INTERNATIONAL DESIGN CONFERENCE - DESIGN 2016
Dubrovnik - Croatia, May 16 - 19, 2016.

COLLABORATIVE DESIGN MANAGEMENT

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Keywords: architectural design, design management, interdisciplinary collaboration, participatory design

1. Introduction

Research on design management since 1964 has been extensive [Farr 2011], so the definition of design management varies according to the researcher's perspective. In some studies Design Management (DM) is divided into three terms - strategic, tactical, and operational - according to the level at which the design is managed [Cooper and Press 1995], [Borja de Mozota 2003], [Best 2009], [Holland and Lam 2014]. DM's main objective is to enable the company to build an environment in which it can achieve its strategic goals efficiently and effectively [Borja de Mozota 2003], [Best 2009]. DM exploits design and corporate strategy to enhance creative processes, innovative culture, and communications for ongoing corporate development and success [Holland and Lam 2014]. When design is managed and exploited strategically and systematically, the company can secure a competitive advantage with industry attractiveness and increased customer awareness, since design differentiates it from its competitors [Hands 2009]. Best [2009] insisted that implementing DM creates added value for clients, business, and all the stakeholders by meeting their different interests at the appropriate stages.
Architectural design firms are design-driven organisations, classified as professional service firms delivering design to clients to meet their requirements [Emmitt 2014]. An architectural design project involves a range of professionals, including engineering, structural, mechanical, electrical, civil, and landscaping experts to solve complex building problems and create an effective solution [Gänshirt 2007]. Many individuals with different interests and desires are involved in various phases of the architectural design process. They assert their requirements and exchange their expertise to achieve the final building design, as each professional's knowledge and skills contributes to solve design problems and co-operatively eliminate project constraints. Exchanging expertise enables all stakeholders to predict challenges and mitigate potential risks, reducing the frequency of design changes and their associated costs to achieve their goals [Lawson 2005]. Throughout the process, participants are required to exchange information, learn, and co-generate ideas to build a successful project [Leslie 2014]. Communication gaps and different thinking patterns can be mitigated by setting common goals and facilitating clear understanding of each other's interests. This approach enables a series of logical, coherent and collaborative actions for solving design problems [Parsaee et al. 2015]. Given that architecture is problem-solving based design, creating the optimum solution is critical. The solution is achieved in communicative flexible processes, with prompt decision-making among designers and stakeholders [Laseau 2000]. The complexity of participants, resources, processes, and activities can be strategically and collaboratively managed by applying DM discipline to architectural practices, to meet the requirements and interests of all the individuals involved [Parsaee et al. 2015].
Our background research identified that architectural practices in South Korea lack strategic management. Strategies must be put into place to enhance collaboration in design teams and with external professionals to find innovative ideas for design solutions. In exploratory interviews, South

Korean architects reported problems such as poor understanding of projects, and of defining design problems in the 'design brief' stage, and inefficiency of design processes and activities. This unsatisfactory situation results from the lack of management in design resources, the trades involved, and design activities. This research aims therefore to develop a DM toolkit for South Korean architectural design firms to make the best use of DM.

2. Methods

This study is designed to identify real-world problems faced by Architectural design companies and to devise appropriate innovative solutions. The research process comprises six phases to devise practical recommendations: understand, empathise, define, ideate, prototype, and test by applying qualitative, creative, and participatory research methods.

First, extensive literature reviews investigated the attributes of architectural practices, current DM theories, and DM's changing role. Interviews were conducted with six DM experts having published books with diverse pespectives to identify key DM issues and the role of design managers, to develop an interim framework for a DM audit. Three architectural design firms were then selected to diagnose real problems and set the research scope. To conduct a DM audit, second interviews were conducted with twelve architects, using a design audit checklist and the interim framework to diagnose current DM states, and identify the critical issues for introducing it into architectural practices. Existing DM processes and architectural design processes were investigated through an extensive literature review and interviews with six DM experts and three architects, to make a comparison to discover the practices' complementary factors. A focus group interview was undertaken with six architects to address the appropriate way to employ DM and harness its potential benefits.

The DM framework and process were developed with reference to the feedback and inspiration from the interviews undertaken with five DM experts from academia and in practice. Evaluation was conducted to validate whether the final recommendations address the main issues of DM and to verify its academic and practical value.

3. Application of design management in an architectural context

According to Gray and Hughes [2007], the success and efficiency of an architectural design project depends on the quality and punctuality of information exchanged between the participants. The investigation by Constructing Excellence [2007, cited in Newton, n.d.] demonstrates a considerable impact on total expenditure when projects are delivered late. The data below show how punctuality can avoid massive overspend. The table below presents persuasive evidence that design and designers' performance must be managed to reduce financial and legal risks, ensure the quality of design information, and enhance time and cost efficiency.

Table 1. Year on year measurement of UK design performance (The relationship between overspend and late delivery of design and engineering). [Source: Constructing Excellence 2007]

Year	% of projects where design & engineering phase overspends	% of projects where design & engineering phase is delivered late	% of projects where construction phase overspends	% of projects where construction phase is delivered late
2000	36%	63%	55%	38%
2006	36%	42%	351%	38%

Gray and Hughes [2007] argue that designers should manage their own tasks rather than delegating them to others. However, the quality and accuracy of outputs generated by designers are undeniably difficult to measure objectively if the evaluation depends on the designers themselves. A design manager can play a pivotal role in this regard. A design manager is responsible for design decision-making, co-ordinating and deploying design resources to ensure that the design team and networks of professionals produce a quality design [Rekola et al. 2012]. The design process should be reviewed from a broad point

of view, because a series of design activities throughout the project can have a cumulative effect on the final outcome.
Another key design manager role is to link stakeholders and architects, especially clients and architects, to interpret the client's needs, handing them on to architects to reflect them precisely [Otter and Emmitt 2008]. Relying on the design manager, designers can devote more time and effort to creative works, rather than deploying resources in reworking and changing designs because of miscommunication [Gray and Hughes 2007], thereby satisfying both clients and stakeholders [Siva and London 2012].
To discover the potential benefits of employing DM, interviews were undertaken with twelve architectural practitioners and design managers in South Korea with literature reviews. Interviewees agreed that DM facilitates value-attainment by using well-organised communication tools and processes to fully grasp clients' requirements. One design manager interviewee argued that clients' requirements are clearly transferred to designers through a design manager, whose role is to link both parties. While predetermined timelines and budgets can be decreased, the high quality of design can be delivered through effective management and collaborative creative solutions [Eynon 2013]. Systematic organised processes and professionally managed services are decisive in contributing to generating values for clients and meeting their architectural design expectations. The high stability of the building is secured by minimising risks by ascertaining potential issues.
In the architectural sector, architectural design firms can build a reputation and differentiate themselves from competitors by encouraging competitiveness as a strategic organisational behaviour, thus providing distinctive values to their clients. To the extent that DM assists firms to deliver both services and design outcomes professionally, a long-term trust relationship is formed with existing clients, and new clients are obtained. The efficiency of a firm's working performance, both internally and with other professionals, can be achieved by improving communications between them through interfaces, structured systems, and tools which minimise the wasted time and costs associated with last-minute design changes caused by poor mutual understanding between the firm and its clients [Emmitt 2014]. Close relationships and communication with clients and all participants are critical to an integrated design process. Each positive outcome becomes part of the firm's project portfolio: a significant asset for forming corporate identity, and a firm foundation for the firm's future development [Best 2009].
Eynon [2013] insists that collaborative work maximises values in systemised processes, while the flow of information between design teams and stakeholders is made seamless through prompt precise responses. Architects in in-depth interviews expected all participants to explore potential risks, and prepare initiatives to remove them or respond to them in advance by sharing expertise to overcome technology limitations. Minimising risks before they occur is one way to maximise values, as project deliverables - including cost, time, and quality - are affected by the level of certainty of risks.

4. Key issues for design managers

The DM experts insisted that design managers are in charge of creating an interface for co-collaboration, and co-creation for co-sharing values, as every individual involved in a project should be a beneficiary of the execution of DM with a clear corporate goal. They agreed that close communications with clients, users, stakeholders, and designer colleagues inspire architects to gain insights. For effective DM, design leaders and design managers should be intertwined. Design leaders play a role in envisioning organisational vision and ambition at the top, while design managers help realise the vision and ambition by adopting a strategic approach and implementing strategies to drive the vision.
The interim framework below, 'Six key issues of DM in architectural practices,' was created by synthesising findings from the primary and secondary research. The key issues are Design Leadership, Design Strategy, Innovation, Communication, Professional Development, and Project Management, reached by integrating the result of interviews with experts, the key factors of architectural design, and the key roles of design managers. The researcher adopted the framework as indicators for the DM Audit in South Korean architectural firms.
The design managers emphasised the importance of Design Leadership to envision a business scenario with strategic intent and vision. Design Strategy was emphasised to formulate strategies for employing design and resources to make differentiated offerings to realise the vision. Innovation was recommended to break conventions for positive changes in the organisation, to support strategies including systems,

environment, working methods, and mindset, while communication systems need to be considered to find the best design solutions for shared values with the individuals involved.
Other key issues suggested by design managers included continuous professional development in expertise and creativity, and project management to help designers devote themselves to creative work, thereby improving the quality of design activities.
Design managers agreed that the six factors are inseparably interrelated and should be co-adopted to create longer-term synergy.

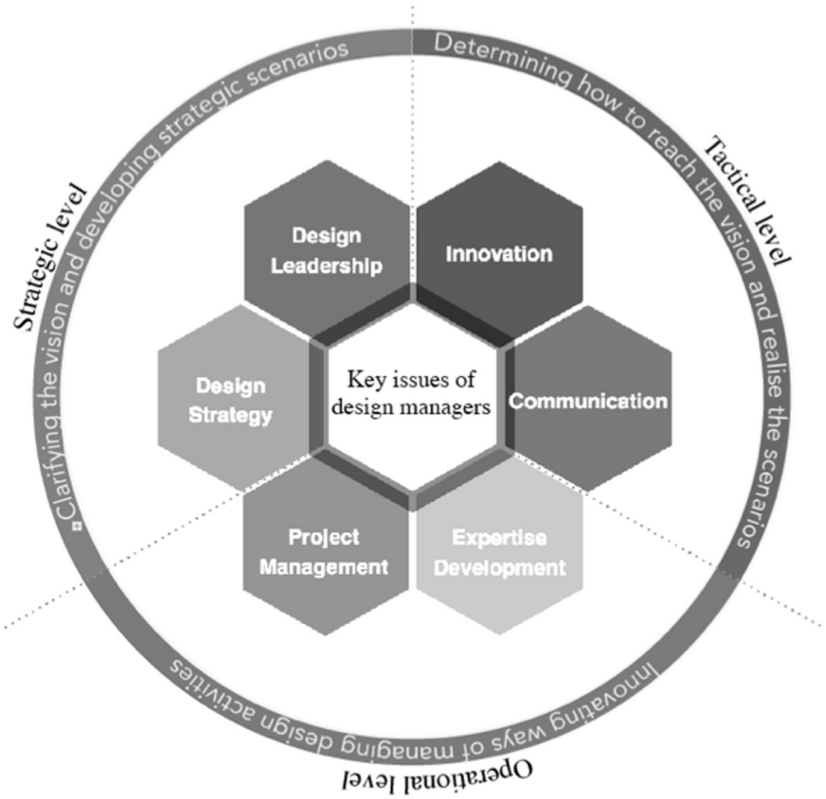

Figure 1. Key issues to be considered by design managers in the architectural context

5. Comparison of processes in architectural design and design management

Comparing and analysing processes and methods of architectural design and DM revealed both commonalities and differences between architects and design managers. The processes and methods of each specialisation have shortcomings which can be mitigated by learning from each other's practices.
Throughout the processes, similarities are discovered about orders, primary tasks, and issues, although architectural design and DM uses different terms to describe project phases and tasks. Among the commonalities, the 'Pre-design' phase in architectural design and the 'Analysis of influential factors in strategy formulation phase' in DM have homogeneous tasks, namely analysing external and internal factors which are influential when establishing business scenarios. The next stages are respectively 'Schematic design' for architectural design and 'Organisational objectives in strategy formulation' for DM. Their analogous points are to make design goals and plans visible, and to establish the core intent for progressing a formulation of design strategies, and setting a design concept and policy. In the next phase the main issue is 'Design development' for architectural design and 'Strategy selection' for DM to develop design proposals and business strategies. Another task is to make a clear plan for selecting specific materials and strategies. The 'Construction documents' step for architectural design shares common ground with DM's 'Strategy implementation' phase in terms of making selections (Architectural design: construction methods and materials, DM: strategic tools) to be materialised by

designers. The last stages are 'Post-design' for architectural design and 'Monitoring and evaluating' for DM, which are similar in that both require supervising, whether or not the strategic design intent is reflected in the process of realisation and performance.
Apart from these common grounds, processes and methods adopted by architects differ from those of DM. It was found that processes and methods of both disciplines are complementary, although usage and practices applied are not identical. To explain in more detail, architectural practices share expertise across the disciplines using collaboration and visual communication. The architect interviewees emphasised that the process needs to add a strategic auditing phase before moving on to 'Design development,' because architectural drawing plans have to include a great deal of detail in order to secure planning permission. Furthermore, it is recommended that architects locate an additional step between the 'Design development' and 'Construction documents' phases to ensure it is sufficient and efficient in terms of the deployment of design resources, and to ensure that the design reflects and complements the business plan built in the earlier stage.
In DM practice, strategy formulation is the starting point. According to the strategy formulated, all supporting environments are built, including all organisational systems, structures, cultures, policies, and resources, with the purpose of aiding the route to realising the strategy. Companies can also logically strategise by using systematic tools to explain and pinpoint stakeholders' interests and requirements, external and internal success factors, and corporate strengths and weaknesses. The factors identified are classified and organised into a matrix as a standard criterion through which it is possible to prioritise and prevent conflicts over design actions and policies, thereby enabling coherence in decision-making regardless of changes of managers. As DM suggests ideas to architects to improve their practices, architects can mitigate their weaknesses by learning from other architectural practices.
In an in-depth interview, architects and design managers emphasised the fundamental dissimilarities of the domains in which architects and DM make the most of their abilities. Architectural designers are adept at creating aesthetically superior outcomes solving problems, and fulfilling client requirements by exploiting design. Design managers, on the other hand, specialise in initiating strategies by which a design process is smoothly and efficiently enacted, to ensure delivery of strategic and effective design using a business plan. Architectural designers are trained in design perspectives, but lack business and management knowledge. Managers have been educated to judge situations and problems and determine solutions from a managerial perspective. Architectural designers and design managers have different mind-sets, expertise, and competencies. Thus ineffectiveness and inefficiency may arise, when either architectural designers separately execute DM, or design managers exercise management in an architectural design firm without guidance from the architects. Architectural expertise is learned through experience and tacit knowledge is accumulated from participating in a range of building projects. Design managers can analyse social factors - society, economics, and market conditions - from a macro perspective, and draw up strategies to ensure that companies are in a competitive position to maximise design value by introducing design into every nook and cranny of the organisation. Provided they construct a mutual learning relationship and intimate collaboration, synergy effects will be created. The principal findings from interviews and comparative analysis between architectural practices and DM practices indicate that the researcher's suggestion to implement DM as a form of co-collaboration is persuasive.

6. Conducting a design management audit

To diagnose the state of DM in architectural practices, three leading South Korean architectural design firms were selected as subjects of a DM audit. In an in-depth interview a design manager recommended that the audit is indispensible to convince practitioners of the value of DM. Current problems must be pinpointed in order to propose practical and relevant solutions.
In semi-constructed interviews with twelve professionals, including CEOs and architects at the selected firms, the researcher discovered problematic issues in practices, using a checklist adapted from Topalian's checklist for corporate design audits [1984, cited in Cooper and Press 1995] and the DM Strategic Audit [Borja de Mozota 2003, p.245].

Table 2. Topalian's checklist for corporate design audits [1984, cited in Cooper and Press, 1995]

Corporate Vision	Design Identity	Guidelines for Design Activities	Internal Communication
Corporate Culture	Design Champions	Design Reviews	Communication Methods
Design Facilities	Design Activities	Design Policy	Marketing and Promotion
Management of data	Corporate Design Standard	Design Department	Visual Identification
Executives' support	Decision-Making System	Research and Development	Differentiation
Communicati on with Clients and Users	Communication between Executives and Designers	Strategy of Human Resources Management	Personnel involved in design projects

The interviews indicated how design is managed, and the perceptions and knowledge of DM. Most architects are unaware of what DM is, and of its importance. It was found that top management and architects lacked common corporate goals and had a broad ambiguous vision. Deficiencies in understanding projects and individual tasks were caused by poor team communication and with other departments. The three firms overlooked the importance of DM, failing to share clear corporate vision and objectives, establish a strategic design policy and guidelines, or foster collaborative corporate culture communication interfaces between the individuals involved.
Findings from in-depth interviews with architects, annual reports, websites, and workplace observations were analysed, evaluated using the DM maturity grid [Kootsra 2009] and visualised on the DM staircase model [Kootsra 2009]. The model informs the three selected firms about their current DM level, helps them set their goals of where to go next. The audit results indicated that all three firms implemented DM at project level and established the goals to reach the culture level.

Table 3. DM maturity grid [Kootstra 2009]

	Level 1 No DM	Level 2 DM as project	Level 3 DM as function	Level 4 DM as culture
Awareness of benefits	Not aware of the benefits and potential value of design	Some functional specialists are aware of the benefits	Most are aware that it is important to remain competitive	All are aware that it is important to gain a leadership position
Process	No idea where design fits within current processes	Inconsistent and late in development; not repeatable across projects	Performed consistently and formal DM process drives performance	Ongoing activity is engaged in continuously improving DM pocess
Planning	Company or marketing plans do not mention the use of design	Limited plans and objectives exist at the individual project level	Plans exist to set direction and integrate design in various activities	Design is part of strategic plans that drives the business
Expertise	Little skills to handle design activity	Some basic DM tools	Standard DM tools applied consistently	Use of advanced DM

		applied inconsistently		tools and metrics
Resources	The business has not committed resources to design (may not appreciate the return of design investment)	Limited resources are allocated for individual projects; one-off design investments with no review of returns	Sufficient resources are allocated on the basis of potential return, limited procedures in place to assist decision making	Substantial resources are allocated; with financial procedures in place to appraise investment, assessing risk & tracking returns

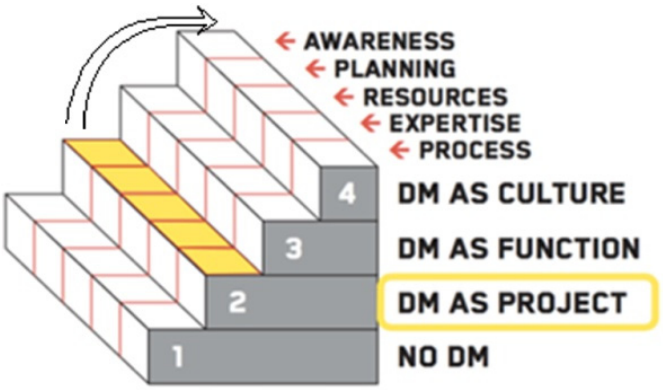

Figure 2. DM maturity staircase of South Korean firm's level of DM [Adapted from Kootstra 2009]

The researcher used the interim framework formulated earlier to identify the strategies currently in use. In the focus group interview, the six architects suggested strategies to be adopted or strengthened to fulfil the strategic scenarios. They reached agreement during the interview that DM should be implemented through co-operation and collaboration between experts in business management and architects at the beginning of the infusion of DM for mutual learning. Internal and external collaboration are necessary, as these professionals have their own expertise and tacit knowledge which stimulate and complement each other.

7. Evolution of the role of design management

DM has evolved in contemporary design disciplines since the early 1990s [Cooper and Press 1995]. However, primary and secondary research indicate that the version and terms of DM should be adjusted to prevent architectural practitioners as end-users from resisting new management systems. Lockwood [2011] advocates a new collaborative and participatory DM model, separate from management by design managers.

DM can redefine conventional working relationships by encouraging project participants to actively interact to spark ideas. Redefined relationships engender shared-value [Farr 2011]. Designers can discuss solutions and predicted values and risks with clients, acting as partners in knowledge-sharing platforms with a deep understanding of projects [Emmitt 2014]. Corporate identity is the core characteristic which companies should express in their actions, products and services. The identity should permeate all parts of the organisation internally, and all of its external offerings. DM helps firms to maintain identity coherence, with design strategy and advanced design leadership. Visual coherence and integration are a catalyst for strategic development [Best 2009].

According to the interviews with DM experts, problem-solving design requires innovation and creativity which are achieved through active and continuous communications with clients and professionals in various fields. Building design involves many individuals who use multidisciplinary collaboration to

solve complex problems and design constraints [Otter and Emmitt 2008]. This entails complex networks and multiple ideas and information exchanges. The new DM model needs to strategically foster collaboration and manage design [Emmitt 2014] as it supports design activities between cross-functional teams, encouraging those involved to be strategic and efficient [Lockwood and Walton 2008].
Architectural design activities are collaborative, iterative, and concurrent when co-working in multidisciplinary problem-solving teams. These phases repeatedly develop designs to achieve the best outcome. Various participants ideate, generate ideas without boundaries, uncovering potential issues with divergent thinking, to find the best solution through convergent thinking [Meinel and Leifer 2011], and with continuous input from multiple participants, all are mutually stimulated. The iterative process encourages a deeper understanding of what projects are about and for. The new version of DM encourages active participation of design teams, users and multidisciplinary professionals to gain innovative ideas from diverse perspectives for the optimum solution [Cooper et al. 2009]. It advocates a crossover in innovation which influences corporate success. By maintaining design coherence, innovation occurs through knowledge-sharing across disciplines, departments, clients and users [Lockwood 2011]. The interface can be created in a collaborative DM system to bring participants together to devise the best solutions for all. The design manager, as navigator and strategist, has a responsibility to recall corporate design strategy and goals, to prevent deviation from the core theme without hampering creativity. Crossover collaboration has various benefits, including increasing work performance and efficiency, and by sharing expertise and experiences creativity is enhanced through co-learning [Otter and Emmitt 2008].
In short, DM should evolve a 'collaborative version' which architects can comprehend, to use DM in the architect context to bring co-created value to all participants, to enable innovation in business with innovative thinking and to guarantee the ongoing development of design competencies and business.

8. Design management framework for architectural practices

Three outcomes were created by integrating the principal findings: a process, matrix, and framework to introduce DM at strategic level into architectural practices. The process is to incorporate DM into architectural practices for long-term development. Each phase has a primary intent and involves activities.
Firstly, all professionals in an architectural firm need to clarify their strategic intent, and commit to the phased implementation of DM. Once all members make the commitment, their current status should be identified by analysing external and internal factors influencing corporate success. Next, the members need to define the corporate identity and plan a strategic scenario, drawing on the analysis of the factors investigated. Members should also conduct a regular DM audit to review design portfolios and activities affecting working performance. All designers and managers need to discuss together their positive and negative practices in the light of the strategic intent, and collaboratively elaborate the corporate goal, mission and objectives. Key drivers can be explored to improve current design performance as the professionals plan specific strategies ranging from adopting tools to transforming organisational structures or systems. The professionals can decide on the purpose and effect of employing the strategies, and how to implement them. They are also required to develop relevant expertise to maximise the efficacy of the strategy. The professionals are empowered to have decision-making rights about which tools or strategies are adopted and when. Evaluation then follows of practices and activities implemented, in terms of relevance, efficiency, and the impact of the intervention of collaborative DM. The DM process should be iteratively applied for complete infusion and sustainable development. The repetitive process can be modified according to changing markets, and opinions suggested by any professionals.
The table below is a matrix indicating architectural practices' status using six elements (Design leadership, Design strategy, Innovation, Communication, Professional development, and Project management). Architects are asked to check which activities help them achieve their vision and strategies. Further to the matrix activities, required actions can be added to the table.
According to the number of activities and methods the architects have ticked in the matrix, blanks in a hexagon should be filled with colour or a note.

Table 4. Matrix for collaboration on a common goal

Main intent	Activities, methods, tools and practices			
Design leadership : Envision corporate future	Commitment to co-operation	Mood board for envisioning	Clear corporate vision	Establishing persona & scenario
Design strategy : Formulate strategies to realise the future	Distinct corporate character	Design policy	Design guideline & checklist	Design audit (assessment)
Innovation : Innovate organisational system and conventions	Innovation in Decision-making process	Innovation in Profit model	Innovation in Network	Horizontal organisation
Collaboration : Work in a common goal	Design review	Knowledge sharing & Brainstorming	Structured route for communication	Co-design with users & clients
Expertise development : Develop relevant professional skills	Workshop	Guest lecture	Training programme	Supporting architects' self development
Project management : Manage collaboratively	Time management	Process management	Quality management	Risk management

The hexagonal framework below indicates where architectural firms go next, and what they need to prioritise and improve. Architects are recommended to repeatedly check the matrix and revise this hexagonal framework to show their status and development progression.

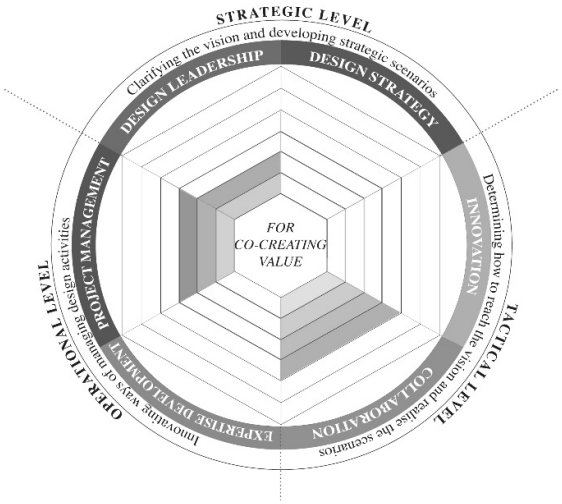

Figure 3. DM framework for co-creating value

9. Conclusions

The purpose of DM is to strategically manage design, design activities, and resources [Borja de Mozota 2003], [Best 2009]. Building DM or architectural management has been implemented in the architectural field. However, both are DM at project level, focusing on an architectural project in the short term [Emmitt 2014]. To flourish in the longer term, architectural practitioners should clearly envision business scenarios and formulate design strategies with a strategic intent through the introduction of DM.

To best introduce DM to architectural practices, DM needs to evolve to a version which is compatible with architectural design practices. To devise pragmatic answers, interviews with practitioners were conducted to gain insights from architects, as end-users of the outcomes, and experts on DM.
Architectural design is a process in which architects co-operate with many professionals from different disciplines to create the optimum solution to design problems with multi-level constraints. Active communication and collaboration deliver creative design, through the positive integration of a range of expertise and know-how.
Architects may be resistant to being managed in an authoritative framework, so it was concluded that DM should be collaborative, integrative, and participatory to lead to benefits and maximise DM value. Internally, designers and top management should commit to an infusion of collaboratively presented DM implemented at the cultural level. This research would benefit from further studies: (1) testing the toolkit of DM in architectural practices to uncover unanticipated issues, (2) developing DM tools based on the six factors of the framework created in this research, and (3) benefits for stakeholders and clients as end-users of buildings.

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