



RISK ANALYSIS FOR INTERIOR DESIGN AND CONSTRUCTION PROJECT IN SURABAYA

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ABSTRACTS

Interior design has been a growing industry and has been known widely in the society. In Surabaya, the rapid development of real estate business has brought up the development pace of interior design industry. In line with its development, the competitors in interior industry are emerging. Project management, specifically risk management, is crucial for this company to manage the projects. New Dizzi Interior also suffers from delays in their projects, cost overrun, and quality deterioration, which most likely resulted from the lack of risk calculation and management. This study is conducted by case study using residential projects, office projects and commercial projects as sample. This research identified risks through preliminary surveys, literature review and focus group discussion to determine the variables used in the study. Main survey is conducted on those variables, in order to determine the probability of the risk occurrence and the extent of damage caused by the risk event. Responses against risk events are analyzed in order to reduce the probability and damage of the event. This study identified 68 variables relevant for residential projects, 50 variables are low level risk and 18 variables are medium level risks. For office projects, 72 variables were identified its relevancy, 23 variables are medium risk levels and 49 variables are low level risks. Whereas for commercial projects, 72 variables were identified its relevancy, 30 variables are medium level and 43 variables are low level risk.

Keywords: *risk analysis, risk ranking, interior design, interior construction*

INTRODUCTION

Interior space is very closely related with people. More than 90% from people's live were spent in interior space (Piotrowski, 2014). Interior design is multifaced proffession using creativity dan technique solution applicated to a structure for generate a interior environment. In East Java, especially Surabaya, interior design industry development is growing up through the year (Solecha, 2014). This development is proportional to property growth in Surabaya.

Interior design is divided to 7 categories: codes, communication, design, furnishings, fixtures and equipment, human needs, interior building construction, and professional practice (Guerin, et.al., 2010). Complexities make interior projects have risks to be considered. Risk mangement process is systematic and proactive approach to control the project, by knowing or decreasing from events that are not sure or not known in advance (Mulcahy, 2010). Risk analysis takes role in design industry (Markeset & Kumar, 2001). Ruan & Qin (2011) used risk management in design process. Some researches such as, Project Risk Management in Hong Kong (Shen, 1977), Understanding the Key Risks in Construction Projects in China (Wang, et.al., 2007), and Assesment of Risks in High Rise



Building Construction in Jakarta (Santoso, et.al., 2003), are using risk management for construction project as research object. Theoretical review of previous researches from Santoso, et.al. (2003), Shen (1997) and Zhi (1995) deliver some variables that used for Focus Group Discussion to see the relevancy with the research object.

In this paper, design and construction interior projects in New Dizzi Interior were chosen for the research object. New Dizzi Interior as a player in this industry have to survive with other players and new entrants in this industry. Risk analysis with PMI method was chosen to know priority risks for each project categories (residential, office, and commercial).

METHODOLOGY

Risk Identification

Risk identification process is performed in two steps. The first step is preliminary survey. Risk variables were collected from research Assesment of Risks in High Rise Building Construction in Jakarta (Santoso, et.al.,2003), Risk Management for Overseas Construction Project (Zhi, 1995) and Project Risk Management in Hong Kong (Shen, 1997). They are used for preliminary survey to see the relevance of these variables against residential projects, office projects and commercial projects that have been undertaken by New Dizzi Interior in 2011 to 2015. Respondents for preliminary survey are top level managements in New Dizzi Interior who has more than 7 years working experience in this company

Step two, after get the results of the preliminary survey, focus group discussions (FGD) was conducted, which is useful to review variables that have been obtained from preliminary survey regarding compliance to the conditions of existing projects. Focus Group Discussion is a discussion conducted in a systematic and focused on a specific issue or problem (Irwanto, 2006).

The results of the preliminary survey shows 64 variables relevant risk for residential projects and 68 relevant risks variables for office and commercial projects. Differences between risk variables for residential project with office projects and commercial projects are variables: access to location (R351), work accidents (R401), employment protection (R402), and retention costs (R702). FGD added variable in subcategories Technicians and Workers of variable commitment implementation schedule and a quality inspection on all three categories of the project. Variable results of FGD will be used for the variables in the main survey.

Risk Scoring

Data for risk assessment is drawn from major survey. Respondents of main survey are sample of personnels who have experiences in directly handling the project. The assesment that is given by respondents is then calculated its average. Risk assessment methods are applied by multiplying the value of the variable risk event probability and impact value when the event occurs (Mulcahy, 2010).

$$\text{Risk Score} = P (\text{probability}) \times I (\text{impact}) \quad (1)$$

Value of probability is determined by using likert scale (1-5) through FGD as presented in Table 1. Value of impact is determined by using likert scale (1-5) through FGD as presented in Table 2.



Table 1. Probability Criteria

| Value | Criteria | Schema |
|-------|----------------------------|---|
| 1 | Rarely Occuring | Risks occur with the percentage <20% |
| 2 | Small Possibility Occuring | Risks occur with a percentage of 20% -40% |
| 3 | Quite Possible to Occur | Risks occur with a percentage of 40% -60% |
| 4 | Very Possible to Occur | Risks occur with the percentage of 60% -80% |
| 5 | Almost Certainly Occuring | Risks occur with the percentage of > 80% |

Table 2. Impact Criteria

| Value | Criteria | Schema |
|-------|---------------|--|
| 1 | Not Important | - Losses cost of less than 0.5% of RAP - The results of the work accepted by the owner - The time delay has no effect on the job |
| 2 | Minor | - Losses cost of less than 0.5% -2% of RAP - The results of the work accepted by the owner - The timing of increases of 5% |
| 3 | Moderate | - Losses cost of less than 2% -10% of RAP - The work was rejected by the owners - The timing of increases of 5% -10% |
| 4 | Major | - Losses costs less than 10% -20% of RAP - The work was rejected by the owners - The timing of the increases of 10% -20% |
| 5 | Fatal | - Losses cost > 20% of RAP - Results of the work ditlak by owners - The timing of the increases 20% |

Table 3. Risk Scoring For Residential Projects

| VARIABLE | CODE | INDICATOR | P | I | R=(P X I) |
|------------------------------|------|-------------------------------------|---|---|-------------|
| 1. Physical risks | R103 | Flood | 2 | 3 | 6 |
| | R104 | Pests | 2 | 3 | 6 |
| Average Risk Level | | | | | 6.00 |
| 2. Personal Risks | | | | | |
| 2.1. Technicians and Workers | R211 | Availability of reliable workforce | 2 | 2 | 4 |
| | R212 | Labor productivity | 3 | 2 | 6 |
| | R213 | Ability to understand images | 1 | 2 | 2 |
| | R214 | Work / manufacture result | 2 | 3 | 6 |
| | R215 | Presence | 1 | 2 | 2 |
| | R216 | Communication | 1 | 2 | 2 |
| | R217 | Commitment work schedule | 3 | 1 | 3 |
| | R218 | Quality inspection | 3 | 3 | 9 |
| 2.2. Subcontractor | R221 | Funds for work | 3 | 2 | 6 |
| | R222 | Technical capability | 2 | 3 | 6 |
| | R223 | Completion Time | 2 | 2 | 4 |
| | R224 | Work quality | 2 | 3 | 6 |
| | R225 | Productivity | 2 | 2 | 4 |
| | R226 | Coordination | 2 | 2 | 4 |
| | R227 | Provision of manpower | 2 | 2 | 4 |
| | R228 | Time management with other projects | 2 | 2 | 4 |
| 2.3. Staff | R231 | Competence | 1 | 2 | 2 |
| | R232 | Responsible | 1 | 2 | 2 |
| | R233 | Experience | 2 | 2 | 4 |
| | R234 | Presence | 1 | 2 | 2 |
| 2.4. Client | R241 | Interference | 3 | 3 | 9 |
| | R242 | Changes in demand | 3 | 3 | 9 |
| | R243 | Expectations on quality | 3 | 3 | 9 |
| Average Risk Level | | | | | 4.74 |
| 3. Technical Risk | | | | | |
| 3.1. Material | R311 | Material prices | 2 | 3 | 6 |
| | R312 | Material submitted | 2 | 2 | 4 |
| | R313 | Availability of material | 2 | 2 | 4 |
| | R314 | Quality materials | 2 | 2 | 4 |
| | R315 | Damage | 1 | 2 | 2 |
| 3.2. Equipment | R321 | Productivity and work efficiency | 2 | 2 | 4 |
| | R322 | Maintenance costs | 1 | 2 | 2 |



| VARIABLE | CODE | INDICATOR | P | I | R=(P X I) |
|----------------------------------|------|---------------------------------|---|---|-------------|
| 3.3. Technic | R323 | Damage | 2 | 2 | 4 |
| | R324 | Availability | 2 | 2 | 4 |
| | R331 | The new technique | 2 | 2 | 4 |
| | R332 | Achieving quality | 2 | 3 | 6 |
| 3.4. Construction Process | R341 | Construction plan | 2 | 2 | 4 |
| | R342 | Problem coordination | 2 | 2 | 4 |
| | R343 | Information from designers | 2 | 2 | 4 |
| | R344 | Locations | 2 | 2 | 4 |
| | R346 | Data on BOQ | 2 | 2 | 4 |
| 3.5. Construction Site | R352 | Working time | 2 | 2 | 4 |
| | R353 | Local Regulations | 1 | 2 | 2 |
| | R355 | Information site investigations | 2 | 2 | 4 |
| | R356 | Problem is not visible | 2 | 2 | 4 |
| Average Risk Level | | | | | 3.90 |
| 5. Design | R501 | The design specifications | 2 | 2 | 4 |
| | R502 | Shop drawing | 2 | 2 | 4 |
| | R503 | The scope of design | 2 | 2 | 4 |
| | R504 | Construction methods | 2 | 2 | 4 |
| | R505 | Material and equipment | 2 | 2 | 4 |
| | R506 | Detail pictures | 2 | 2 | 4 |
| | R507 | Change | 3 | 2 | 6 |
| Average Risk Level | | | | | 4.29 |
| 6. Political Risk and Regulation | R604 | Procedure permits and approvals | 1 | 2 | 2 |
| | R605 | Staff government corruption | 1 | 2 | 2 |
| Average Risk Level | | | | | 2.00 |
| 7. Financial Risk | R701 | Payment | 2 | 3 | 6 |
| | R703 | Additional cost variation | 3 | 2 | 6 |
| | R704 | Estimated costs | 2 | 3 | 6 |
| | R705 | Loss | 2 | 3 | 6 |
| | R707 | Labor costs | 2 | 2 | 4 |
| | R708 | Tax | 2 | 1 | 2 |
| | R709 | Cost of materials | 2 | 2 | 4 |
| Average Risk Level | | | | | 4.86 |
| 8. Contractual Risk | R801 | The provisions of the contract | 1 | 2 | 2 |
| | R802 | A clause contained | 1 | 1 | 1 |
| | R803 | Working conditions | 2 | 2 | 4 |
| Average Risk Level | | | | | 2.33 |
| 9. Environmental and Social | R901 | Pollution | 2 | 1 | 2 |
| | R902 | Cultural traditions | 1 | 1 | 1 |
| Average Risk Level | | | | | 1.50 |

From the results of risk assessments for residential projects, as presented in Table 3, it can be seen that the physical risk, financial risk and personal risk are the top three variable categories that probably impact on interior design and construction of residential projects.

Table 4. Risk Scoring For Office and Commercial Projects

| VARIABLE | CODE | INDICATOR | OFFICE PROJECT | | | COMMERCIAL PROJECT | | |
|------------------------------|------|-------------------------------------|----------------|---|-------------|--------------------|-------------|-----------|
| | | | P | I | R=(P X I) | P | I | R=(P X I) |
| 1. Physical risks | R103 | Flood | 1 | 3 | 3 | 1 | 3 | 3 |
| | R104 | Pests | 2 | 2 | 4 | 2 | 2 | 4 |
| Average Risk Level | | | | | 3.50 | | 3.50 | |
| 2. Personal Risks | | | | | | | | |
| 2.1. Technicians and Workers | R211 | Availability of reliable workforce | 2 | 2 | 4 | 2 | 2 | 4 |
| | R212 | Labor productivity | 2 | 3 | 6 | 2 | 2 | 6 |
| | R213 | Ability to understand images | 2 | 2 | 4 | 2 | 2 | 4 |
| | R214 | Work / manufacture result | 1 | 3 | 3 | 2 | 2 | 6 |
| | R215 | Presence | 2 | 2 | 4 | 2 | 2 | 4 |
| | R216 | Communication | 2 | 2 | 4 | 2 | 2 | 4 |
| | R217 | Commitment work schedule | 1 | 2 | 2 | 2 | 2 | 4 |
| | R218 | Quality inspection | 2 | 2 | 4 | 2 | 2 | 6 |
| 2.2. Subcontractor | R221 | Funds for work | 3 | 2 | 6 | 3 | 2 | 6 |
| | R222 | Technical capability | 2 | 3 | 6 | 2 | 3 | 6 |
| | R223 | Completion Time | 2 | 3 | 6 | 2 | 3 | 6 |
| | R224 | Work quality | 2 | 3 | 6 | 2 | 4 | 8 |
| | R225 | Productivity | 2 | 3 | 6 | 2 | 3 | 6 |
| | R226 | Coordination | 2 | 2 | 4 | 2 | 2 | 4 |
| | R227 | Provision of manpower | 2 | 2 | 4 | 2 | 2 | 4 |
| 2.3. Staff | R228 | Time management with other projects | 2 | 2 | 4 | 2 | 3 | 6 |
| | R231 | Competence | 2 | 2 | 4 | 2 | 2 | 4 |



| VARIABLE | CODE | INDICATOR | OFFICE PROJECT | | | COMMERCIAL PROJECT | | |
|----------------------------------|------|----------------------------------|----------------|---|-----------|--------------------|---|-----------|
| | | | P | I | R=(P X I) | P | I | R=(P X I) |
| 2.4. Client | R232 | Responsible | 1 | 2 | 2 | 2 | 2 | 4 |
| | R233 | Experience | 2 | 2 | 4 | 2 | 3 | 6 |
| | R234 | Presence | 2 | 2 | 4 | 2 | 2 | 4 |
| | R241 | Interference | 3 | 3 | 9 | 2 | 3 | 6 |
| | R242 | Changes in demand | 3 | 3 | 9 | 3 | 3 | 9 |
| | R243 | Expectations on quality | 2 | 3 | 6 | 2 | 2 | 4 |
| Average Risk Level | | | 4.83 | | | 5.26 | | |
| 3. Technical Risk | | | | | | | | |
| 3.1. Material | R311 | Material prices | 2 | 3 | 6 | 2 | 3 | 6 |
| | R312 | Material submitted | 2 | 2 | 4 | 2 | 2 | 4 |
| 3.1. Material | R313 | Availability of material | 2 | 2 | 4 | 2 | 2 | 4 |
| | R314 | Quality materials | 2 | 3 | 6 | 2 | 3 | 6 |
| | R315 | Damage | 2 | 3 | 6 | 2 | 3 | 6 |
| 3.2. Equipment | R321 | Productivity and work efficiency | 2 | 2 | 4 | 2 | 2 | 4 |
| | R322 | Maintenance costs | 1 | 2 | 2 | 1 | 2 | 2 |
| | R323 | Damage | 2 | 2 | 4 | 2 | 2 | 4 |
| | R324 | Availability | 2 | 2 | 4 | 2 | 2 | 4 |
| 3.3. Technic | R331 | The new technique | 2 | 2 | 4 | 3 | 2 | 6 |
| | R332 | Achieving quality | 2 | 3 | 6 | 3 | 3 | 9 |
| 3.4. Construction Process | R341 | Construction plan | 2 | 2 | 4 | 2 | 2 | 4 |
| | R342 | Problem coordination | 2 | 2 | 4 | 2 | 3 | 6 |
| | R343 | Information from designers | 2 | 2 | 4 | 3 | 3 | 9 |
| | R344 | Locations | 2 | 2 | 4 | 3 | 2 | 6 |
| | R346 | Data on BOQ | 2 | 2 | 4 | 2 | 3 | 6 |
| 3.5. Construction Site | R351 | Access to the site | 2 | 2 | 4 | 2 | 2 | 4 |
| | R352 | Working time | 4 | 2 | 8 | 4 | 2 | 8 |
| | R353 | Local regulations | 3 | 2 | 6 | 3 | 2 | 6 |
| | R355 | Information site investigations | 2 | 3 | 6 | 3 | 3 | 9 |
| | R356 | Problem is not visible | 3 | 3 | 9 | 3 | 3 | 9 |
| Average Risk Level | | | 4.90 | | | 5.81 | | |
| 4. Working Accident Risk | R401 | Work accident | 1 | 2 | 2 | 1 | 2 | 2 |
| | R402 | Labor protection | 2 | 2 | 4 | 2 | 2 | 4 |
| Average Risk Level | | | 3.00 | | | 3.00 | | |
| 5. Design | R501 | The design specifications | 2 | 2 | 4 | 2 | 3 | 6 |
| | R502 | Shop drawing | 2 | 3 | 6 | 2 | 3 | 6 |
| | R503 | The scope of design | 2 | 2 | 4 | 2 | 2 | 4 |
| | R504 | Construction methods | 2 | 2 | 4 | 2 | 2 | 4 |
| | R505 | Material and equipment | 2 | 2 | 4 | 2 | 2 | 4 |
| | R506 | Detail pictures | 3 | 2 | 6 | 2 | 2 | 4 |
| | R507 | Change | 2 | 2 | 4 | 2 | 2 | 4 |
| Average Risk Level | | | 4.57 | | | 4.57 | | |
| 6. Political Risk and Regulation | R604 | Procedure permits and approvals | 2 | 2 | 4 | 2 | 1 | 2 |
| | R605 | Staff government corruption | 2 | 2 | 4 | 2 | 2 | 4 |
| Average Risk Level | | | 4.00 | | | 3.00 | | |
| 7. Financial Risk | R701 | Payment | 2 | 3 | 6 | 3 | 4 | 12 |
| | R702 | Retention costs | 2 | 3 | 6 | 2 | 3 | 6 |
| | R703 | Additional cost variance | 3 | 3 | 9 | 3 | 3 | 9 |
| | R704 | Estimated costs | 2 | 3 | 6 | 3 | 3 | 9 |
| | R705 | Loss | 3 | 3 | 9 | 3 | 3 | 9 |
| | R707 | Labor costs | 2 | 2 | 4 | 2 | 2 | 4 |
| | R708 | Tax | 2 | 2 | 4 | 2 | 2 | 4 |
| | R709 | Cost of materials | 2 | 2 | 4 | 2 | 2 | 4 |
| Average Risk Level | | | 6.00 | | | 7.13 | | |
| 8. Contractual Risk | R801 | The provisions of the contract | 2 | 2 | 4 | 2 | 2 | 4 |
| | R802 | A clause contained | 2 | 2 | 4 | 2 | 2 | 4 |
| | R803 | Working conditions | 2 | 2 | 4 | 2 | 2 | 4 |
| Average Risk Level | | | 4.00 | | | 4.00 | | |
| 9. Environmental and Social | R901 | Pollution | 2 | 2 | 4 | 2 | 2 | 4 |
| | R902 | Cultural traditions | 2 | 2 | 4 | 1 | 2 | 2 |
| Average Risk Level | | | 4.00 | | | 3.00 | | |

Based on the result of risk assessment for office project, as presented in Table 4, it can be seen that the financial risk, technical risk and personal risk are the top three variable categories that probably impact on interior design and construction of office projects. The risk assessment for a commercial project, said that a financial risk, technical risk and personal



risk are the top three variable categories that probably impact on interior design and construction of commercial projects.

Risk Ranking

Risk ranking is determined by probability and impacts risk matrix in Table 1 and Table 2, in which value of the probability and impact of each variable inserted into the matrix to obtain ranking (Low, Medium and High) of each risk variables.

Table 5. Probability and Impact Matrix For Residential Project

| | | | | | | |
|-------------|-----------------------------------|------------|--|--|-----------|--|
| PROBABILITY | 5 (Almost Certainly Occurring) | | | | | |
| | 4 (Very Possible to Occur) | | | | | |
| | 3 (Quite Possible to Occur) | R217 | R212, R221, R507, R703, | R218, R241, R242, R243 | | |
| | 2 (Small Possibility Occuring) | R708, R901 | R211, R223, R225, R226, R227, R228, R233, R312, R313, R314, R321, R323, R324, R331, R341, R342, R343, R344, R346, R352, R355, R356, R501, R502, R503, R504, R505, R506, R707, R709, R803 | R103, R104, R214, R222, R224, R311, R332, R701, R704, R705 | | |
| | 1 (Rarely Occuring) | R802, R902 | R213, R215, R216, R231, R232, R234, R315, R322, R353, R604, R605, R801 | | | |
| RESIDENTIAL | 1 (Not Important) | 2 (Minor) | 3 (Moderate) | 4 (Major) | 5 (Fatal) | |
| IMPACT | | | | | | |
| Note: | | | | | | |
| | | Low | | | | |
| | | Medium | | | | |
| | | High | | | | |

RESULTS AND DISCUSSION

From Table 5, Table 6 and Table 7 the highest risk score for residential project, office project and commercial project are from personal risk category, technical risk category, and financial risk category. Shen (1997) said that design risk is a variable with the highest risk score for construction project in Hong Kong. In this research, quality inspection (R218), interference (R241), changes in demand (R242), and expectations on quality (R243) are have highest risk score for residential project. For office project: interference (R241), changes in demand (R242), problem is not visible (R356), additional cost variation (R703), and loss (R705) are variables with highest risk score. Payment (R701) is a variable with highest risk score for commercial project. Zou, et.al. (2007), in his research about construction project in China, said that project funding problems and variations by the client are the top two of significance risk score.



Table 6. Probability and Impact Matrix For Office Project

| | | | | | | |
|-------------|-----------------------------------|-----------|--|--|-----------|--|
| PROBABILITY | 5 (Almost Certainly Occurring) | | | | | |
| | 4 (Very Possible to Occur) | | R352 | | | |
| | 3 (Quite Possible to Occur) | | R221, R353, R506 | R241, R242, R356, R703; R705 | | |
| | 2 (Small Possibility Occuring) | | R104, R211, R213, R215, R216, R218, R226, R227, R228, R231, R233, R234, R312, R313, R321, R323, R324, R331, R341, R342, R343, R344, R346, R351, R402, R501, R503, R504, R505, R507, R604, R605, R707, R708, R709, R801, R802, R803, R901, R902 | R212, R222, R223, R224, R225, R243, R311, R314, R315, R332, R355, R701, R702, R704 | | |
| | 1 (Rarely Occuring) | | R217, R232, R322, R401 | R103, R214 | | |
| OFFICE | 1 (Not Important) | 2 (Minor) | 3 (Moderate) | 4 (Major) | 5 (Fatal) | |
| IMPACT | | | | | | |
| Note: | | | | | | |
| | | | Low | | | |
| | | | Medium | | | |
| | | | High | | | |

Table 7. Probability and Impact Matrix For Commercial Project

| | | | | | | |
|-------------|-----------------------------------|-----------|--|--|-----------|--|
| PROBABILITY | 5 (Almost Certainly Occurring) | | | | | |
| | 4 (Very Possible to Occur) | | | | | |
| | 3 (Quite Possible to Occur) | | R221, R331, R344, R353, | R242, R332, R343, R355, R356, R703; R704, R705 | R701 | |
| | 2 (Small Possibility Occuring) | R604 | R104, R211, R213, R215, R216, R217, R226, R227, R231, R232, R234, R243, R312, R313, R321, R323, R324, R341, R351, R402, R503, R504, R505, R506, R507, R605, R707, R708, R709, R801, R802, R803, R901 | R212, R214, R218, R222, R223, R225, R228; R233, R241, R314, R315; R342, R346, R501, R502, R702 | R224 | |
| | 1 (Rarely Occuring) | | R322, R401, R902 | R103 | | |
| COMMERCIAL | 1 (Not Important) | 2 (Minor) | 3 (Moderate) | 4 (Major) | 5 (Fatal) | |
| IMPACT | | | | | | |
| Note: | | | | | | |
| | | | Low | | | |
| | | | Medium | | | |
| | | | High | | | |



CONCLUSIONS AND RECOMMENDATIONS

Based on the result, it can be concluded that for residential projects, from 66 relevant risk variables, there are 18 risk variables categorized as Medium Risk, and 48 risk variables categorized as Low Risk. For office projects, it is concluded from 70 relevant risk variables, there are 23 risk variables categorized as Medium Risk, and 47 risk variables categorized as Medium Risk. While for commercial projects there are 70 relevant risk variables. 30 risk variables from them categorized as Medium Risk, and 40 variables from relevant risk variables categorized as Low Risk.

Some recommendations for future research are provide risk responses for some risks with high ranking in order to reduce its risk score. In future research, this research can be performed on other object in order to develop risk variables that can occur in interior design and construction project in general.

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