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Letter from the Editor **April 2020**

W117 Visionaries:

Thank you for the efforts of the W117 Best Value International Board and the W117 journal paper reviewers for doing such a spectacular job. The objective of the journal this year is to meet the requirements of being a ranked journal. To increase reads on the published papers, W117 is sending all papers to Research Gate if approved by the authors. Research Gate does the metrics on all papers. This is the journal's methodology to get the published papers reviewed and "on the street" as soon as possible to allow industry and academic researchers to utilize the research results. Using Dr. Kashiwagi as an example, the reads on 138 papers has increased from 6.6K reads in 2017, to 36.8K reads in March 2020, an increase of 450% in 3 years. We encourage all researchers in the specialty areas of performance information, facility management, project management, risk management and supply chain management to get their papers into the industry as soon as possible.

The coronavirus pandemic has a "silver lining". It introduced the automation age to everyone before its time. Stakeholders are being forced to utilize automation [minimization of human thinking, decision making and communication] to mitigate their risk. W117 is increasing the innovation by aligning visionary stakeholders in the supply chain and utilizing them to help change the current paradigm. The approach being used by W117 is to use the Information Measurement Theory (IMT) as the foundation for their research. It assumes most stakeholders in the supply chain have the following characteristics:

1. Operations are based on decision making, management, direction and control.
2. Processes are ineffective and inefficient.
3. Poor project performance.

The W117 research agenda for the next five years includes:

1. Changing the structure of W117. Research will be recursive as the actions of all the participants in the W117 structure will be actively participating in the research.
2. Forming an international board of experts in the Best Value Approach (BVA). This board will run tests, document the tests with peer reviewed papers, and become reviewers for other BVA papers.
3. Forming PBSRG education satellite sites that are facilitated by BVA International Board members to proliferate the BVA.
4. Implementing the BVA into both private and public organizations in the United States to replace management, direction and control in the delivery of services by identifying and utilizing expertise.

5. Design an Information Based Continuous Improvement (IBCI) system which uses accurate and timely performance information to optimize the Kingdom of Saudi Arabia classification system.
6. A research effort to change the project management model from the management, direction and control approach to the utilization of expertise and transparency. This effort is integrating the BVA test projects, the IBCI project, and a research effort at the SKEMA Project Management School to define the Project Management Model of the Future.
7. Use a new component of W117, Leadership Society of Arizona (LSA), to test and implement IMT information concepts to prepare young students to operate in the age of automation by minimizing thinking, data collection and decision making. This education overcomes the paradox of how to understand reality with minimal information. These programs produce Information Workers (IW) who use the language of dominant metrics to understand the present and future conditions of reality.

I encourage journal readers to dream of innovation. This year (2020) will produce results which will dwarf the results previously discovered in the use of performance information. Best wishes to everyone!

Dr. Dean

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A Performing Manufacturer Mitigates Risk by Using Performance Information Systems

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A manufacturer initially approached the researchers to identify how to use the performance information of their high-performance urethane coating system to increase quality. The research project used the construction industry structure to identify owners who understood the high risk and transactions caused by low bid practices. Intelligent owners understood that value was delivered by expert contractors using high performance products rather than warranties. However, during the economic downturn, high performing contractors reverted to the low bid practices of using warranties to win work rather than performance. To create a high-performance environment, the manufacturer again approached the researchers to mitigate the risk caused by their warranties. The research identified that risk was not mitigated by warranties, but by transparency and performance information. A structure was developed that mitigated risk caused by a change in paradigm that resulted in a "win-win" result in a test case that involved the school district. As the system was installed, the performance of contractors increased, and the sprayed urethane foam contractors became the only roofing contractors at the school district to consistently maintain their installed roofs and mitigate the risk to the client at their own cost without using the manufacturer's warranty.

Keywords: Manufacturer, Performance, Risk, Roofing, SPF.

Introduction

A manufacturer was introduced to the Research Group in 1996. Since that time, the Alpha Program (1996 - 2015) was the longest running sprayed polyurethane foam (SPF) roofing program. The aromatic polyurethane coating developed by the subject manufacturer has the proven performance and durability as identified by the performance of the roofing system in heavy hail areas (Gajjar et. al. 2014, Gajjar et. al. 2015, Kashiwagi et. al. 2016; Kashiwagi et. al. 2017). The Alpha SPF roofing system is the only system that was proven to withstand the FM-SH test 4470 (Kashiwagi & Pandey, 1997).

A school district had been using the manufacturer’s Alpha roofing system since 1996 due to the characteristics of the SPF Alpha roofing system:

1. High performance; the oldest performing roof was 26 years old.
2. Monolithic, lightweight (4 PCF), high compressive strength of SPF (50 psi), very high insulating value (R7 per inch of SPF and hail resistant).
3. Could be installed over an existing BUR or SPF roof system.
4. Encapsulated the existing roofing system, saving the cost of removing and disposing of other roofing systems.
5. The overall cost of the SPF Alpha system lower than the removal cost of the existing roof system and the installation of some of the other traditional roofing systems.

In the five years during the economic downturn, the contractors started to bid low and use warranties to win projects, while material prices increased. The school district identified that performance of roofing contractors has decreased, and the risk for the client has increased as they have been unable to enforce the manufacturers' warranties to get the expected roofing performance (Smith, 2011).

The school district wanted a system that mitigated this risk of roofing projects. The school district had the following constraints:

1. The roofing projects were a part of bond projects awarded to general contractors.
2. General contractors were responding to request for bids, with price the most important factor.
3. The designers of the roofing specifications were not skilled in specifying the roofing projects, many times leaving things out of the specifications.
4. The only real control was the school district roofing manager, who expected the manufacturers to respond to non-performance due to their warranties.

The manufacturer initially gave the school district a "joint and several" warranty, but after analyzing the risk caused by the price-based environment, refused to continue to give the warranty. The warranty initially covered the roofing system from the roof deck to the Alpha SPF roof system which overlaid other roofing system or existing SPF roofing system. This warranty was given with the assumption that the Alpha roofing contractors were doing their due diligence to maintain their performance regardless of the specifications. However, under the pressure of price, and with the downturn in the economy, the Alpha roofing contractors began reverting back to low bid practices. The school district wanted the manufacturer to manage their contractors by eliminating contractors who did not perform and issuing a warranty that protected the school district. The manufacturer thought the risk was too high and refused to protect the school district.

Problem

The school district wanted the Alpha roofing performance but wanted the manufacturer to manage its contractors. The manufacturer wanted the contractors to increase their performance, and if they did not, the risk to the manufacturer was increased. This paper presents a case study involving a school district and a manufacturer and how a unique industry structure and performance information was used to solve the issue of low performance.

Proposal

The researchers proposed that the solution was a "win-win-win" for the school district, the roofing contractor, and the manufacturer. The proposed solution was to identify risk caused by all parties and minimize the risk by creating a "win-win-win" alignment.

Construction Industry Structure

The researchers used the Construction Industry Structure (CIS) (Figure 1) to design a solution. The CIS identifies the price-based environment as:

1. The wrong party doing the decision making, directing, managing and controlling the contractor. The expert should be the contractor, and not the designer or the client.
2. The method of winning the award is to be the "low price".
3. Once the contractor bids a low price, they approach the project as a low risk project.
4. Contractors approach the project as meeting minimum requirements (as directed by the designer).

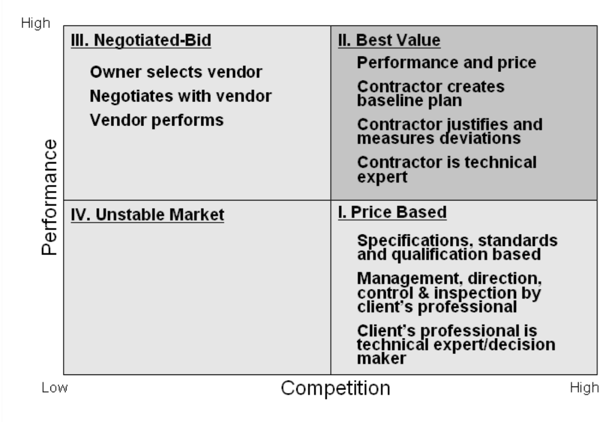

Figure 1: CIS Solution (Kashiwagi, 2011).

The school district roofing projects had all the above characteristics. They wanted the manufacturer to issue warranties that would cover the risk of poor contractor performance. However, when a roofing project was not performing, the school district did not have the ability to force the manufacturers to pay for the non-performance. This led to a condition where the school district could not manage the contractors and the manufacturers to maintain their roofs once the roofs were installed.

Warranty Issue

The CIS identifies the price-based environment where warranties are the most important. In the roofing industry, warranty is an offer of protection provided by the manufacturer to the buyer (Agrawal et al. 1996). The warranty is written by the manufacturer and their legal representatives (Murthy & Djamaludin, 2002). Warranties contain certain exclusions that, if encountered, will void the warranty (Christozov et al., 2009). Therefore, it is the buyer's burden to show that they did not do anything to violate the exclusions of the warranty. The manufacturer must then also agree that the buyer did not void the warranty leading to parties blaming each other. The best value environment has the following characteristics:

1. Expert contractors dictate the construction project.
2. Expert contractors do not depend on the warranty but fix their problems. By definition (Figure 1) the best value environment has high performance.

3. Expert contractors identify and mitigate risk that they do not control. Experts do not have technical risk. The only risk they have is risk that is outside of the project scope, the risk that they do not control.
4. Expert contractors identify the risk that they do not control and set up a plan to mitigate the risk before they do construction. They then document any risk and cost and time deviation because the risk is owned by the owner.
5. Because they clearly identify what they cannot control (risk), and clearly lay out to the owner that it is outside of the contract. Being experts, they track the risk and identify when it impacts their scope.

When the contractor has input in writing the contract (what they are delivering and how they are delivering), what they are not delivering is clearly documented in their contract along with their risk mitigation plan (Kashiwagi, 2010). The need for warranties is minimized due to the expertise of the contractors. The request of the school district for the manufacturer to increase the coverage of their warranty shows the following:

1. Win-lose; the school district wins, and the manufacturer loses.
2. Does not assist the manufacturer in mitigating the risk of nonperformance of the Alpha contractors in a low-price award environment created by the general contractors and the price-based environment.
3. The manufacturer cannot manage the general contractors who are awarding the roofing work based on the low price.
4. The manufacturer and the school district cannot control the designers to produce a more accurate specification. The designers are a part of the low bid environment causing them to be reactive (Child, 2010).

The manufacturer would not alter their warranty to joint and several warranty covering the installed Alpha roofing system to the deck including the existing roofing system which may not be installed with their products.

Risk of Non-performance

The system to create a "win-win-win" would require a best value environment. The researchers identified that the system attributes which would reflect the best value environment. The requirements of the new system would include:

1. Roofing contractor in control of the project regardless of poor design and a low bid environment.
2. The school district roofing manager able to give input before the construction started.
3. The manufacturer representative able to give their requirements before construction based on the unique project conditions.
4. Motivate the roofing contractor to perform and study the roof out in detail and identify what they priced out and what they did not due to an incomplete design.
5. Meet all the legal requirements of the school district and their construction delivery system.

The best value requirements would include:

1. Minimization of risk by contractor, especially correction of designer errors.
2. "Win-win-win." Roofing contractor cannot be expected to cost risk that they cannot control.
3. Preplanning.
4. Contractors which understand the client's and the manufacturer's expectation before starting construction instead of by inspections after material has already been installed.
5. Transparency.
6. Measurement of performance.
7. Motivation for contractors to be accountable and perform during and after installation.

The current process at the school district is:

1. Roofing contractors submit bids to general contractor.
2. General contractors compete, and the winner has an Alpha subcontractor.
3. Roofing subcontractor goes to preconstruction meeting.
4. Roofing subcontractor installs roof.
5. School district roofing manager, general contractor and roofing consultant inspect roof and identify problem areas.
6. Roofing contractor fixes the roof.

The problems that are occurring include:

1. General contractor pre-construction meeting does not address roofing issues. There are too many sub vendors and professionals.
2. Alpha roofing contractors are bidding what is specified, and many times it is confusing. Some Alpha contractors are including non-specified work into their bids based on previous knowledge of what the school district expects, and some contractors are not.
3. The general contractors do not want to approach the school district on change orders.
4. Problems are identified at the end of job inspection that force "win-lose" situations due to the amount of resources and material installed on the roof.

The school district blames the manufacturer for not controlling their Alpha contractors and wants a more inclusive warranty. The manufacturer states that the designers are at fault, and that the contractors should have higher bids to cover the discrepancies, and the contractor is blaming the school district for not having better designers and the manufacturer for not supporting them when issues occur. The resulting environment conclusion is:

1. The manufacturer will not give a more inclusive warranty and risks losing the school district work that amounted to 3M+ SF.
1. School district will lose its best roofing system based on performance and price.
2. Alpha contractors need the school district work to survive as school district is one of the major clients of the Alpha system in the Dallas-Fort Worth area.
3. The Alpha SPF system will get poor publicity as a system that does not perform due to contractor nonperformance.

Solution

The warranty is depended on most in the price-based environment where work is strictly based on price and the length of the warranty. The manufacturer should understand that risk is mitigated by the contractor in a proactive approach; therefore, the manufacturer should assist in requiring a meeting with the Alpha contractor before construction to assist the contractor in understanding the project risks. The client should also have a representative who attends the pre-construction meeting to identify and answer issues that the Alpha contractor may have. The school district representative should understand the following:

1. The Alpha contractors are being picked on low price and not best value.
2. The designers have incomplete specifications.
3. The school district cannot expect best value delivered Alpha system results.
4. The school district needs to be fair, “win-win" and identify and agree to change order issues that result from incomplete or irrational specifications. If the price is too high for the change orders, school district should discontinue using the Alpha roofing system.
5. Contractors should not price risk items that are not in the specifications. This will ensure that the bids are competitive, and the risk items will be priced at the preconstruction meeting.
6. The school district system of project managers, designers, selecting contractors in a price-based environment and general contractors picking roofing contractors to do school renovations which includes the roofing work is not an optimized system which in the past 10 years has not been corrected. School district should treat the system as a non-optimized system and put in activities which increase the value and minimizes the risk of nonperformance.

The only point of contact at the school district is the roofing manager. He is responsible to select the roofs for reroofing; controls the school district specifications and he is responsible for maintaining the roofs after installation. He should minimize his effort but participate at the right time to ensure his overall effort in managing specifications, inspecting roofs and managing the maintenance of the roofs is minimized. His goal is to assist the entire supply chain to minimize cost and every participant’s effort while increasing the performance of the installed Alpha roofing system.

The manufacturer must do its utmost to motivate the best SPF contractors to minimize risk and maintain their installed Alpha roofs without coming back to the manufacturer for further material or assistance in maintaining the roofs within the warranty period. This required the manufacturer to have a program that identifies the contractors who can install an Alpha roof system, and which motivates the contractors to stay in the program. The Alpha roof program included the following requirements (Gajjar et. al. 2013):

1. Annually turn in all roof applications for a customer satisfaction check.
2. Every other year have a roof inspection of the 25 roofs which has the greatest risk of not performing. This is coupled with a survey completed by the owners to identify which roofs may have risk.
3. Keep a 98% customer satisfaction rating, and 98% roof performance rating.

4. Any Alpha contractor's client can call the Alpha program administrator and identify their roof as leaking (nonperforming) and the client as being not satisfied, and the contractor must rectify the problem to stay in the 98% requirement. In the 15 years of the Alpha program, there have been less than 10 disputes, which were all resolved.

At the same time, the manufacturer is responsible for assisting the contractors at the right time (before construction) on their expectations to issue a warranty at the end of the project. The manufacturer cannot be changing their requirements during the project.

The Alpha contractors need to understand that the solution in maximizing their profit is to implement the best value environment characteristics in the low bid environment. They must understand the following:

1. They cannot be reactive.
2. They must ensure that they act in the best interest of all supply chain participants.
3. They cannot be pricing in risk items that are outside of the scope of the specifications. This is the major problem and is causing confusion among contractors who are hoping to have a relationship with the school district for taking care of risk items that are not specified.
4. They must hold a roofing preconstruction meeting where the school district roofing manager, the manufacturer representative, the general contractor and the roofing designer or professional attends. All risk items that were not identified in the specifications or were ambiguous should be identified and change orders should be issued on those items.
5. All deviations to project cost and time should be documented by the Alpha contractor. The contractor is responsible to identify the risk that caused the deviation. If the source of the risk was the contractor, the contractor should fix the problem at their cost.
6. The contractor is responsible for maintaining the roof for the length of the warranty period. They should respond to the owner in a reasonable time to rectify the problems. This has been a problem as the contractor with the most work, also has the most maintenance to complete.

Supply Chain Solution

The researchers propose that the solution must be a supply chain solution as well as a best value solution. Therefore, it is a paradigm shift more than changing the legal constraints of the delivery system. The following were the major components of this solution:

1. The manufacturer had to ensure that the Alpha program contractors are meeting the simplistic requirements of 98% customer satisfaction and roof performance.
2. The school district needed to determine when a roof requires maintenance repairs based on performance information of the roofs, and the duration of time that the contractor has to fix the roofs. If they do not, school district must give a dissatisfied response, and the contractor will not be allowed to do further work due to being ejected from the Alpha program due to not meeting the 98% customer satisfaction and roof nonperformance requirements. All school district roofs are inspected once a year to identify nonperforming issues. The school district also has an internal reporting system for nonperformance issues such as leaking or blistering (major issue with SPF roof systems.)

3. The Alpha contractors cannot be pricing risk items that are not listed in the specification. The school district roofing manager was asking for a "freebee" which led to relationships and non-transparency. This is a silo-based action that leads to contractors to form relationships with the school district manager that affected the maintenance of the roof. A contractor with a relationship, did not repair their roofs in time, thus putting the school district roof manager at risk of defending why he was specifying the Alpha SPF system if the roof required maintenance.
4. A weekly risk report be sent to all Alpha contractors with the performance information of the contractors.
5. A roofing pre-construction meeting to be held that identifies the risk and change orders required to meet school district's requirements. Everyone must understand that the delivery system is not optimized, and the system has not been corrected for the past ten years, and instead of putting the effort in to change the existing conditions, a simple meeting with the supply chain participants can rectify the problem.

Performance Data of the School District Alpha Applications

School district roofs were inspected every year for a total of three years. As the solutions have been implemented, the roof performance has been analyzed. The school district has four million square feet of Alpha Roofing on 87 projects. Table 1 compares the blistering, leaking and repair rates of the Alpha Contractors. Table 2 compares the blistering, and repair rates by year.

Table 1: Blistering/Leaking/Repair Rates of Alpha Contractors (PBSRG, 2012).

No	Criteria	Unit	Contractor Code					
			A	B	C	D	E	F
1	Percent of jobs that do not currently leak	%	100%	100%	100%	100%	100%	100%
2	Total blisters	SF	2,267	3	60	1,585	0	0
3	Percent of total roof area blistered	%	0.10%	0.00%	0.06%	0.18%	0.00%	0.00%
4	Total repairs	SF	4,406	130	160	10,250	0	0
5	Percent of total roof area repaired	%	0.19%	0.07%	0.15%	1.19%	0.00%	0.00%
6	Total job area inspected	SF	2,352,035	192,000	108,500	861,919	389,250	75,211

Table 2: Analysis of Percentage of Blistering/Repair Rates (PBSRG, 2012).

Criteria	Year 1	Year 2	Year 3
Total blisters (SF)	4,160	4,117	3,915
% of total roof area blistered	0.15%	0.13%	0.10%
Average blister size (SF)	1.9	1	0.8
Total repairs (SF)	26,696	8,721	14,946
% of total roof area repaired	0.88%	0.27%	0.38%
Total roof area (SF)	3,023,405	3,209,733	3,978,915

Roof performance increased annually, the number of nonperforming roofs minimized, and the maintenance requirement caused by blisters decreased (Table 3). Also, very few roofs have had leaking. The school district has been impressed with the increase in quality over the last few years. It is also important to note that the Alpha SPF roof system contractors are the only roofing contractors who have installed roofs at the school district, that have returned and maintained their roofs. The maintenance providing by the contractors is at no cost to the school district. The maintenance repairs have been estimated by the Alpha contractors at over $100K.

Most Alpha roof systems (75%) had less than 0.1% roof maintenance requirements (Table 3). From this analysis, it was determined by school district that any roofs above 0.1% maintenance requirement, or leaking, or having blisters over one foot in diameter, or open blisters would require maintenance within 15 days of notification to avoid a customer dissatisfaction rating on the roof project. This would threaten the Alpha rating of contractor, make them ineligible for future work, and label them as a non-performer for other clients.

Table 3: Category of Risk on Alpha Projects.

Criteria	Data
Total number of roofs	87
Total number of roofs over .1% blistered	22
Total number of roofs that have blisters over 1 foot in diameter	21
Total number of roofs with open blisters	13
Total number of roofs leaked	1
Number of roofs that required maintenance	23
Number of roofs fixed by the contractor	23
Number of roofs that still need maintenance	0

Figure 2, Figure 3 and Figure 4 is a screenshot of the Weekly Risk Report (WRR) sent to the school district every week. It shows that the contractor who has done the most work, has formed a relationship with the school district. They are the only contractor who has not met their maintenance requirement. The school district has the option to identify the roofs as non-performing roofs, which may lead to the disqualification of the contractor from future work and ability to install Alpha roofing systems.

CONTRACTOR	TOTAL JOB AREA (SF)	AVERAGE AGE (YR)	TOTAL BLISTERS (SF)	TOTAL % OF ROOF AREA BLISTERED	TOTAL REPAIRS (SF)	TOTAL % OF ROOF AREA REPAIRED
A	2,352,035	6	2,267	0.10%	4,406	0.19%
B	192,000	7	3	0.00%	130	0.07%
C	108,500	7	60	0.06%	160	0.15%
D	861,919	7	1,585	0.18%	10,250	1.19%
E	389,250	0.2	0	0.00%	0	0.00%
F	75,211	0.2	0	0.00%	0	0.00%

Figure 2. Weekly Risk Report Showing Contractor Performance.

NO	CRITERIA	UNIT	YEAR 3 RESULTS
1	Oldest job surveyed	Years	20
2	Average age of jobs surveyed	Years	6
3	Age sum of all projects inspected (doesn't leak, total years combined)	Years	506
4	Average total repairs on each roof	Sf	172
5	% of total roof area repaired	%	0.38%
6	Average blister area on roofs	Sf	45
7	% of total roof area currently blistered	%	0.10%
8	Total existing blisters	Sf	3,915
9	Total job area (of job surveyed and inspected)	Sf	3,978,915
10	Total number of jobs inspected	#	87

Figure 3. Weekly Risk Report Showing School District Alpha Roof System Performance.

NO	ALPHA CONTRACTOR	SCHOOL DISTRICT ALPHA ROOF PERFORMANCE	ALPHA ROOF PROGRAM PERFORMANCE
1	Total sf	3,978,915	12,604,280
2	Total sf blisters	3,915	2,092
3	% of roof area blistered	0.10%	0.02%
4	Total sf repairs	14,946	790
5	% of roof area repaired	0.38%	0.00%

Figure 4. School District Alpha Roof Performance vs Alpha Roof Program Performance.

Figure 4 shows that Alpha Contractors servicing the school district had more blisters and repair work than Alpha contractors at other sites. There are unique site conditions; however, the supply chain approach improved the school district roof performance. Other observations from the data in the above tables and figures show:

1. One contractor was getting most of the work.
2. Other contractors with better performance were not getting as much work.
3. The roof system's performance is increasing.
4. Th roof system's maintenance requirements are decreasing.

The authors proposed the following:

1. There may be a pricing issue, where one contractor may be pricing their work too low or including risk items in their pricing.
2. Over time, there has been a relationship formed between the school district and one contractor which has been detrimental to the Alpha program and the school district.

Conclusion

The school district had a delivery system for installing roofing systems that was not optimal. The Alpha sprayed polyurethane (SPF) roof system had given the school district the best roofing performance. The Alpha program contractors were the only contractors to have their performance measured, their roofs inspected annually, and maintenance done at no cost to the school district. The problem faced by the school district was identified by the Construction Industry Structure model. The difference between the low bid sector and the best value sector is that in the low bid sector all participants in the supply chain are looking after their own interest, the wrong parties are making decisions, directing, and attempting to control. In contrast, the best value environment has participants in the supply chain act as a supply chain.

This research identifies how a school district increased the value of the Alpha roof systems, overcoming the non-optimized system of their price-based delivery system. It also identifies how the manufacturer-maintained a school district as a client without offering a warranty that they could not support financially. Lastly it identifies how a school district improved the value of their roofs by implementing "win-win-win" activities such as identifying risk at a roofing preconstruction meeting, not expecting more than what was specified, not forming relationships with certain contractors and by using performance information to motivate the contractors to provide maintenance on their installed roofs.

This research identifies the potential impact of implementing best value practices in a price-based environment. It is acting as a supply chain instead of a silo-based approach. It shows the value of understanding the construction industry structure and that the problems in the construction industry are being caused by a system and not individual entities.

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Innovative Technology Is a Key to Facility Management Survival

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The business environment is rapidly changing. Automation and information systems are eliminating stakeholders out of the supply chain at a dizzying speed. Facility managers (FM) must change to prevent extinction. The path to extinction is clear; outsourcing, followed by loss of benefits, followed by commoditization and abusive work hours and demands. Often a major method of survival is cutting costs which results in poor performance. FM accountability and performance decrease under these conditions. FMs must identify and utilize cutting-edge information system practices that simplify and minimize FMs' workload and cost, while increasing value and impact. Technology developed at Arizona State University (ASU) over the last 25 years, and now in testing by government and private organizations, allows FMs to become information workers, expand their influence and responsibilities, and cut their costs by 90%. This new FM approach increases capability to lead and deliver all building systems with minimal experience.

Keywords: Best Value Approach, Facility Manager, Expertise, Outsource, Leadership, Information Worker.

Introduction

The business environment that facility managers (FM) work in is rapidly changing. The objective is lowering cost in the worldwide competitive marketplace. Automation and information systems are eliminating stakeholders [removing costs] out of the supply chain at a dizzying speed (Muro et al., 2019). FMs must change their role to prevent professional extinction. The path to that extinction is clear; it is outsourcing, followed by loss of benefits, commoditization and then abusive work hours and demands. A major method for survival is cost cutting which results in poor performance of the supply chain. FM professionalism, accountability and performance decrease under these conditions. The key to maintaining professionalism is the use of technology to improve value.

Outsourcing services are never a long-term solution. It often involves the reorganization of personnel and only works if the personnel do more work for less compensation. There are different ways to achieve this, often it is to sacrifice the level of service that is provided. A second method is to identify organizations and personnel who are doing similar tasks and combine the tasks. An example of this is real estate organizations moving into facility management.

Reality shows that it is a zero-sum game. When organizations create silos, as with outsourced services, they expect that it is not a zero-sum game. The silos often prevent organizations from seeing the zero-sum game. Organizations can be very inefficient; however, efficiency will not increase unless the structure or the individuals change. The challenge of the FM community is that technology is being used to change the structure and products, but the FMs are not able to change sufficiently to keep up.

Problem: Zero-Sum Game

There are a few observable examples of people not changing in the FM community. Experienced FMs are retiring. Older FMs who are not yet retired, are working as long as they can. The young FMs, that will replace them, do not have the experience of the older FMs (Gunnoe et al., 2018; Hightower & Highsmith, 2013; Sullivan et al., 2010a). The young FMs do not have the opportunity for more experience, or the knowledge, and they are working in a system in which they are attempting to manage, direct and control (MDC) vendors as if they are their experienced, knowledgeable predecessors (Kashiwagi et al., 2015a). The environment is complicated by an observable lack of experienced FM associate vendors who are delivering the services. A new structure is required for the new professional FMs to increase the performance of the delivered services (D. Kashiwagi, J. Kashiwagi, Child, & Sullivan, 2014; Rivera, Le, J. Kashiwagi, & D. Kashiwagi, 2016).

The other dominant observable example is that organizations are outsourcing their FM services (Kashiwagi et al., 2015b). The outsourced services utilize the same FM professionals. They are paid less, forced to work harder, and their resources are cut due to the client's organization belief that the outsourcing of the services minimizes costs.

FMs must identify and utilize cutting-edge information system practices that simplify and minimize FM's daily responsibilities and costs but increase value and impact. Technology developed at Arizona State University (ASU) over the last 25 years is now in testing by government and private organizations. It allows FMs to become information workers (IW), and expands their influence and responsibilities while cutting their activity by 90% and costs by 30% (D. Kashiwagi, J. Kashiwagi, Sullivan, & I. Kashiwagi, 2015; D. Kashiwagi, J. Kashiwagi, A. Kashiwagi, & Sullivan, 2012; Gastelum, 2017). Can traditional FMs accept new technology?

Research Question

How does the FM industry sustain the value and performance of FM professionals and associates when replacing retiring FMs with personnel with less experience, less knowledge and less stature within the C-Suite, but lower the cost and improve the professional value of FM personnel? Making the situation more complex is the impact of the worldwide competitive marketplace focusing on lower costs and the movement of the business environment toward automation and use of information systems that minimize the need for decision making and other human activities.

Proposal

By observation of the existing trends, the professional and associate FMs of the future must meet the following requirements (Rivera, D. Kashiwagi, J. Kashiwagi, & Doyle, 2016; Gunnoe, Kashiwagi, & Corea, 2018; Gunnoe & Krassa, 2019):

1. Minimize their workload along with their stress level.
2. Increase the breadth of their responsibility without increasing their workload.
3. Increase the FM performance by utilizing FM expert vendors.
4. Create an environment of transparency where the C-Suite can clearly identify the value and performance of the FM.
5. Make their profession one which is in demand.
6. Make the FM a leadership-oriented job.

These requirements are observable and logical. FMs are overworked, under-compensated and undervalued. International Facility Management Association (IFMA) chapters are now being led by IFMA associates, where 20 years ago, they were led by FM professionals. FM professionals are too busy to participate at the same levels. The general trend is that FM positions are being outsourced. Many FMs work in real estate or food service organizations.

Theoretical Concept Development

A technology has been researched and developed over the past 25 years that may help professional FMs improve their professionalism, value, and level of expertise in facility management services. Developed in the construction industry, the technology is called the Best Value Approach (BVA) and is intended to deliver the following characteristics (Kashiwagi, 2013; Krouwel, 2018; Natasja & Kashiwagi, 2017):

1. One professional FM can do the responsibility of 10.
2. The performance of the service is on time and on budget with 98% customer satisfaction (Krouwel, 2018).
3. The cost of the services can be reduced by 5 to 30% (Gajjar, Kashiwagi, Hurtado, & Sullivan, 2014; I. Kashiwagi, D. Kashiwagi, & Gambla, 2018).
4. The professional communicates in terms of performance metrics to FM vendor services and to the C-Suite. Easily understood metrics demonstrate value and minimize C-Suite decision making (Verway, I. Kashiwagi, Vries, & D. Kashiwagi, 2015).
5. The professional does not need technical knowledge but has the technology that can identify and utilize expert FM vendor expertise, increase performance and decrease cost while decreasing the need to manage and direct the FM vendor services.
6. The professional utilizes performance metrics that increases the breadth of their expertise to reduce cost.

Documented Results of New FM Model

A new model for the FM professional was created at Arizona State University (ASU) and tested extensively with very consistent results to increase the performance of the delivered services while cutting the cost by 5 to 30%. The research resulted in (Duren & Dorée; 2008; Kashiwagi, 2019; State of Hawaii PIPS Advisory Committee, 2002; Sullivan et al., 2010):

1. Research funding of $17.6M over 25 years, much of the funding from professional FMs and their purchasing counterparts.
2. 2,000+ tests delivering $6.5B of services.
3. 98% customer satisfaction.
4. Minimized vendor caused time and cost deviation to 1%.
5. Minimized professional efforts by 90%.
6. Most licensed intellectual property (IP) of any technology developed at Arizona State University [US News and World Report identified ASU as the most innovative university for the last four years] with 61 licenses in the last 15 years.
7. Documented with 350 books and refereed conference and journal papers.
8. Research results audited four times by the State of Hawaii [resulted in State Legislature official report with performance results], Western States Contracting Alliance [resulted in the sole source contract for WSCA members], Corp of Engineers [white paper stating approach met all legal requirements] and the Twente University [dissertation by PhD student].

The documentation and lessons learned from the research tests gives instructions to the FM industry to do the following:

1. Identify and utilize expert vendors who increase the value of FM services, provide performance metrics and reduce the cost (Kashiwagi, Rivera, & Taba, 2019).
2. Minimize the FM workload while increasing responsibilities (Claaasen, Roodhorst, & Kashiwagi, 2019).
3. Simplify explanation of FM responsibilities that the C-Suite will immediately understand.
4. Learn how to use the language of metrics to communicate with users that will increase the FM's influence and value.
5. Increase the organization's perception of the role and value of the FM professional (Kashiwagi, Zulanas, & Dhaval, 2016).
6. Expose the industry and FMs to a change in paradigm for the FM Professional and Associate (Smithwick, Schultz, Sullivan, & Kashiwagi, 2013).

Major Challenges to Overcome

The major challenge is not organizational C-Suites, traditional procurement organizations or a lack of resources and budgets. The major challenge comes from within the industry from traditionalist FMs who are concentrating on surviving in their own positions and not the furthering industry's future.

Traditional professional FMs in positions of leadership in the FM community are still expecting technical education for FM professionals. These traditional FMs became leaders due to their experience and technical knowledge. They are working many hours just to maintain and proliferate that position. They do not have the time or energy to consider the obvious, observable present (Kashiwagi et al., 2015a; Rivera & Kashiwagi, 2016a, 2016b):

1. The FM professional is being outsourced.
2. FM professionals are being tasked to work harder with fewer benefits in outsourced services.
3. FM professionals find themselves reporting to individuals who do not have FM knowledge or expertise.
4. There is more of an emphasis of low-cost FM service providers.
5. Cutting costs has become more important than utilizing expertise to lower cost.
6. FM professionals are required to know everything about FM services.
7. The levels of expertise in both the FM professional and the FM associate services are decreasing.
8. FM associate expert vendors are being directed to do things that they know are not optimal.
9. The FM education and certification structure has been setup as a technical management path modeled financially to proliferate itself in an environment that is moving in a different direction and requires a different structure.

The major challenge to the future professionalism of the FM community [both professionals and associates] is being sustained by the FM community itself. They do not:

1. Know how to create significant change for themselves.
2. Know what to do to change in their organizations.
3. Know how to transition from the traditional model to an FM model that will sustain itself in an age of increased competition and use of information and automation.
4. Know how to have a doable strategic plan.
5. Know how to optimize the resources they have by using meaningful performance and value metrics to bring change.
6. Know how to do “real” research that allows the FM industry to change into a sustainable, value-added industry.

Their actions are reactionary, short-term and cannot bring change. They are driven by competition, low price, and win-lose relationships. Resources are spent, and no change occurs.

Strategic Vision to Make the FM Professional and Associate Sustainable

The strategic vision of the industry must be realistic. Drastic changes are not acceptable. They create fear, opposition and result in no changes and the extinction of the visionaries. The requirement of organization C-Suites are easy to observe:

1. Minimize the number of employees.
2. Minimize the functions of non-essential services.
3. Minimize cost and increase capability and stakeholder satisfaction at the same time.

The requirement of the FM professional is simple:

1. Get into the C-Suite.
2. Have the same objectives and results as the C-Suite.
3. Ensure that the C-Suite understands their contribution: lower cost and higher capability.

The IFMA organization and the industry must maintain its organizational fiscal position and not make drastic changes. It must make the right changes that gives a hopeful vision of the future to its organization and industry, while minimizing the impact on its members and fiscal operations. Some suggested changes recommended from this to the IFMA organization are:

1. Encourage the FM associates to become more active on education and certification. They are the future experts in the FM community.
2. Educate the FM associates on how to identify and utilize their own expertise.
3. Educate the FM associates [who cause 90% of project cost and time deviations] on how to minimize the risk of the FM professionals.
4. Create a course that educates on a Future FM model [using information systems and minimizing management and control by identifying and utilizing expertise]. Identify FM professional visionaries who have proven experience in creating and testing FM models for the Future. Give the visionaries a structure to recruit a small class of FM professionals and associates of the Future. The requirement to ensure the capability to be visionary [observant, logical, think of the industry before themselves and has common sense] should be utilized for both students and instructors. The course should include logic, industry and organizational structure, information systems and automation, implementation, and how to measure and document test results.
5. Expose the FM industry to a new entry model which identifies and utilizes potential FM professionals and associates of the Future [high school level] that minimizes investment and can track success rates. One such model has been created by FM visionaries, entirely self-funded with assistance from the local Greater Phoenix IFMA chapter, with amazing results.

Conclusion

The time is now for identifying how to change the FM industry. The irony is the change must minimize the need for the FM industry to change. The answer is automation. Automation must minimize the technical knowledge and time needed for FMs to think and make decisions. The answer lies in minimizing the need to use someone's own experience. The FM model of the Future has already been tested. It must now be exposed to the industry. It must cut costs, improve performance, demonstrate the value of the FM professional and associate, minimize the physical efforts and stress of the FM professionals while delivering recognizable results. The proposals and recommendations contained here were developed and are offered toward strengthening the future of the FM profession and the IFMA Organization.

Recommendations

Expose FM visionaries to the following:

1. The FM professional of the Future is as an “Information Worker” [does not require technical FM experience], who minimizes effort while delivering a significant increase in performance and capability.
2. The FM associate of the Future is the technical expert of the future, but needs education to learn how to identify, utilize and leverage their expertise in their organization.
3. A new approach/entry point for the FM industry, using updated technology to attract future FM professionals and associate vendor personnel.
4. Successful approach to establishing FM college education programs.

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Construction Risks in Developing Countries: A Vietnam Case Study

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Most construction projects in the developing countries are marred with delays, cost overruns and low satisfaction levels. This paper focuses on analysis of the data collected from a survey that include the twenty-three (23) common risk factors that cause non-performance in construction projects in developing countries. The factors were consolidated from an extensive literature review, and inputs were solicited from 103 construction practitioners in Vietnam. The study reveals the top five risk factors as the bureaucratic administrative system, financial difficulties of owner, slow payment of completed works, poor contractor performance, financial difficulties of contractor. Spearman's rank-order correlation tests determined no significant differences between the participating groups. Factor analysis explored the correlations among the risks and yielded four outcomes – Lack of Site and Legal Information, Lack of Capable Managers, Poor Deliverables Quality, and Owner's Financial Incapability. The findings lay the foundation for stakeholders in the developing countries' construction industry to better plan and manage the risks for their projects and investment and develop innovative solutions to improve their construction project performances.

Keywords: Construction Industry Risks, Developing Countries, Construction Delay and Cost Overrun, Risk Importance Index, Factor Analysis, Vietnam

Introduction

A construction industry lays the foundation for both developing and developed economies as it provides the infrastructure for any nations. It contributes to economic growth, delivers jobs and provides critical infrastructure (e.g. healthcare facilities and transportation network) to support the growth and development of various economic sectors. Economic growth results in improving the quality of life of a country, where (only) well invested construction projects would alleviate people from poverty as more wealth is created. While the construction industry is one of the oldest industries in any civilizations, modern construction industry (even the ones in the developed countries) is still marred with inefficiencies and disputes that resulted in inefficient capital investment and utilization (Rivera et al., 2017). Investment in construction faces multiple scrutiny where many countries still face project delays, budget overrun, low stakeholders' satisfaction, and in the worst cases, corruption, even though these are the essential elements to determine how successful a construction project truly is (Long et al., 2004).

The challenges that developing and developed countries face are different. This study would focus on Vietnam and thus deploy research only from similar countries, especially those rapidly developing countries in Asia. The study also focuses on identify the risks that put construction project cost, schedule and quality at stake, particularly those that hinder construction project performance in the developing countries (Koushki et al., 2005; Sambasivan, 2007; Toor et al., 2008, Le-Hoai, 2008). Particular attention is given to the development of factor models for enhancing the construction project performance in the developing countries.

Objectives of the Study

The main research objective is to identify risk factors affecting construction project performance in developing countries, particularly Vietnam. The research would first identify the risk factors through extensive literature review for developing countries, and prior research in the field. The research would then rank and examine the frequency, relevance, severity and importance of the identified risk factors. After which, the research team would determine how different construction stakeholders rank the risk factors, and how they perceive their impacts. The analysis would finally identify and model the potential relationships between risks, and the results are simplified factors that would be used at the project pre-planning phase and throughout the project.

Literature Review

Extensive literature reviews, case analysis, and discussion with multiple construction stakeholders were conducted to identify the relevant construction risk factors for developing countries. Over 90 risk factors pertaining to construction projects were compiled for the studies from the following countries: Kuwait (Koushki et al., 2005), Malaysia (Sambasivan & Soon, 2007), Jordan (Sweis et al., 2008), Ghana (Frimpong et al., 2003), Nigeria (Aibinu et al., 2006), Vietnam (Le, 2017), Thailand (Toor & Ogunlana, 2008), Indonesia (Kaming et al., 1997), Lebanon (Mezher & Tawil, 1998), Zambia (Kaliba et al., 2009), India (Doloi, et al., 2012), Egypt (Aziz & Abdel-Hakam, 2016), Uganda (Alinaitwe et al., 2013), Gaza (Enshassi et al., 2009), Palestine (Mahamid et al., 2012), and Oman (Ruqaishi & Bashir, 2015). Summaries from some of the major studies include:

- Koushki et al. (2003) interviewed over 450 private residential owners and developers in Kuwait and identified the major factor contributing to projects' time-delay and cost-increase to include inadequate budget and time allocated at the design phase. Other causes of delays and cost overruns included high number of change orders, financial constraints, owners' lack of experience in construction, contractor-related problems, and material-related problems.
- Sambasivan & Soon (2006) conducted a survey on 150 owners, consultants, and contractors in Malaysia to identify the ten most impactful causes as contractor's improper planning, contractor's poor site management, inadequate contractor experience, inadequate client's finance and payments for completed work, problems with subcontractors, shortage in material, labor supply, equipment availability and failure, lack of communication between parties, and mistakes during construction stage. The main effects of these causes were: time overrun, cost overrun, disputes, arbitration, litigation, and total abandonment.
- Sweis et al. (2007) collected data from 29 consultants, 36 contractors, and 26 clients on project delay in Jordan and found that poor planning of scheduling, financial difficulties, too many change orders, shortage of manpower (skilled, semi-skilled, unskilled labor), and

incompetent technical staff assigned to the project were the leading risk causes for delays. These causes were pertained to the internal environment of the supply chain, especially that of the contractor, while exogenous factors had relatively lesser impact on project delay.

- Frimpong et al. (2001) research using questionnaire surveys to identify and evaluate the relative importance risk factors pertaining to the non-performance if Ghana groundwater construction projects revealed that the major risk factors included monthly payment difficulties from agencies, poor contractor management, material procurement, poor technical performances, and escalation of material prices. Most of the identified problems originated from poor resources management (human, technical, and material).
- Toor and Ogunlana (2007) examined the causes of construction delays in Thailand and found that the most significant problems were the lack of standardization in design, lack of contractor's experience and control over project, inadequate experience of staff, lack of competent subcontractors/supplies, unrealistic project schedule, lack of responsibility, contractor's financial difficulties, poor contract management, poor site access or availability, and poor efficiency of supervisor or foreman.
- In particular to Vietnam, Le (2017) reviewed 100+ peer-reviewed manuscripts of the construction industry in Vietnam in the last 15 years and found 23 non-performance causes, out of which, the top five factors by appearance frequency included ineffective designs and frequent design changes, poor contractor performance, ineffective project management, financial difficulties of owner, and financial difficulties of contractor. Further, the authors also compared risks found in Vietnam to those occurred elsewhere in other developing countries and suggested that 91% of them are similar.

Similar risk factors found in the literature review were grouped under one risk factor. For example, "Lack of design standardization" found in Toor and Ogunlana (2007) is grouped under "Ineffective Designs and Frequent Design Changes" as shown in Table 1. The reason for grouping them is to simplify the research process and analysis procedures while staying relevant to the research. The standardization process would allow the research team to focus on identify the factors first, before further studies would be conducted to better identify the details. The research grouped the risk factors into 23 common risk factors for developing countries as shown in Table 1. Literature review showed that the developing countries faced many common risk factors despite differences in socio-economic, cultural, and political aspects.

Table 1: Common Risk Factors that Cause Construction Non-Performance in Developing Countries.

Risk Factors	Kuwait	Malaysia	Jordan	Ghana	Nigeria	Vietnam	Thailand	Indonesia	Lebanon	Zambia	India	Egypt	Uganda	Gaza	Palestine	Oman
Bureaucratic administrative system		x	x	x	x	x	x		x		x		x	x		
Corruption/Collusion						x	x									
Defective works and reworks				x		x				x	x	x	x	x	x	x
Financial difficulties of contractor	x		x	x	x	x	x			x	x			x	x	
Financial difficulties of owner	x		x	x	x	x	x			x		x		x	x	
Improper planning and scheduling	x	x	x	x	x	x	x	x			x		x	x	x	x
Inaccurate estimates	x			x		x			x			x		x		
Inadequate legal framework						x										
Ineffective designs and frequent design changes	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x
Ineffective project management	x	x		x		x	x		x	x	x		x			x
Interest and inflation rates				x	x	x	x	x			x		x	x	x	
Lack of accurate historical information		x		x	x	x	x	x	x		x	x	x			x
Lack of capable owners	x	x			x	x	x		x	x	x		x	x	x	x
Lack of experience in complex projects						x		x			x	x	x	x		x
Owners' site clearance difficulties			x			x					x	x		x	x	x
Poor contractor performance	x	x	x			x	x			x		x	x	x	x	x
Poor site management and supervision		x				x			x	x	x	x		x	x	x
Poor subcontractor performance		x	x		x	x	x		x	x	x	x	x	x	x	x
Poor tendering practices [Low bid practice]				x		x	x									x
Shortages of materials	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x
Slow payment of completed works		x	x	x		x	x		x	x	x		x	x	x	x
Slow site handover			x		x	x					x	x			x	
Unpredictable government policies and priorities		x	x		x	x	x		x		x				x	x
Total Counts	9	12	12	12	12	23	15	6	11	11	17	12	13	16	15	15

Research Methodology

This research uses field survey as its key research method to collect data pertaining to the research objectives. The survey focuses on data collection from various construction stakeholders pertaining to the understanding of various risks that impact construction performances, particularly, schedule delay, cost overrun and client satisfaction. The survey was designed using the 23 common risk factors from the literature research (shown on Table 1) with a goal to quantify the construction project and industry performances pertaining to time, cost, and customer satisfaction. The survey also aimed to identify the relative impacts that those risk factors had on construction projects and industry. The five-point Likert scale of 0 to 4 measured the respondents' experiences between the risk factors and their impacts on construction projects, based on their occurrences and severities. The numerical values assigned for the Likert Scale are as follow: '0 – Never Happen; 1 – Rarely; 2 – Sometimes; 3 – Often; 4 – Always' for frequency, and '0 – No Influence, 1 – Mild, 2 – Moderate, 3 – Very, 4 – Extremely' for severity. The respondents had the option to include additional risk factors they personally experienced but was not included in the 23 common risk factors.

The questionnaire/survey was validated before it was sent out to the experts. Four construction industry experts were identified and participated in the validation exercises. The experts included a civil engineering/construction engineering professor, a practicing contractor, and two owner representatives. These experts had at least 15 years of experience in the industry at the time of the validation test. The experts reviewed the structure and content of the questionnaire, and recommended changes to the originals. Their recommendations are incorporated into the final questionnaire. It was then sent to the selected survey participants in Vietnam. The stakeholders are divided into "Owners", "Contractors" and "Consultants", and they were either sent an email with a link connected to the survey or physical mail to their offices. The online survey was developed using Google Survey and printed copies of the survey forms were mailed out with return envelopes enclosed. Completed surveys were compiled online and physically from the returned mails. The surveys were returned within a month after they were mailed out.

The collected survey was quantitatively analyzed using IBM SPSS Statistics v25. The research team used the following techniques:

1. Cronbach's alpha coefficients to test internal consistency of the results,
2. Risk factor analysis to rank the risk factors in terms of degree of frequency, severity and importance
3. Spearman's rank-order correlation coefficient was then utilized to determine the degree of agreement of risk rankings between each responded group,
4. Factor analysis was used to derive interrelationships among the risk factors.

Data Collection

The survey was sent to over 300 construction professionals from the three stakeholder groups only in Vietnam. These professionals were selected from companies that faced the highest risk factors, such as the type, complexity and size of the construction projects their companies are involved in. The research team avoided the companies that were involved in low-risk projects, such as renovation and structural repairs where cost and budget are less volatile. Large-size complex projects face increasing risks of budget, schedule and quality issues. They also faced greater scrutiny from the Vietnamese regulators and clients.

Nearly half of the surveys were returned (140 surveys were returned). Of the 140 surveys that were returned, incomplete surveys were also eliminated from the responses. There were 37 surveys removed from the analysis as a result. These numbers were consistent with previous studies (Le-Hoai, 2008; Sambasivan & Soon, 2007; Sweis et al., 2008; Frimpong et al., 2003; Toor et al., 2008). Table 2 describes the characteristics of the survey participants from those who responded. While the total response rate was around 48%, a total of 34.3% of the invited survey were used for the analysis. The survey period occurred in the first two quarters of 2018.

Table 2: Characteristics of Questionnaire Respondents.

Demographic Characteristics		Responses	%
Groups			
	Owners	45	43.7%
	Contractors	36	35.0%
	Consultants	22	21.4%
Industry Experience			
	0 - 5 years	18	17.5%
	6 - 10 years	18	17.5%
	11 - 20 years	42	40.8%
	Over 20 years	25	24.3%
Project Involvements			
	Commercial / Residential	63	60.7%
	Infrastructure / Heavy Civil	22	21.4%
	Industrial	18	17.9%
Project Sizes			
	< $1M	22	21.4%
	$1M - 5M	46	44.6%
	> $5M	35	33.9%

Characteristics of Respondents

Among the 103 returned questionnaire, 45 respondents worked for owners (43.7% of the responses), 36 for contractors (35%), and 22 for designers and/or consultants (21.4%). The participants held high level managerial positions, such as project managers, directors or associate directors. More than half of the respondents had over 15 years of experience. This ratio had improved from a similar past study (Le-Hoai, 2008) and reflected the growth in experience of industry participants in the last 10 years. The respondents' mean years of relevant experience in the construction industry is around 18 years. Such highly experienced profile and the management roles of the respondents would likely translate into highly reliable results and thus enhance the quality of the findings. The majority of respondents were involved in Commercial / Residential projects (60.7%) which highlighted the abundance of building projects in Vietnam and made this study more applicable to building projects. The participants were asked to provide the projects' performance metrics that they experienced over the past five years prior to the survey, and these are documented in Table 3. The participants did not add new risks to the questionnaire and concluded that the 23 risk factors accurately describe most of the risks they faced.

Table 3: Projects Performance of Questionnaire Respondents.

Performance Metrics		Responses	%
Time			
	Delayed	97	94.2%
	On-Time	6	5.8%
	Average Time Extension	-	30.0%
Cost			
	Over-budget	84	81.6%
	Under-budget	19	18.4%
	Average Cost Growth	-	14.0%
Stakeholders' Satisfaction			
	Unsatisfied	28	27.2%
	Neutral	56	54.5%
	Satisfied	19	18.4%

Data Analysis

The research team used the following techniques:

Cronbach's Alpha Coefficients

The Cronbach's Alpha Coefficients of the internal consistency reliability tests for risk factors' frequency and severity ratings of the survey results are 0.928 and 0.942 respectively. Litwin & Fink (1995) and Kog (2019) suggested that consistency is high when Cronbach's alpha is above 0.7. This confirmed that there is high internal consistency among the answers.

Risk Factors Analysis

The survey results were analyzed using three indices that were previously used by Kaming et al. (1997), Le-Hoai (2008) and Doloi, et al. (2012). These indices are as following:

1. Frequency Index (FI): This index measures the frequency of occurrence for each risk factor. It is computed with the following formula:

$$FI = \frac{\sum_0^4 a_i n_i}{4N}$$

in which a = the weight assigned to each response (as in this research, a range of 0 for "Never Happen" to 4 for "Always"), n = frequency of occurrence for each response, and N = total number of responses.

2. Severity Index (SI): This index measures the severity of each risk factor to project performance. It is computed with the following formula:

$$SI = \frac{\sum_0^4 a_i n_i}{4N}$$

in which a = the weight assigned to each response (as in this research, a range of 0 for "No Influence" to 4 for "Extremely"), n = frequency of occurrence for each response, and N = total number of responses.

3. Relative Importance Index (RII): This index measures the relative importance of each risk factor pertaining to the frequency of occurrence and severity to project performance. It is computed with the following formula:

$$RII = FI \times SI$$

The calculations of FI, SI, and RII and the rankings of the 23 risk factors identified in the questionnaire are presented in the Appendix, Table 4, 5, and 6. The following observations were made:

1. There are not many discrepancies between the FI, SI, and RII rankings. Seven out of top 10 importance factors (Appendix, Table 6) happened to be the top ten with regards to frequency (Appendix, Table 4) and severity (Appendix, Table 5).
2. Top risk - Bureaucracy: As shown in Appendix, Table 6, the top risk is "Bureaucratic administrative system" and associated with the administrative nature of how the construction industry operates. Bureaucracy, or better known as red tape, hinders project progress through high level barriers that increase risks of project delays, cost overrun and affecting project quality. This is also the most highly ranked risks among the owners, contractors, and consultants. Further investigation also found that 'Bureaucratic administrative system' has become an increasingly critical hindrance of construction project performance in Vietnam as government and clients are increasing the amount of unnecessary procedures (red tape).
3. Risks pertaining to finance and cash flow: The analysis showed that three of the top five issues are tied to issues surrounding project financing, like slow payment, financial difficulties of owners and contractors, and improper planning. Cash flow is critical for any construction projects as profit is often "razor thin". Narrow profit margin forces contractors and owners to depend heavily on payment and financing every month. Contractors rely on monthly payment to pay their subcontractors and employees, and owners to secure financing to pay their contractors. Understanding cash flow is a critical knowledge especially in Vietnam.
4. Risks pertaining to experience and capability are also highly ranked risks: "Lack of experience in complex projects" and 'Ineffective designs and frequent design changes' were found to be critical risk factors surrounding the experience and capability of the construction professionals in Vietnam. The fast-paced development in Vietnam demand a significant number of construction workforce at all levels. This has resulted in the massive employment of professionals who may not have the necessary experience and skills in the first place. As a newly developing nation, Vietnam's young workforce offers the vigor and energy but not the

experience and knowledge. Adding on to the lack of industry professional support, like the American Society for Civil Engineers (ASCE), the survey clearly indicated the lack of experience and capability to increase risks of the local projects. This has also caused frequent changes made to projects due to both inexperienced owners and professionals as they were unable to meet the exact requirements with their initial designs and plans. Frequent changes to projects are often costly and affect project quality and schedule.

5. Managerial and administrative risks: The ninth to sixteenth factors have an FI above 0.5 and an SI above 0.6 (Appendix, Table 6). These risk factors are closely associated with the managerial and administrative aspect of construction project performance, particularly to the ability to make reliable decisions on project, schedule, bids, handover, supervision and eliminate mistakes. The survey clearly indicated the lack of solid foundation for management. Owners found various issues to manage their projects effectively as they lack the right knowledge to submit accurate bids, determine the best approaches to manage projects, supervise workforce, ensure smooth handover, and manage their extremely ill-prepared subcontractors. They also highlighted that both contractors and consultants made frequent mistakes in their estimates and injected plenty of avoidable risks into their projects, and many of these mistakes are technical-related.
6. External risks: The seventeenth to twenty-third risk factors (Appendix, Table 6) are mostly related to the external environment such as interest and inflation rates, legal framework, lack of accurate historical information, unpredictable government policies and priorities, and shortages of materials. The effects of these risks vary from countries to countries due to differences in socio-economic, cultural, and political aspects. The participants ranked the importance of these risks among the lowest. They found these factors were beyond their control. The participants rank the risks they were able to control higher than those they were unable to control.
7. "Not my problem" – An issue with personal accountability: The research also found an interesting phenomenon that the team identifies as "not my problem". The analysis found that the three groups of stakeholders rank the risks from the opposing stakeholders higher than those affected by them. For example, 'Financial difficulties of owner', 'Lack of capable owners', and 'Owners' site clearance difficulties' are lower ranked on the survey completed by the owners and higher on those completed by the contractors and consultants. Alternatively, the contractors ranked 'Poor contractor performance', 'Financial difficulties of contractor', 'Inaccurate estimates', 'Poor tendering practices' are ranked lower than the owners and consultants. 'Lack of experience in complex projects', 'Ineffective design and frequent design changes' were ranked lower by the consultants than owners and contractors at the same time. The survey found that the stakeholders often assumed their roles contributed to lower risks towards the projects. This might suggest self-accountability could be an issue.

Spearman's Rank-Order Correlation

The Spearman's Rank-Order Correlation (SRC) measures the implied degree of agreement on the ranking among groups of respondents. It is computed with the following formula:

$$\rho = 1 - \frac{6 \times \sum d^2}{n(n^2 - 1)}$$

in which ρ = level of consensus between two groups ($0 \leq \rho \leq 1$); d = the difference in ranking of a risk factor, and n = number of ranking places.

Table 7 (see Appendix) shows the Spearman's Rank-Order Correlation among the survey returns from the stakeholders. The analysis shows that the owners and contractors generally agreed with each other on the types of risks affecting construction project performance with regards to the frequency (78%), severity (52%) and importance (67%). However, designers/consultants did not share similar sentiments as Table 7 (see Appendix) clearly indicates. The survey shows that the consultants did not generally agree with the owners and contractors. Owners and contractors commonly share more similar project goals (i.e. on-time, on-budget) and their perception on project quality is mostly similar (quality generally means focusing on visible quality). The goals of designers and consultants focus are mainly on the technical aspects of projects, such as structural design, aesthetics and functional performances. The designers/consultants are also involved at the design and planning phases of the projects, rather than the actual construction process.

Table 8 (see Appendix) shows Spearman's Rank-Order Correlation between the three stakeholder types and overall rankings by all of them. The analysis found that the contractors' responses were highly correlated (92% on frequency, 90% on severity, and 94% on importance) with overall rankings. The results clearly indicate the contractors' clear perceptions on project risks, and how their involvement throughout the construction project delivery process could have led to such clarity. Contractors work closely with both owners and designers/consultants, and they would have perceived and partake risks more comprehensively than other stakeholders.

Factor Analysis

The relationships between each risk factors were further investigated in order to identify the most significant ones. Factor analysis was used to, first, measure the multivariate interrelationships between and within the risk factors, and second, analyze the structure and correlations between the variables by defining a set of common underlying dimensions (also known as factors or components) (Hair et al., 1998). The Kaiser-Meyer Olkin (KMO) and Bartlett's Test of Sphericity were conducted to verify the legitimacy of factor analysis. In this study, Bartlett's test approximate of Chi-square is 1481.631 with 253 degrees of freedom, which is significant at the 0.05 level of significance, suggesting that the population correlation matrix is not an identity matrix. The KMO statistic of 0.899 is also greater than 0.5 which is satisfactory for the factor analysis.

The Principal Component method was utilized for factor extraction. The Oblimin rotations with Kaiser Normalization rotation method was selected for this analysis. Four components were identified with Eigenvalues to be greater than 1.00 (shown in Appendix, Table 9). These four components account for 64.5% of the variance in construction non-performance.

Table 10 shows the four component loadings extracted from the factor analysis and these exclude the factors with loading values of less than 0.5. The four components are labeled as follow:

1. Component 1 – Lack of Site and Legal Information

2. Component 2 – Lack of Capable Managers
3. Component 3 – Poor Deliverables Quality
4. Component 4 – Owner's Financial Incapability

Table 10: Factor Analysis Loading Results.

Components	Eigenvalue	Variance (%)	Risk Factors	Factor Loading
1	10.569	45.952	Lack of accurate historical information	0.858
			Unpredictable government policies and priorities	0.819
			Inadequate legal framework	0.781
			Bureaucratic administrative system	0.592
			Interest and inflation rates	0.553
			Corruption/Collusion	0.508
2	1.670	7.260	Ineffective designs and frequent design changes	0.823
			Inaccurate estimates	0.604
			Ineffective project management	0.598
			Poor site management and supervision	0.593
			Poor contractor performance	0.571
			Improper planning and scheduling	0.543
3	1.472	6.400	Slow site handover	0.855
			Defective works and reworks	0.773
			Poor subcontractor performance	0.578
			Shortages of materials	0.564
			Financial difficulties of contractor	0.518
4	1.115	4.848	Financial difficulties of owner	0.764
			Slow payment of completed works	0.724

Component 1: Lack of Site and Legal Information

Component 1 consists of 'lack of accurate historical information', 'unpredictable government policies and priorities', 'inadequate legal framework', 'bureaucratic administrative system', 'interest and inflation rates', and 'corruption/collusion'. This component implies the construction participants' lack of information on site conditions and government legal framework, leading to projects being delayed and sometimes affected by inflation and interest rates, and the use of fraudulent practices to fasten the process.

'Lack of accurate historical information' has factor loading value of 0.858 (Table 10). Vietnam does not have accurate data on soil, weather, and traffic (Ling & Bui, 2010). The underground site condition in Vietnam is complex due to soft soil that change unexpectedly along the country (Le-Hoai et al., 2008). Despite inspection works strictly follow government standards, soil condition is always one of the biggest risks for most projects (Le-Hoai et al., 2013). Contractors also face the lack of accurate weather forecasts. As Vietnam is a tropical country, typhoons, heavy rain, and flood often occur and can lead to flooding on-site and subsequent remedial measures can lead to delay and cost overrun (Ling & Bui, 2010). On the other hand, designers rely on traffic volume provided by the government to design underpasses but sometimes the traffic information is found inaccurate only after construction began (Ling & Bui, 2010). As soil, weather, and traffic information are important input data for project activities, time and budget should be built into the master program to investigate site conditions during pre-construction phase (Ling & Bui, 2010). It is also necessary to consider the conditions of contract to adequately allocate risks between parties (Le-Hoai et al., 2008).

The legal system governing construction projects in Vietnam continues to change unexpectedly (‘unpredictable government policies and priorities’, Table 10, Factor loading value 0.819), is inconsistent on various levels (‘inadequate legal framework’, Table 10, Factor loading value 0.781), and requires excessive time and effort for approvals (‘bureaucracy administrative system, Table 10, Factor loading value 0.592). Research has found that government funded projects in developing countries tend to be political in nature (Luu et al., 2008). These projects face the risk of being terminated even after the design has been well developed. In Vietnam, and possibly other developing countries, due to high demand for infrastructure projects, it is possible that new government officials might abandon an ongoing project to channel funding elsewhere (Luu et al., 2008). Foreign firms in Vietnam have voiced their concerns of having to work in an environment where the legal code was inconsistent (Ling & Hoang, 2010). As building regulations are still primitive, there is no unified legal framework for the conduct of construction business. As shown in Table 1, Vietnam is not the only country that suffers from bureaucracy administrative system. Slow government permits, unstable regulatory framework, slow site clearance, unsatisfactory site compensation, incompetent staff of government regulatory agencies, unclear responsibility and power, relatively poor law implementation process, and complex approval procedures constitute into the bureaucracy administrative system that causes delays in Vietnam (Long et al., 2004; Thuyet et al., 2007). Master plans, zoning, and future plans for the land are frequently changed, or sometimes, even concealed by officials, making it difficult to plan for long-term development (Ling & Hoang, 2010). Not only this risk causes delays, it reduces Vietnam’s image in the eyes of foreign investors as total foreign investment capital into Vietnam has decreased (Thuyet et al., 2007). Vietnamese government requires a proof of financial status and a deposit which would be held for 1 – 2 years for firms to obtain project approvals (Ling & Hoang, 2010). This requirement makes it difficult for small, medium, and foreign firms to compete with big and established firms in Vietnam. The government recognized this and has been trying to institute administrative reforms and openness in the operations of state agencies (Ling & Hoang, 2010). To manage this risk, in addition to being in good relationship with government, environment authority, and NGO’s, construction owners and contractors should be familiar and conversant with approval processes and understand local laws and regulations. Building database of past projects approvals and forming templates of approval documentation are also recommended to reduce time and cost of project approval process (Long et al., 2004).

As bureaucracy is an issue, close and cooperative relations with local government and authorities are essential to obtain orders (Luu et al., 2008) and fraudulent practices (‘corruption/collusion, Table 10, Factor loading value 0.508) seem to be the fastest way to build relationships. It has been estimated that 20 – 40% of capital investment in construction is lost due to poor management for which bureaucracy and briberies are mainly responsible (Long et al., 2004). The Vietnamese government has been introducing anticorruption law and enacting relevant regulations to combat corruption. An anticorruption strategy, and project to monitor incomes of public employees and government officials are in the pipeline for 2020. On the company level, antigraft training should be provided to staff to lessen or eradicate corruption and wastefulness within the company (Ling & Hoang, 2010).

'Interest and inflation rates' has factor loading value of 0.553 (Table 10). Projects that are affected by this risk the most are those that require special, non-local materials which are not readily available in Vietnam, and those that take too long to obtain approvals due to bureaucracy. Interest and inflation rates in Vietnam fluctuate wildly (Ling & Hoang, 2010). The average inflation rate of Vietnam is currently at 4% which is more than half the profit of construction projects for contractors (6%) (Kim et al., 2016). Due to high inflationary trend, price fluctuation is difficult to predict and would cause materials and labor costs to increase during construction phase (Le-Hoai et al., 2008, Ling & Hoang, 2010). Several measures have been recommended to manage this risk: introducing fluctuation clause in the contract (contractor to bear risk of cost increase for the original scope, owner to bear risk of cost increase for change orders) (Ling & Hoang, 2010), designers to conduct market surveys before specifying non-local materials and consider alternative materials (Ling & Bui, 2010), alternative materials should follow quality standards, owner to make advance payments for materials to lock in their prices, contractors to purchase materials in bulk, or enter into exclusive agreement with suppliers to fix costs of materials (Ling & Hoang, 2010).

Component 2: Lack of Capable Managers

Component 2 consists of 'ineffective designs and frequent design changes', 'inaccurate estimates', 'ineffective project management', 'poor site management and supervision', 'poor contractor performance', and 'improper planning and scheduling'. This component shows the lack of capable managers who can coordinate project activities from beginning to end using logical steps.

Managing projects is quickly becoming a critical function as construction projects become increasingly complex. Developing countries are increasing the number of complex projects as these countries are beginning to ramp up the development of critical infrastructure to support their economic growth. However, the professional workforce, owners and government in the developing countries still lack the required knowledge and experience, and coupled with unsupportive government policies, these countries continue to face challenges starting with the design phase ('ineffective designs and frequent design changes', Table 10, Factor loading value 0.823; 'inaccurate estimates', Table 10, Factor loading 0.604). Vietnamese designers have been criticized for their incompetence, outdated skills, and lack experience to make good designs (Le-Hoai et al., 2008; Yean et al., 2009). For that reason, there is a dominance of foreign designers in complex projects in Vietnam (Thuyet et al., 2007). Despite being more skilled and experienced, these foreign designers still stumble on design issues such as owner's unclear scopes and unrealistic expectations, use of different standard design systems, poor inspection and approval of design process (Thuyet et al., 2007; Le-Hoai et al., 2008; Kim et al., 2016). Perhaps the lack of a management approach that could address and resolve the owners' lack of experience and uncertainty in what they want is the main cause of design issues (Kashiwagi, 2018). As design problems increase, change orders and inaccurate estimates would likely happen along the way (Long et al., 2004). A number of management strategies have been proposed to improve the design phase: selecting designer should be based on past and relevant performance and utilizing the designer's expertise, not owner's, to come up with the design (Thuyet et al., 2007; Kashiwagi, 2018), owner's ideas should be presented in simple, non-technical, and measurable metrics for the designer to translate into their own technical terms (Thuyet et al., 2007;

Kashiwagi, 2018), the design office should establish a system to track and control changes with an effective risk management plan (Le-Hoai et al., 2008), conducting concurrent engineering activities to improve constructability (Thuyet et al., 2007), and employing expert consultants to evaluate the quality of designs and estimations (Thuyet et al., 2007; Long et al., 2004).

Construction phases also suffers from the lack of capable managers (‘ineffective project management’, Table 10, Factor loading value 0.598; ‘poor site management and supervision’, Table 10, Factor loading value 0.593; ‘improper planning and scheduling’, Table 10, Factor loading value 0.543). Strong project management capability is crucial in construction projects, though there has been a shortage of project managers who could handle large-scale projects in Vietnam (Yean et al., 2009). Despite project management has been professionalized, the works remain poor (Le-Hoai et al., 2013). Effective management and continuing professional development courses should be introduced at all levels (corporate, process, project, and activity) to improve performance (Yean et al., 2009). On the site level, poor site management and supervision has been a tough problem and emphasizing the weakness of contractors (‘poor contractor performance’, Table 10, Factor loading value 0.571). Contractors lack in skilled human resource, superintendents are often rated on years of experience not actual performance, the industry is not capable in adopt or adapt best practices already working in other countries are issues that should be addressed (Le-Hoai et al., 2008; Long et al., 2004). After the ‘Open Door’ policy has been applied, many foreign project management consultants and contractors have been joining the Vietnam construction market, so Vietnam is not lacking competent contractors (Le-Hoai et al., 2008). However, the right contractors still need to be identified and utilized for the right projects. Procurement and project delivery system have not been conducted properly (Long et al., 2004). Bidding processes have been criticized as being unfair, unhealthy, and costly due to excessive time required, even leading to contracts being awarded to incapable contractors (Long et al., 2004). Kashiwagi (2016) proposes the Best Value Approach that could accurately determine the qualification of contractors based on quantifiable past experience, risk management plan, and value-add. Contractors should be required to plan the project from start to finish and submit their high-level plan for review. The plan would provide enough details and shed lights on the potential success and failure of the project, thus allow stakeholders to better act and monitor risks through a project. The key challenge remains on how these ideas could be implemented and their effects could be observed in a developing country such as Vietnam without any prior knowledge.

Component 3: Poor Deliverables Quality

Component 3 consists of ‘slow site handover’, ‘defective works and reworks’, ‘poor subcontractor performance’, ‘shortage of materials’, and ‘financial difficulties of contractor’. This component resonates the effects of Component 1 and 2. The lack of information and capable managers to effectively look at projects from beginning to end, identify and manage risks, address the bureaucracy nature of the industry, select the right contractors, has resulted in poor deliverables from project team which emerge at the construction phase even though their causes are injected into the project much earlier.

Site handover is considered very serious and a big milestone in Vietnam (Luu et al., 2009). The Vietnamese Land Law separates the right of land use from land ownership. The government owns the land while the people own the right of land use. Before starting projects, owners have to negotiate with the communities for compensation to the right of land use, and then must receive approvals from the local government (Luu et al., 2009). Due to bureaucratic approval process, major delays have been caused by complex procedure for issuance of land use certificates (Luu et al., 2009). This risk ('slow site handover', Table 10, Factor loading value 0.855) is often overlooked by inexperienced owners and consultants (Kim et al., 2016). In addition to topographical surveys and geotechnical surveys, other tasks should be implemented in the comprehensive site investigation program to prepare the site well before commencing construction or mobilization: informing affected people near the site about the project, offering satisfactory compensation, conducting environmental and social impact assessments. These measures reduce the risk of slow site handover and interruptions during construction phase (Long et al., 2004).

Defective works and reworks (Table 10, Factor loading value 0.773) also affect the quality of final deliverables. Even though incapable designers may cause this risk due to impractical designs and lack of involvement throughout the project's life (Luu et al., 2009), contractors and subcontractors, especially, also share responsibilities ('poor subcontractor performance', Table 10, Factor loading value 0.578). Recently, the amount of subcontracting has increased through the use of specialist works and off-site production (Long et al., 2004). Vietnam has the advantage of a large population base that continuously supplies laborers at low cost. However, this advantage comes with low degree of mechanization, obsolete technology, and heavy reliance on unskilled workers observed in many subcontractors that ultimately cause defects and reworks (Yean et al., 2009). Defective works and reworks may cause of shortages of materials (Table 10, Factor loading value 0.564). Other causes of shortages of materials include high demand of fast development, price fluctuation, requirement of special materials (Le-Hoai et al., 2008, Ling & Bui, 2010). Consultants are recommended to conduct detailed market research on availability of materials, standard of quality, and suitable suppliers (Ling & Bui, 2010). Additional lead time should be built in the master program for imported materials, and suppliers should be evaluated on ability to deliver based on a specified time frame (Ling & Bui, 2010). Other measures to deal with materials price fluctuation have also been suggested in the 'interest and inflation rates' discussion in Component 1. As deliverables are not up to quality, contractors may encounter financial challenges ('financial difficulties of contractors', Table 10, Factor loading value 0.518) for having to pay for defects and reworks, extra materials, and time of subcontractors. Hence, financial capability of contractors should become one of the selection criteria during procurement phase.

Component 4: Owner's Financial Incapability

Component 4 consists of 'financial difficulties of owner' (Table 10, Factor loading value 0.764), and 'slow payment of completed works' (Table 10, Factor loading value 0.724). This component highlights financial incapability from owners. Money and resources ensure construction projects run smoothly and are obvious imperatives to carry out projects (Long et al., 2004). Since the majority of owners in Vietnam are medium-sized developers, they tend to have financial difficulties originating from land use compensation and monthly payments to contractors (Luu et al., 2009). Public owners on large projects suffer from bureaucracy in approving completed works and make late payments (Yean et al., 2009). Management of financial issues require efforts from both owner and contractor: owner should prepare an available fund for project and build financial plan to pay contractor as in contract agreement, contractor must prepare a detailed, feasible financial plan for project and it should be submitted and approved by owner before contract award (Le-Hoai et al., 2008; Kashiwagi, 2018).

Conclusions & Recommendations

Construction is a crucial industry for nearly every country. Despite being one of the oldest industries in human history, construction projects worldwide are still suffering from poor performance such as delays, cost overrun, and low satisfaction. It is crucial to identify new methodologies to improve construction performance because it highly impacts project participants, the community, and national development. Developing countries face different and unique challenges that developed countries do not.

This paper identifies the future research into managing construction project risks in the developing countries by identifying the relationships and correlations between and among the twenty-three (23) risk factors. A questionnaire survey was developed, administered, and analyzed to assess current dominant risks with participants from the Vietnam Construction Industry. These risks were then ranked from the perspectives of three main project participating groups (owners, contractors, and consultants). ‘Bureaucratic administrative system’, ‘financial difficulties of owner’, ‘slow payment of completed works’, ‘poor contractor performance’, ‘financial difficulties of contractor’ were found to be the most dominant risks. There were no significant disagreements between each party in ranking these risks. Further analysis examines interrelationships among these risk factors and grouped them into four main components: ‘Lack of Site and Legal Information’, ‘Lack of Capable Managers’, ‘Poor Deliverables Quality’, and ‘Owner’s Financial Incapability’. Noticeable observations include:

- Vietnam, and possibly other developing countries, suffer from a continuously changing, inconsistent on different levels, and inefficient legal system governing construction projects, so construction participants should be aware of current processes to smoothly obtain approvals;
- Domestic designers have been criticized for design issues and changes, though the fact the foreign and experienced designers also encounter similar problems emphasize that it is probably the owner’s lack of experience and uncertainty in what they want are the main causes of design issues;
- Vietnam is not lacking capable contractors; however, the right contractors still need to be identified and utilized for the right projects. Current procurement and project delivery system have not been effective. Innovative ideas to improve the supply chain face challenges of implementation in the industry without any prior knowledge;
- Site handover risks should be seriously considered and studied to avoid slow site handover and interruptions during construction phase;
- Financial issues and slow payments are common and should be cooperatively planned for by both owner and contractor even before the contract is awarded.

The findings could help construction practitioners in developing countries improve their understanding of the root causes of poor performance. Project managers could make better plans accordingly in their current and future projects if they could understand how to manage these risk factors. In the long run, it is important to improve the capability of managers, and engineers working in developing countries. The current education of focusing on technical skills while leaving a gap in planning, managing, and forecasting knowledge needs to change. This study includes the views of both inexperienced and veteran construction participants which may not fully reflect the reality in the industry. The authors recommend an analysis to determine the difference in perspectives between those two parties. The authors also recommend the verification the findings in this study, development of management strategies for common risks, and feasibility of employing innovative ideas from developed countries that could help leveraging construction education and trainings in developing countries.

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Tables

Table 4: Frequency Index and Rankings.

Risk Factors	Overall		Owner		Contractor		Consultant	
	FI	Rank	FI	Rank	FI	Rank	FI	Rank
Bureaucratic administrative system	0.711	1	0.711	1	0.722	1	0.693	1
Slow payment of completed works	0.617	2	0.572	3	0.674	3	0.614	2
Ineffective designs and frequent design changes	0.609	3	0.580	2	0.681	2	0.548	7
Corruption/Collusion	0.569	4	0.545	6	0.639	5	0.500	13
Lack of experience in complex projects	0.568	5	0.556	5	0.611	8	0.523	12
Lack of accurate historical information	0.561	6	0.563	4	0.639	6	0.432	19
Financial difficulties of owner	0.559	7	0.506	14	0.646	4	0.523	11
Financial difficulties of contractor	0.558	8	0.528	9	0.604	10	0.545	9
Improper planning and scheduling	0.554	9	0.534	8	0.576	15	0.557	6
Poor contractor performance	0.551	10	0.517	12	0.569	16	0.591	3
Poor subcontractor performance	0.546	11	0.472	19	0.625	7	0.568	4
Slow site handover	0.544	12	0.506	16	0.586	13	0.557	5
Inaccurate estimates	0.541	13	0.522	10	0.596	12	0.545	10
Interest and inflation rates	0.540	14	0.534	7	0.611	9	0.409	22
Ineffective project management	0.527	15	0.472	18	0.583	14	0.545	8
Poor site management and supervision	0.527	16	0.517	13	0.604	11	0.420	20
Inadequate legal framework	0.527	17	0.522	11	0.569	17	0.466	17
Poor tendering practices [Low bid practice]	0.525	18	0.506	15	0.563	19	0.500	14
Unpredictable government policies and priorities	0.493	19	0.483	17	0.549	20	0.420	21
Lack of capable owners	0.483	20	0.422	22	0.563	18	0.477	15
Owners' site clearance difficulties	0.473	21	0.433	21	0.521	21	0.477	16
Defective works and reworks	0.465	22	0.455	20	0.486	22	0.455	18
Shortages of materials	0.392	23	0.372	23	0.429	23	0.375	23

Table 5: Severity Index and Rankings.

Risk Factors	Overall		Owner		Contractor		Consultant	
	SI	Rank	SI	Rank	SI	Rank	SI	Rank
Financial difficulties of owner	0.740	1	0.611	12	0.854	1	0.670	2
Poor contractor performance	0.694	2	0.661	2	0.757	2	0.655	4
Financial difficulties of contractor	0.680	3	0.656	3	0.701	5	0.693	1
Corruption/Collusion	0.659	4	0.683	1	0.694	7	0.352	23
Lack of experience in complex projects	0.658	5	0.656	4	0.736	3	0.580	9
Ineffective project management	0.657	6	0.633	7	0.722	4	0.523	17
Slow payment of completed works	0.636	7	0.648	5	0.674	11	0.670	3
Lack of capable owners	0.633	8	0.633	8	0.681	10	0.591	7
Bureaucratic administrative system	0.631	9	0.589	13	0.660	12	0.568	12
Poor site management and supervision	0.624	10	0.639	6	0.653	13	0.557	14
Poor subcontractor performance	0.621	11	0.533	22	0.688	9	0.591	6
Defective works and reworks	0.621	12	0.561	18	0.653	14	0.568	13
Improper planning and scheduling	0.621	13	0.544	21	0.653	15	0.580	10

Ineffective designs and frequent design changes	0.612	14	0.583	15	0.694	6	0.477	19
Shortages of materials	0.609	15	0.550	20	0.694	8	0.477	21
Poor tendering practices [Low bid practice]	0.604	16	0.622	10	0.639	16	0.591	8
Slow site handover	0.595	17	0.617	11	0.632	17	0.625	5
Inaccurate estimates	0.587	18	0.631	9	0.590	19	0.580	11
Inadequate legal framework	0.578	19	0.589	14	0.611	18	0.466	22
Unpredictable government policies and priorities	0.568	20	0.583	16	0.403	23	0.523	18
Interest and inflation rates	0.566	21	0.583	17	0.507	22	0.536	16
Lack of accurate historical information	0.527	22	0.489	23	0.549	21	0.477	20
Owners' site clearance difficulties	0.525	23	0.561	19	0.563	20	0.538	15

Table 6: Risk Importance Index and Rankings.

Risk Factors	Overall		Owner		Contractor		Consultant	
	RII	Rank	RII	Rank	RII	Rank	RII	Rank
Bureaucratic administrative system	0.449	1	0.419	1	0.476	2	0.394	2
Financial difficulties of owner	0.414	2	0.309	13	0.552	1	0.350	5
Slow payment of completed works	0.392	3	0.371	3	0.454	4	0.411	1
Poor contractor performance	0.382	4	0.342	6	0.431	7	0.387	3
Financial difficulties of contractor	0.379	5	0.346	5	0.424	9	0.378	4
Corruption/Collusion	0.375	6	0.373	2	0.444	6	0.176	23
Lack of experience in complex projects	0.374	7	0.364	4	0.450	5	0.303	10
Ineffective designs and frequent design changes	0.372	8	0.338	7	0.473	3	0.261	14
Ineffective project management	0.346	9	0.299	15	0.421	10	0.285	12
Improper planning and scheduling	0.344	10	0.291	16	0.376	13	0.323	8
Poor subcontractor performance	0.339	11	0.252	21	0.430	8	0.336	7
Poor site management and supervision	0.329	12	0.330	8	0.394	11	0.234	17
Slow site handover	0.324	13	0.312	11	0.370	14	0.348	6
Inaccurate estimates	0.318	14	0.329	9	0.352	16	0.316	9
Poor tendering practices [Low bid practice]	0.317	15	0.315	10	0.359	15	0.295	11
Lack of capable owners	0.306	16	0.267	19	0.383	12	0.282	13
Interest and inflation rates	0.306	17	0.312	12	0.310	20	0.219	19
Inadequate legal framework	0.304	18	0.308	14	0.348	18	0.217	20
Lack of accurate historical information	0.296	19	0.275	18	0.351	17	0.206	21
Defective works and reworks	0.289	20	0.255	20	0.317	19	0.258	15
Unpredictable government policies and priorities	0.280	21	0.282	17	0.221	23	0.220	18
Owners' site clearance difficulties	0.248	22	0.243	22	0.293	22	0.257	16
Shortages of materials	0.239	23	0.205	23	0.298	21	0.179	22

Table 7: Spearman's Rank-Order Correlation Among Parties – Differences between Groups.

	Frequency Index		Severity Index		Importance Index	
Groups	SRC	Sig. level	SRC	Sig. level	SRC	Sig. level
Owners - Contractors	0.782	0.001	0.519	0.011	0.673	0.001
Contractors - Consultants	0.499	0.015	0.356	0.096	0.607	0.002
Owners - Consultants	0.361	0.001	0.336	0.117	0.42	0.046

Table 8: Spearman's Rank-Order Correlation Between Each Party and Overall Rankings – Differences within Group.

	Frequency Index		Severity Index		Importance Index	
Groups	SRC	Sig. level	SRC	Sig. level	SRC	Sig. level
Overall - Owners	0.863	0.001	0.683	0.001	0.773	0.001
Overall - Contractors	0.915	0.001	0.898	0.001	0.941	0.001
Overall - Consultants	0.648	0.001	0.502	0.015	0.71	0.001

Table 9: Total Variance Explained.

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	10.569	45.952	45.952	10.569	45.952	45.952	7.251
2	1.670	7.260	53.212	1.670	7.260	53.212	6.097
3	1.472	6.400	59.611	1.472	6.400	59.611	6.203
4	1.115	4.848	64.459	1.115	4.848	64.459	5.234

Facility Managers Can Impact the Procurement Landscape by Modifying the Technical Requirements

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A major problem for Facility Managers (FMs) is to get the procurement department to procure expert vendors. Hiring an expert is often neglected by a low-bidding vendor who seems to meet the organizations' minimal technical requirements. A new approach has been developed and tested which changes the procurement landscape and ensures that the FM gets an expert vendor who pre-plans, identifies what they will deliver ahead of time in a simplistic fashion, and continually measures deviations as they perform their service. The new approach will automatically filter proposals that are not doable or deliverable and minimize risks that are caused by non-expert stakeholders' decision making. Recent testing of this approach for a large bureaucratic organization led to 15% savings in cost, 50% savings in procurement time and elimination of extenuating and complex issues caused by stakeholders in a bureaucratic organization. This new approach is controlled by the FM professional. The approach eliminates major problems that procurement causes. The paper will review the case study and the method of application of this new approach.

Keywords: Best Value Approach, Facility Manager, Procurement, Risk Management, Project Management, Performance Metrics, Information Worker.

Introduction

A major issue for Facility Managers (FMs) is that the procurement department of organizations does not allow professional FMs to identify, select and utilize expert vendors (Rivera & Kashiwagi, 2016a, 2016b; Le, 2017). Traditional procurement processes often force the FM to accept the low-price vendor (D. Kashiwagi, J. Kashiwagi, Child, & Sullivan, 2014; Kashiwagi, 2015a). This practice encourages vendors to concentrate on getting work instead of maintaining a high level of performance. Vendors may be technically qualified based on the minimum requirements of the specifications, but do not have high performance or expertise that acts in the best interest of the professional FM.

A source of the problem is the requirement of the FM to create a technical specification that procurement uses to identify the low-priced bidder. Whenever a technical specification is utilized by procurement, it is assumed that all the participating vendors are of equal value, and therefore the lowest price is the best value. It is common knowledge that skilled craftspeople in the trades and construction are becoming a scarce commodity (AGC, 2015). Low price procurement awards lower the quality of service to the professional FM.

This concept is not new but has been an ongoing issue for over 30 years (Egan, 1998; Latham, 1994). Past research conducted in the construction industry has identified that performance has been low in terms being on time, on budget, and with high customer satisfaction (CII, 2015; Egbu, 2008; HIS Markit, 2013; Horman, M. & Kenley, R. 2005; Lee, et al., 1999; PBSRG, 2017; Rivera, 2014). This is experienced by organizations throughout the world (PBSRG, 2017). This issue is also seen outside of the construction industry (Bo-Jie, et al., 2010; Buntaine, et al., 2013; Cervone, 2011; Deming, 1982; D. Kashiwagi & I. Kashiwagi, 2014; Miller, et al., 2013; PBSRG, 2017).

The requirement for the professional FM to be the technical expert in delivering all FM services in an increasingly complicated environment places an unrealistic expectation on professional FMs (Kashiwagi, 2018). The professional FM must identify the technical scope of the required service and must manage, direct and control (MDC) the project. As the requirements of facilities evolve and multiply due to green buildings, environmental issues and new systems, the approach that the professional FM continues to be the technical expert in the entire breadth of facility requirements is overburdening and increases the technical and legal risk of the professional FMs (Kashiwagi et al., 2015a; Rivera, Le, J. Kashiwagi, & D. Kashiwagi, 2016).

As the aging FMs retire, the young FMs do not have the experience to replace the outgoing professional FMs. The requirement for new professional FMs cannot be to replace the aging professional FM's experience and knowledge (Gunnoe et al., 2018; Hightower & Highsmith, 2013; Sullivan et al., 2010). They do not have the opportunity nor the time to equal the retiring FM. The International Facility Management Association (IFMA) has proposed technical certifications for the professional FM. This is a knowledge transfer concept. This approach cannot continue to be successful. A problem with changing the approach for the future professional FMs is that the current "knowledge based" professional FMs are limited to encouraging the future professional FMs to be technically based (https://foundation.ifma.org/).

Another challenge to professional FMs is the diminishing access to the executive-level managers within a company (C-Suite). The C-Suite is interested in increasing the quality and controlling the costs of facilities. They are not technically oriented. The perception of increased cost and risk of the organization's facility, results in the C-Suite perceiving the professional FM as a potentially "toxic" player in reducing cost and consequently is a candidate for outsourcing. There is a definite difference between the level of professionalism of an FM who is in the C-Suite, internal to the organization, and an outsourced service to the organization. Observation identifies that the farther away the FM is from the organization's C-Suite, the lower the level of the FM's professional value. This increases the need for the procurement's function to low bid the FM services.

Research Objectives and Methodology

Organizations' traditional procurement structures and processes are decreasing the value of the professional FM. The procurement structure becomes an obstacle to the development of FM value and professionalism. The FM professional needs a way to bypass the traditional procurement structure to optimize their value and performance. The research objectives of this paper are to explore, identify, and validate these FM issues and an FM solution.

In order to meet the research objectives, the researcher proposes the following methodology:

- Propose a FM solution.
- Outline a theoretical framework for the solution.
- Design the FM transformation.
- Conduct a case study to validate the solution.
- Make conclusions and recommendations.

Proposal

The researcher proposes to do the following:

1. Create a proactive FM approach that allows the FM to control and override the traditional purchasing structure.
2. Create a new professional FM approach that simplifies the complexity of the professional FM.
3. Minimize the need for information transfer, experience, and management, direction, and control (MDC) that comes with being the traditional professional FM technical expert.
4. Simplify communications using the language of metrics [cost, customer satisfaction, operational capability] that the C-Suite can understand (Verway, I. Kashiwagi, Vries, & D. Kashiwagi, 2015).
5. Improve the value and worth of the professional FM to the C-Suite by increasing the value and decreasing the cost of facilities.
6. Allow the associate FMs to become the expert in delivering the FM services. Have them communicate their value through the use of metrics. This includes time, quality, and the tracking of time and cost deviations (Gajjar, Kashiwagi, Hurtado, & Sullivan, 2014).
7. Create flexibility within the delivery of FM services that can overcome perceived organizational procurement and legal requirements.

Theoretical Solution

Research and observation of the FM industry shows that traditional professional FMs have unknowingly put themselves in a box (Gastelum, 2017). It perhaps has been a critical mistake in differentiating themselves by using technical knowledge as the basis of their professionalism. They then used technical certification to differentiate the level of professionalism of FMs. However, as organizations attempt to become more competitive in the worldwide global economy, organizations have outsourced services that are not their core technical expertise [FM] (Kashiwagi et al., 2015b). By the movement to outsource the professional FM, the C-Suite view the professional FM as a cost. Outsourcing the professional FMs function, minimizes the value and contribution of the professional FM [reduced benefits, increased workload, and ever-increasing need for certification and education].

The theoretical solution proposed utilizes the following paradigm shifts:

1. Change the professional FM from a technical expert to non-technical Information Worker (IW) position (Gunnoe & Krassa, 2019; Rivera, D. Kashiwagi, J. Kashiwagi, & Doyle, 2016).
2. The information based professional FM (information worker) will be a leader and not simply a manager of FM technical services.
3. The associate FM will simplify their approach by utilizing metrics that are observable and countable to show their expertise and value to the C-Suite.
4. The professional FM will be an Information Worker (IW). They will become a part of the C-Suite.
5. The expert associate FM will be the technical expert and will use information that creates transparency that results in cost reduction and an increase in value, thus becoming more important to the C-Suite.
6. The new professional FM will utilize expert associate FMs to create a transparent environment which minimizes cost by 20% [lower cost, fewer stakeholders involved in the delivery of the FM services].
7. FM's transparent environment will minimize C-Suite and stakeholder decision making and increase the breadth of the professional FM's role.
8. The new professional FM role will require the understanding of dominant information [observable and countable that minimizes the need to make decisions].
9. The organization's procurement will no longer use traditional technical specifications to procure. They will identify the requirement in terms of observable and countable metrics and cost. The contract will then be awarded to the vendor who delivers the highest value for the least risk and cost (D. Kashiwagi, J. Kashiwagi, A. Kashiwagi, & Sullivan, 2012).
10. The procurement approach will be a non-technical competition based on performance metrics and cost to meet a non-technical requirement. The selected vendor will identify their value using performance metrics and how they will deliver their service based on technical requirements.

Simply put, the following paradigm shifts will be made:

1. The professional FM will become an information worker (IW) who delivers high performance for a much lowest cost. An IW is a professional that uses simplicity, data, and information to make his decisions instead of his own or other peoples' bias, opinion, and judgement.
2. The associate FM will become the technical expert and will create transparency by monitoring and reporting their performance with observable and countable metrics that show value and lower cost.
3. The professional FM will be certified in being an IW.
4. The associate FM will become the technical expert and require the technical certifications.

This new approach has been tested over 25 years with stunning results of high performance and low costs. In research tests, the IW professional can accomplish ten times the number of projects, minimize cost by 5 to 30%, and communicate the results in a very simple manner (Duren &

Dorée; 2008; Kashiwagi, 2013; Krouwel, 2018; Natasja & Kashiwagi, 2017; State of Hawaii PIPS Advisory Committee, 2002; Sullivan et al., 2010).

Design of FM Transformation to Take Control of Procurement

The FM Requirement

The FM will change their specifications from technical to include non-technical requirements. The FM will identify their requirements in the most simplistic terms. Requirements will be in terms of observable and countable metrics. Vendors will show their performance by showing their capability to provide services matching the requirements as close as possible with their capability shown by past performance (I. Kashiwagi, D. Kashiwagi, & Gambla, 2018).
Table 1 is an example of what an FM used for his requirement for providing photovoltaic panels. Column one is the client/facility requirements. Column two is a vendor's proposal based on their capability [past performance]. If the difference between the two columns is minimized, the vendor is an expert vendor. The vendors will compete based on their ability to show their level of expertise, capability and their lower cost.

Table 1: Solar Panel Requirement/Vendor Capability

Requirement	Client Requirement	Vendor's Past Project Performance
# of PV installations	2	55
Schedule	2 months	1.5 months
Average budget	$ 45K	$20K
# of people using the building	600	800
Existing KW/hr. charge	$0.40	$0.35
Reduction in KW/hr. charge	50%	25%
Return on Investment (ROI)	15 years	30 years
Time Deviation	0%	0.5%
Cost Deviation	0%	0%
Customer Satisfaction	9.5/10.0	9.5 / 10

Selecting Vendors

The selection of the vendor will be based on the highest performance [performance metrics] and lowest cost that matches the requirement as proposed by the client (Smithwick, Schultz, Sullivan, & Kashiwagi, 2013). The FM will use the following as contractor performance criteria of the requirement:

1. Expertise in doing projects that are very similar to the requirement [Level of Expertise].
2. Identification of risk and how the risk will be mitigated [Risk Assessment].
3. Value added proposals on how to make the service or project better [Value Added].
4. Cost breakout of their price for the project. The client is looking for the lowest cost [Price].
5. An interview of the vendor's expert who is delivering the project/service [Interview].

All vendor communications in the selection approach must utilize observable metrics identifying the level of experience and performance that supports a performance claim. This includes risk mitigation and value added. The submittal must include with the risk mitigation and the value added, how many times [the number of times that the vendor was successful in applying the risk mitigation or value added on similar projects].

The FM will identify the importance of their five selection criteria by using a weighting system that represents identifying and utilizing expertise for the lowest cost (Claaasen, Roodhorst, & Taba, 2019; D. Kashiwagi, J. Kashiwagi, Sullivan, & I. Kashiwagi, 2015; Kashiwagi, Rivera, & Taba, 2019;). A selection committee will then rate the vendor's proposals. The ratings of all the selection committee will be averaged for each vendor proposal to come to an average score for each criterion [an example is shown in Table 2]. Price is the only criteria that is not rated.

The ratings will then be normalized with the pricing as shown in Tables 2. The normalized score is then multiplied by the weight [assigned by the FM] to assign points to each vendor.

Table 2: Assignment of Points Based on Ratings and Weights

No	Criteria (Raw Scores)	Unit	Vendor A	Vendor B	Vendor C
1	Level of Expertise [LE]	(1-10)	5.00	10.00	10.00
2	Risk Assessment [RA]	(1-10)	5.00	5.00	5.00
3	Value Added Plan [VA]	(1-10)	10.00	10.00	5.00
4	Interview	(1-10)	1.00	5.00	10.00
5	Total Cost	$	50,000.00	80,000.00	82,000.00
No	**Criteria (Normalized Scores)**	**Best Score**	**Vendor A**	**Vendor B**	**Vendor C**
1	Level of Expertise [LE]	10	0.50	1.00	1.00
2	Risk Assessment [RA]	5	1.00	1.00	1.00
3	Value Added Plan [VA]	10	1.00	1.00	0.50
4	Interview	10	0.10	0.50	1.00
5	Total Cost	50,000.00	1.00	0.63	0.61
No	**Criteria (Assigned Points)**	**Weight**	**Vendor A**	**Vendor B**	**Vendor C**
1	Level of Expertise [LE]	35	17.50	35.00	35.00
2	Risk Assessment [RA]	5	5.00	5.00	5.00
3	Value Added Plan [VA]	5	5.00	5.00	2.50
4	Interview	20	2.00	10.00	20.00
5	Total Cost	35	35.00	21.90	21.30

The best performing vendor will then be requested to provide the technical specifications that they will be using to deliver the service. They will be asked to identify their performance and monitor deviations to their proposed performance.

Case Study: Facility Supplies Project

Client Requirement

A large organization required a vendor to provide janitorial supplies for use by in-house janitorial workers. The organization's requirement was identified by the following client conditions:

- 7,000 facilities in the USA and Canada [621].
- List of products.
- List of janitorial services activities.
- On-site janitorial services clean facilities 1-2 times per week.
- Deep cleaning of each facility is done 1-4 times per year by outsourced suppliers. The outsource supplier uses their own products.
- The service is a 10-year contract broken out by year.

Selecting the Vendor

Three vendors met the requirements and submitted proposals. The selection committee rated the vendor proposals and the information was put in the selection matrix [see Table 3] After analyzing the submittals, Vendor B provided a cost that was ~25% below the cost of the other vendors. Vendor B identified their value by utilizing information.

Table 3: Assignment of Points for Facility Supplies Project

No	**Criteria (Raw Scores)**	**Distance**	**Vendor B**	**Vendor G**	**Vendor I**
1	Level of Expertise [LE]	(1-10)	5.0	7.0	7.0
2	Risk Assessment [RA]	(1-10)	7.0	8.0	6.0
3	Value Added Plan [VA]	(1-10)	7.0	8.0	5.0
4	Interview	(1-10)	5.0	10.0	10.0
5	Total Cost (Millions)	$	9.4	7.5	10.6
No	**Criteria (Normalized Scores)**	**Best Score**	**Vendor A**	**Vendor B**	**Vendor C**
1	Level of Expertise [LE]	7.0	0.7	1.0	1.0
2	Risk Assessment [RA]	8.0	0.9	1.0	0.8
3	Value Added Plan [VA]	8.0	0.9	1.0	0.6
4	Interview	10.0	0.5	1.0	1.0
5	Total Cost (Millions)	7.5	0.8	1.0	0.7
No	**Criteria (Assigned Points)**	**Weight**	**Vendor A**	**Vendor B**	**Vendor C**
1	Level of Expertise [LE]	35	25.0	35.0	35.0
2	Risk Assessment [RA]	10	8.8	10.0	7.5
3	Value Added Plan [VA]	15	13.1	15.0	9.4
4	Interview	30	15.0	30.0	30.0
5	Total Cost (Millions)	10	8.0	10.0	7.1
-	**Total Points**	**100**	**69.9**	**100.0**	**88.9**
Prioritization			**3**	**1**	**2**

When Vendor B was asked how they determined that they could reduce the client's spend rate by 25%, they provided the following information:

1. Using history for the quantity of items being ordered.
2. Identifying that 80% of spend was based on paper products and cleaners.
3. Differentiating between types of buildings and identifying algorithms to represent the different types of buildings.
4. Used 30 facilities to compare spend rates which they used a year spend of previous suppliers with a year's spend based on their deliveries.
5. Used another sample of 100 facilities where they used nine months spend of a previous supplier compared with a year's spend of their services.
6. Determined by their information models representing different types of facilities that they could reduce the spend rate of facilities by 25% by delivering the right amounts of janitorial supplies.

The client organization took the information from the selection competition and added another requirement. They also required the vendor to deliver the janitorial supplies into their facility janitorial closets. The client also wanted the vendor to use their information modeling to automate the ordering of 80% of the janitorial supplies. The successful vendor increased their cost by 19% and took the responsibility of delivering the supplies into the janitorial closet. The client perceived that they had reduced their spend rate by 6%, received automated ordering and had the supplies delivered into the janitorial closets [increased value].

The information-based vendor automated the ordering of 80% of the janitorial supplies using the different information models for the different types of buildings and began building models for the 18% of the other janitorial items and delivered the supplies into the janitorial closets instead of delivering it to the client's facility managers [who then stocked their own closets]. The information-based vendor then tracked the spend rates every week. The results were staggering. By automating and charging 19% more for delivering into the closet, the client's spend rate has dropped by 31%. The FM now has less responsibility and has become more important to the organization's C-Suite.

Conclusion

The professional FM can change the procurement landscape to providing value, rather than low cost, by changing their own paradigm. Instead of being the technical expert, the professional FM can be an information worker (IW) who uses information to define their requirement and select the best value vendor. By changing into an information worker, the professional FM can identify and utilize expert FM associates to increase the value of FM services while minimizing the cost. By using performance information [non-technical metrics that are observable and countable] the professional FM can utilize the expertise of FM associates. The new model increases the capability of the professional FM [increases the capability to do ten times the projects] and increase the ability to communicate with the C-Suite. The professional FM of the future also requires the FM associates to become the technical experts of FM services. This aligns the technical experts who do the work to be the experts. The minimization of the FM professional attempting to manage, direct and control the expert FM associates has led to a more efficient and effective supply chain that improves performance and reduces cost. The new approach allows the professional FM to increase their professionalism and value. The new model is a leadership model that aligns expertise. This model has been tested over 25 years and has led to a reduction of 5 - 30% of the cost of FM services.

Recommendations

The authors recommend that the International Facility Management Association (IFMA), or other professional certification groups, create a professional FM Information Worker (IW) course that teaches how to develop appropriate performance and cost metrics that will add value to the C-Suite and have the associate FMs increase their technical experts by technical certifications.

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