which is closely linked with client focus.

Table 6 High performing projects

CS no.	CSF and grade	Analysis
CS4	<ul style="list-style-type: none"> a. Defined project goals (5) b. Shared project vision (5) c. Time management (5) 	<ul style="list-style-type: none"> a. [The project goal and vision] “... was to deliver the project on a strict deadline.” b. Time was managed strictly to achieve this goal – “...completed on very strict deadline, everyone did whatever it took to complete on time for the Ashes.”
CS7	<ul style="list-style-type: none"> a. Defined project goals (5) b. Commercial awareness (5) c. Technical skills (5) d. Client focus (5) e. Defined roles and responsibilities (5) 	<ul style="list-style-type: none"> a. “The goal was to make the project a commercial success, give flexibility and choice to client.” Clearly defined roles and responsibilities: “... the architects and project managers prepared a full program complete with aims and objectives and delegated work to architects, contractors, sub-contractors.” b. “... was a common thread as each decision reflected on commercial value of the building.” c. “... excellent technical skills, best consultants in their field were used.” d. “... maintained throughout by [the architects], this was the reason for three design options so that the client could have flexibility and choose what they liked.” <p>The clients prepared a detailed report with aims and objectives, this set out the roles of each consultant. Moreover they selected the best consultants in the field and provided them with sufficient resources. The consultants in turn maintained clear client focus throughout.</p>
CS10	<ul style="list-style-type: none"> a. Commercial awareness (5) b. Technical skills (5) c. Social skills (5) d. Team building process (5) e. Time management (5) f. Change management and flexibility (5) 	<ul style="list-style-type: none"> a. “Strong focus throughout, bankers always a part of meetings and advised on costs and budgets.” b. “Key problem areas were quickly identified - like HVAC and interior/exterior finishes, and simplified to reduce time and cost (6 weeks saved). Simple solutions like retaining a well finished concrete surface rather than painting with epoxy high gloss saved thousands in material and labour costs.” c. “Skills like listening carefully helped form an understanding of the project.” d. “The team was motivated by quick response to design discussions, sketching by day, drafting by night and presenting next morning helped to consolidate the design quickly.” e. “... eye on agreed objectives and weekly score of them, constant focus on objectives and deliverable dates resulted in project completed before time.” f. By architect when client adamantly purchased and assembled non-suitable windows which leaked and caused mildew, the architect tried an innovative spray on sealant which worked very well. So there was flexibility despite non-cooperative client.
CS11	<ul style="list-style-type: none"> a. Commercial awareness (5) b. Transformations (4) c. Interdisciplinary team work (4) d. Client focus (4) e. Change management and flexibility (4) 	<ul style="list-style-type: none"> a. As client and contractor were the same the focus was on this aspect. Primary goal was to have maximum net lettable area. The architect was sidelined after the initial stage to focus on building fast. b. “[The engineers] maintained a practical outlook and the perception of hard work by undertaking rework, this established a good relation with the contractor.” Innovative solutions to the horizontal loads problem in the building - this reduced maintenance and increased net lettable area. c. “This was seen between [the engineering consultants] and fabricators, it limited abortive work and maximized profit. Working closely with fabricators minimized errors.” d. The team worked to woo the high profile client in order to win further work. “[The engineering consultants] absorbed design and co-ordination role, usually the domain of the architect but necessary here as contractor passed information directly to them they maintained open communication channels and provided innovative solutions quickly.”
CS15	<ul style="list-style-type: none"> a. Transformations (mostly 4) 	<ul style="list-style-type: none"> a. Highly professional and experienced staff, interdisciplinary meetings held regularly and allowed everyone to discuss ideas and resolve problems

	b. Continuity (mostly 4)	<p>together, helped to avoid breakdown of relationships despite difficult client.</p> <p><i>“Workshops and team building process helped communication, this was later seen in the way team handled constant changes and took them in their stride.”</i></p> <p><i>“Inter-disciplinary meetings were held regularly and allowed everyone to discuss ideas and resolve problems together.”</i></p> <p>b. <i>“The team maintained rich communication and despite frequent changes attempted to maintain flexibility and keep work on track. They also had shared values: “To see the project successfully to its end and ensure client is happy.”</i></p>
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5 Findings

In broad terms, projects whose authors report on them positively overall are achieved when most of the critical success factors are also present. And conversely, when little attention is paid to these factors, projects in this study have been reported by their case study authors as underperforming. This is only to be expected and neither of these findings is a surprise. What is more valuable is to assess whether, within the framework of 31 critical success factors, it is possible to identify those that appear to be essential to high performance. According to the present analysis there are ten success factors that appear to be *crucial* for high performance, in that each of our high performing case studies scored highly with respect to each of these ten. These are highlighted in table 4 and listed in table 7 below.

Table 7 Crucial success factors in the IDBE data set

Decision Makers	Transformations	Continuity
Commercial Awareness	Technical skills Social skills Team building process Effective interdisciplinary team working	Client focus Change management & flexibility Motivation Challenging task Passion and Enthusiasm

A key question then becomes: ‘how are these *crucial factors* rated in those projects judged as of medium success?’ Here the pattern is not clear cut. As table 4 shows three of the ten (*client focus, motivation and challenging task*) were fairly highly rated in the set of medium performing projects but the other seven were not; and meanwhile the factors of *defined project goals, creativity and innovation, sufficient resources, and recognition and appreciation*, were highly rated in the medium performing projects, though they are not among the ten *crucial factors* of high performing projects.

The expectation of this analysis was that as projects are rated more and more successful, then more and more of the CSFs would be met at higher and higher levels. That simple pattern is not entirely evident in Table 3. In part this is undoubtedly due to methodological limitations of this study, and specifically the subjective nature of our interpretations of others’ project descriptions and evaluations. But equally, it reinforces the line taken by Koutsikouri et al that ‘simply attempting to identify and classify CSFs is not enough in understanding how project success

can be achieved in complex projects.' Built environment projects involve complicated procedures and processes, and the **degree of integration across factors** may be equally or more impactful than success against each judged separately.

A further finding relates to the application of the CSF framework devised by Koutsikouri et al. While their study was based upon interview data from only one organization, it has been applied beneficially here to a diverse sample of multi-organizational built environment projects and been found to offer an insightful assessment system for these as well. Despite the fact that the IDBE case studies were not written in accordance with the framework, and nor were the original case study authors questioned, a mention of almost every factor was found in each of the 15 cases. This illustrates the potential of the CSF framework in a wider context.

6 Conclusions

Clearly every construction project is unique, and it is neither possible nor desirable to propose a single universal formula that will guarantee a successful outcome for every project. Nevertheless this study has usefully applied *a framework of critical success factors* and found it to be an analytical tool that has helped to pinpoint strengths and weaknesses of each of these 15 projects.

In the context of the IDBE masters course, from which the case studies have been taken, arguably the ten crucial factors from the high performing projects should be at the core of the course to deliver to its students. Fortunately IDBE is already strongly focused on some of them – in particular **social skills**, **team building process**, **interdisciplinary team working**, and **client focus** (as part of a broader concern with design for use and skills in stakeholder engagement). **Change management and flexibility**, and **motivation** are delivered but to a lesser extent. As the students are experienced professionals, there is little emphasis on the course in **technical skills** other than those in connection with the sustainability agenda. Students are set **challenging tasks** in the studio design projects, and those taking the course are invariably **passionate** and **enthusiastic** which is why they want to take the course in the first place. Measured against the crucial success factors, the largest gap in the course syllabus is **commercial awareness** and this is a skill to which the course needs to pay more attention.

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